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Elementary Teachers' Affective Relationship with Mathematics and its Influence on Mathematics Instruction

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This is to certify that the doctoral study by

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Walden University
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Abstract

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Kelly Kreitzer Sutton

MS, Walden University, 2005

BS, Clemson University, 2001

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

In a South Carolina school district, approximately 45% of 3rd-5th grade students performed poorly on the state mathematics test. K-5 teachers attended district training to improve mathematics instruction and content mastery, but the training omitted teachers' affective domain in teaching. Teachers' affective relationships with mathematics (ARM) affects content delivery, instructional decisions, and teachers' confidence levels and motivation. The purpose of this sequential mixed methods study was to investigate whether teachers' years of experience, grade levels taught, or past mathematics experiences influenced K-5 teachers' ARM, as measured by the ARM survey, and to explore teachers' perceptions of their ARM in instruction. Bandura's theory of self-efficacy framed this study. A representative sample of 160 K-5 mathematics teachers in 11 schools completed surveys. A purposeful sample of 9 teachers with high, medium, or low ARM index were interviewed. One-way ANOVA tests determined there was no statistical significant difference between teachers' ARM index and years of experience or grade level. Simple linear regression determined there was a statistical significant difference between teachers' ARM and past mathematics experiences. Interview data were analyzed thematically using open, axial, and thematic coding strategies. Teachers revealed that their perceived past mathematics experiences and collaboration influenced their ARM and instruction. Based on the findings, a 3-day workshop was created to improve teachers' ARM featuring reflection on teachers' past mathematics experiences and collaboration. This endeavor may contribute to positive social change if district leaders assist teachers to improve their confidence in mathematics instruction and instructional decision making; thus, improving student mathematics achievement.

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Dedication

This doctoral study is dedicated to my husband who persevered with me every step of the way. It is also dedicated to elementary mathematics teachers who share their love of mathematics with students every day.

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Section 1: The Problem

Introduction

The 21st century student has an increasing need to use mathematics in his or her everyday life along with the need for understanding complex mathematical situations in the workplace (South Carolina Department of Education [SCDOE], 2017; The National Council of Teachers of Mathematics [NCTM], 2000). A strong mathematical foundation is vital for job opportunities in many fields such as finance, business, statistics, technology, education, and the sciences: medicine, engineering, aeronautics, genetics, etc. (Jaggernauth & Jameson-Charles, 2015; NCTM, 2000). Therefore, effective mathematics instruction serves as a tool for young learners to gain critical skills.

At the elementary school level K-5, most teachers teach all subjects, not just mathematics (Abed, Asha, & Ibrahim, 2014). This expectation can be overwhelming and places a large responsibility on elementary teachers (Abed et al., 2014). Teachers are expected to become masters of content and pedagogy in all subject areas they teach whether they like or enjoy teaching the subject (Abed et al., 2014; Strohl, Schmertzing, & Schmertzing, 2014). Abed et al. (2014) found that the grade level elementary teachers taught as well as their previous experiences and background had a correlation to their favorite subject and affected the way they taught each subject. Of all college majors, those studying elementary education were found to have the highest level of mathematics anxiety and avoidance (Hughes, 2016). Teachers who liked mathematics and enjoyed teaching it spent 50% more time teaching mathematics than teachers who disliked the subject, and teachers who disliked mathematics spent more time teaching skills and facts versus cognitive process and reasoning (Etheridge, 2016; Haciomeroglu, 2013).

Teachers' attitudes toward a subject can influence how they teach, instructional decisions they make, their confidence level, and motivation (Chen, McCray, Adams, & Leow, 2014; Geist, 2015; Grootenboer & Marshman, 2016). Abed et al. (2014) also found that students' achievement and their attitudes towards the subject they are learning was influenced by their teachers' attitudes towards that subject. Attitude is one dimension of a person's affective domain. The affective domain includes facets that are beyond the cognitive domain and contains key interrelated dimensions of beliefs, values, attitudes, and emotions (Grootenboer & Marshman, 2016). These key dimensions assimilate other constructs that include motivation, engagement, anxiety, confidence, efficacy, and dispositions (Grootenboer & Marshman, 2016). Salzer (2010), in the first study of its kind, determined that a person's affective domain in relation to the subject of mathematics is identified as a person's affective relationship with mathematics (ARM). ARM encompasses a person's feelings and attitudes towards mathematics, his or her enjoyment of mathematics, his or her beliefs about mathematics, and his or her confidence in his or her mathematics ability (Salzer, 2010). A teacher's ARM can sway students' mathematics experiences negatively because it is communicated through teacher's actions and instruction (Etheridge, 2016), putting at risk the quality of students' mathematics learning (Coppola, Di Martino, Pacelli, & Sabena, 2012). Teachers' ARM influences teaching practices through instructional decisions they make, including time on task and methods used for delivering mathematics content. Unless the affective domain is addressed in mathematics instruction, there will be a gap in teachers' instructional decisions and practices that hinders student achievement.

The Local Problem

In a school district in upstate South Carolina, elementary mathematics instruction is not effective, and information is needed about how teachers' ARM influences their mathematical instructional decisions (Elementary Administrator, personal communication, June 27, 2016). According to the district's strategic plan, mathematics achievement is low in in the third through fifth grades and significant work needs to be done to improve mathematics instruction. This lack of success negatively influences student achievement through the progression of mathematic skills and knowledge in subsequent grade levels because mathematics curriculum and content is cumulative and requires increasing complexity throughout each grade level (Ottmar, Grissmer, Konold, Cameron, & Berry, 2013). Student achievement has been linked to teachers' self-efficacy, which is their ability to execute effective mathematical instruction (Nurlu, 2015). Low mathematics self-efficacy and low confidence in a teacher's mathematics teaching competence can hinder a teacher's instructional performance in the classroom (Bates, Latham, & Kim, 2013). Factors that affect teachers' self-efficacy towards mathematics instruction include years of experience (Putman, 2012), grade level taught (Wilkins, 2010), and prior experiences with mathematics (Hughes, 2016).

Teachers' self-efficacy and confidence levels towards mathematics content and instruction directly influence their instruction by affecting their thinking, motivation, and behavior (Chen et al., 2014). Self-efficacy and confidence are two affective variables that determine teachers' ARM that "mediate the relationship between teachers' knowledge and action and have related effects on student achievement" (Putman, 2012, p. 26). Teachers with high efficacy levels are more likely to use effective strategies for instruction and seek ways to improve their teaching methods when needed (Putman, 2012). In a recent study, researchers compared the relationship between teachers' mathematics self-efficacy towards mathematical instruction and student achievement (Son, Han, Kang, & Kwon, 2016). In this study, students who had teachers with high mathematics self-efficacy toward mathematical instruction scored 10 percentage points higher on their achievement tests than students whose teachers had low mathematics self-efficacy (Son et al., 2016). In another study, researchers discovered that teachers' attitudes toward the subject(s) they teach can be used as a predictor of students' achievement; therefore, teachers' affective relationships with the subject(s) they teach should be frequently examined (Abed et al., 2014). This sheds light on the importance of understanding how teachers feel about their abilities to teach mathematics, and how their ARM influences their instructional decisions and competence.

Some educators might disagree that teachers' affective domain influences their instructional decisions, and they may argue that by increasing teachers' content knowledge and pedagogy, mathematics instruction and achievement will improve within the school district (Hughes, 2016). However, researchers emphasized that an effective mathematics teacher must be a master of the mathematical content as well as possess positive attitudes and beliefs towards mathematics teaching (Cross Francis, 2015; Jones, Vermette, & Jones, 2012; Polly, Neale, & Pugalee, 2014; Swars, 2015). District administrators in this study focused on improving teachers' mathematics content knowledge and pedagogy, but it has not examined teachers' ARM and its influence on instructional practices.

Rationale

Local Evidence

According to the district's strategic plan, students' mathematics achievement is low, and work needs to be done to improve mathematics instruction and achievement. State assessment data indicated that 45% of the school district's third through fifth graders scored below grade level on the state mathematics assessment (SCDOE, 2015), and the percentage increased to 50% for the 2016 mathematics assessment (SCDOE, 2016). Individual grade level data showed an increase in percentages of students achieving below grade level as students progress in grade levels. Mathematics assessment data for 2016 showed that 46% of third graders, 48% of fourth graders, and 55% of fifth graders scored below grade level in mathematics (SCDOE, 2016).

The SCDOE (2017) created a set of mathematics content standards, South Carolina College- and Career-Ready Standards for Mathematics (SCCCR), for all teachers to use to guide their instructional practices. These standards also included seven mathematical process standards that should be integrated into teachers' mathematics instructional practices (SCDOE, 2017). These mathematical process standards are

1. Make sense of problems and persevere in solving them.
2. Reason both contextually and abstractly.

3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.
4. Connect mathematical ideas and real-world situations through modeling.
5. Use a variety of mathematical tools effectively and strategically.
6. Communicate mathematically and approach mathematical situations with precision.
7. Identify and utilize structure and patterns. (pp. 7-8)

These mathematical process standards encourage teachers to include engaging activities that foster collaboration, communication, and critical thinking in instruction.

An elementary administrator in the school district for this study stated that she sees many elementary teachers who are not comfortable with teaching mathematics (personal communication, June 27, 2016). She noted that these teachers are not mathematically minded and are teaching verbatim from the textbook instead of using mathematical best practices for instruction. An Assisting, Developing, and Evaluating Professional Teaching (ADEPT) evaluator in the district stated that she observed several elementary mathematics teachers providing direct instruction with little or no inquiry (personal communication, October 27, 2016). In these cases, the teacher was providing most of the answers and not allowing for student mathematical discovery (ADEPT evaluator, personal communication, October 27, 2016). She also stated that some teachers seemed to lack confidence in their abilities to teach the content and struggled with being able to ask and answer student questions. The school district's administration in this study also conducted a needs assessment and determined that mathematics instruction has not been effective. In a district where mathematics proficiency is a concern, it is important to understand how teachers feel about their abilities to teach mathematics, and how their ARM influences their instructional decisions and competence.

Evidence from Literature

In the United States, student mathematics achievement at the elementary level is low compared to other nations (National Center for Education Statistics [NCES], 2015), but, at the same time, it is vital to improve mathematics education and achievement. "The globalization of markets, the spread of information technologies, and the premium being paid for workforce skills all emphasize the mounting need for proficiency in mathematics" (National Research Council [NRC], 2001, p. xiii). To improve mathematics education and achievement, mathematics classrooms require a supportive environment that fosters creativity, collaboration, and critical thinking (NCTM, 2000). In addition to requiring qualified mathematics teachers who have knowledge of curriculum, subject matter, and pedagogy, teachers should also possess positive beliefs, attitudes, and emotions towards mathematics (Coppola et al., 2012). As the trend towards a greater focus on student achievement and teacher accountability continues, more emphasis on teachers' abilities to teach and to provide a higher level of rigor with mathematical concepts and skills is needed. In each mathematics classroom, there must be a teacher who is a master of the mathematical content and who possesses positive attitudes and beliefs towards mathematics teaching (Jones et al., 2012).

However, teachers' affective domain as it relates to mathematics may hinder this process. Teachers may not have positive beliefs, attitudes, and emotions towards mathematics. They may struggle with mathematics anxiety, mathematics self-efficacy, and teaching efficacy, all of which can obstruct the mathematics learning process (Etheridge, 2016). Teachers' affective domain influences their instructional decisions, confidence levels, and motivation (Chen et. al, 2014; Geist, 2015; Grootenboer & Marshman, 2016). Teachers who have low confidence levels in mathematics tend to provide direct instruction with the teacher as the leader instead of a student centered inquiry approach that focuses on real understanding (Evans, 2010). Teachers who have a disinclination towards mathematics spend 50% less time on mathematics instruction (Etheridge, 2016; Haciomeroglu, 2013). In order for students to learn mathematics at a high level, they need consistent exposure to mathematics concepts and sufficient opportunities to practice mathematical concepts and skills (Ottmar et al., 2013). If teachers' ARM is influencing their instructional practices, such as time on task, then students are not receiving the exposure to mathematics concepts and sufficient amount of practice needed for mastery.

Purpose

The school district for this study focused on improving teacher content mastery and pedagogy through teacher professional development, but it has not addressed the issue of teachers' ARM and how it may influence instructional practices (Elementary Administrator, personal communication, June 27, 2016). While researchers stated that teachers' ARM influences instructional decisions through their thinking, motivation, and behavior during the planning and implementation phases of instruction (Bates et al., 2013; Uswatte, 2013), the local school district has not examined this relationship

(Elementary Administrator, personal communication, June 27, 2016). The purpose of this mixed methods study was to investigate which factors influence elementary mathematics teachers' ARM, and to explore teachers' perceptions of their ARM in their instruction. This study aimed to bridge the gap in the district's mathematics instructional practices by aiding the district in improving or implementing professional development that enhances and develops these influential factors.

Definition of Terms

Affective domain: Affective domain encompasses emotions or feelings that are attached to an idea or object (Jong & Hodges, 2013). The affective domain includes interrelated dimensions of beliefs, values, attitudes, and emotions (Lomas, Grootenboer, & Attard, 2012).

Affective relationship with mathematics (ARM): A general term identifying the noncognitive aspects of learning and applying mathematics. This term includes beliefs, attitudes, values, and emotions as well as confidence and enjoyment of mathematics (Briley, 2012; Salzer, 2010).

Instructional practices: The decisions teachers make and actions taken by teachers to promote the development of conceptual mathematics knowledge and skills (Firmender, Gavine, & McCoach, 2014).

Mathematics anxiety: The tension and fear felt by people that interferes with their ability to perform mathematical tasks such as computing numbers or solving problems (Hughes, 2016).

Mathematics attitude: A multidimensional construct that includes the like or dislike of mathematics, people's ideas about whether they are good or bad at mathematics, and whether they think it is important or useful (Aslan, 2013). Attitude also includes one's anxiety level towards mathematics, whether someone avoids or engages in mathematics, as well as one's confidence level (Aslan, 2013).

Teacher efficacy: Teachers' confidence in their capabilities to successfully complete a certain task in a specific context (Shi, 2014).

Significance of the Study

There is little known, locally and in the mathematics education profession, about elementary teachers' ARM and the influence it may have on their mathematics instructional practices. An increased understanding of this issue may be valuable to the local school district's administrators and the mathematics education profession. It may provide the needed insight to strengthen elementary mathematics instruction by leading to professional development or a mentoring program that could maintain and improve elementary teachers' ARM, possibly leading to improved mathematics instruction for student achievement.

Mathematics skills are taught for the public good so that citizens can reason, understand science and economics, and use data to make informed decisions about themselves and their communities (Hannula, 2016). Those who understand mathematics have more options for shaping their futures through opportunities in professional fields such as business, medicine, finance, sciences, technology, engineering, and education (Jaggernauth & Jameson-Charles, 2015; NCTM, 2000). Factors that affect students' mathematics success include students' levels of conceptual understanding of mathematics concepts and their confidence in their mathematics abilities, as well as their teachers' content knowledge, instructional practices, and beliefs and confidence in their own mathematics teaching (Giles, Byrd, & Bendolph, 2016; Jaggernauth & Jameson-Charles, 2015). Findings from this study may lead to positive social change by improving teachers' understanding of their own confidence in mathematics instruction. It may also lead to improving students' mathematics achievement, which may enable students to be better prepared for subsequent grades and expand the workforce choices they have by ensuring mathematical confidence and competence. There is a documented connection between a student's mathematics performance and future college courses taken, degree completion, and career earnings (Shanley, 2015). The impact of a teacher's ARM can also be cyclical in nature because current students may one day become elementary mathematics teachers who were influenced by their current teacher's ARM and instructional decisions (Jaggernauth & Jameson-Charles, 2015). This study was an attempt to discover how elementary teachers' ARM influences their instructional practices and to provide a potential first step toward increasing elementary teachers' ARM, and, indirectly, student mathematics achievement.

Research Questions and Hypotheses

This mixed methods study examined factors that influence elementary mathematics teachers' ARM, and how teachers believe this relationship influences their instructional decisions and practice. The following research questions are for the quantitative portion of the study:

1. Is there a statistically significant difference between elementary teachers' years of experience (1 to 6 years, 7 to 15 years, and 16+ years) and their ARM?

   $H_0 1$: There will be no statistically significant difference between elementary teachers' years of experience and their ARM.

   $H_A 1$: There will be a statistically significant difference between elementary teachers' years of experience and their ARM.

2. Is there a statistically significant difference between elementary teachers' grade level taught and their ARM?

   $H_0 2$: There is no statistically significant difference between elementary teachers' grade level taught and their ARM.

   $H_A 2$: There will be a statistically significant difference between elementary teachers' grade level taught and their ARM.

3. Is there a statistically significant difference between elementary teachers' past experiences with mathematics and their ARM?

   $H_0 3$: There is no statistically significant difference between elementary teachers' past experiences with mathematics and their ARM.

   $H_A 3$: There will be a statistically significant difference between elementary teachers' past experiences with mathematics and their ARM.

The following research question was used for the qualitative portion of the study:

1. What are elementary teachers' perceptions on how their ARM influences their mathematical instructional decisions and practices?

Subquestions include

1. What are elementary teachers' perceptions of their ARM regarding their mathematical instructional time?
2. What are elementary teachers' perceptions of their ARM regarding their use of the SCCCR seven mathematical process standards during instruction?

Review of the Literature

In the United States, mathematics achievement at the elementary level is low compared to other nations (NCES, 2015). Improving mathematics achievement requires qualified mathematics teachers who have curricular knowledge, subject matter knowledge, and pedagogical knowledge related to mathematics in addition to positive beliefs, attitudes, and emotions towards mathematics (Coppola et al., 2012). However, elementary mathematics teachers may struggle with mathematics anxiety, mathematics self-efficacy, and teaching efficacy, all of which can obstruct the mathematics learning process (Etheridge, 2016). Therefore, when mathematics achievement is low, teachers' ARM needs to be studied with the hope of improving mathematics instruction.

The purpose of this mixed methods study was to determine which factors influence elementary mathematics teachers' ARM, and how teachers believe this relationship influences their instructional practices. The first part of this section presents Bandura's (1977) theory of self-efficacy as the conceptual framework. Next, effective instructional practices are discussed in relation to mathematics teaching. Finally, literature is presented that focuses on the affective domain as it relates to mathematics including attitudes, beliefs, mathematics anxiety, and teaching efficacy.

I collected and analyzed research from peer-reviewed articles and journals, school data, and books to conduct the literature review. I conducted an exhaustive search using Walden University's metasearch resources including searching ERIC and Education Research Complete databases. I also conducted basic Internet searches using Google and Google Scholar, and I used NCTM's website and journals. Keywords included *elementary mathematics education, affective domain, teachers' relationships with mathematics, mathematics beliefs, mathematics attitudes, self-efficacy, mathematics self-efficacy, mathematics teaching efficacy, mathematics anxiety,* and *effective mathematics instruction.* I also analyzed the reference section of current articles to find additional research related to the study's topic.

Conceptual Framework

The conceptual framework that I used for my study was Bandura's (1977) theory of self-efficacy, which is the belief that people have in themselves to successfully complete a task such as how teachers' ARM influences their instructional practices. Bandura (1977) stated that psychological processes create and strengthen how people perceive their personal efficacy. Bandura (1982) suggested that "people avoid activities that they believe exceed their coping capabilities, but they undertake and perform assuredly those that they judge themselves capable of managing" (p. 124). Therefore, the strength of one's personal efficacy can affect whether a person can manage or try to manage a specific situation, and it influences a person's choice of activities (Bandura, 1977). Based on Bandura's theory, if teachers perceived that teaching mathematics effectively was beyond their capability, than teachers will not feel assured to or even avoid completing a mathematical tasks.

According to Bandura (1977), self-efficacy differs in degree, generality, and intensity from person to person and situation to situation. Magnitude is the level of a task a person believes he or she can accomplish from simple to complex (Bandura, 1977). The generality of self-efficacy extends one's beliefs of accomplishments beyond a successfully completed task (Bandura, 1977). Expectations of one's self-efficacy vary in strength where individuals with strong self-efficacy persevere longer on tasks than individuals with a weak self-efficacy (Bandura, 1977). For example, a person may have a high self-efficacy towards completing a writing task but a low self-efficacy towards completing a mathematical task. If a person perceives they have a high self-efficacy towards a task, he or she will have a belief in their capability to accomplish the task and will persevere longer while working on the task compared to a person with a low self-efficacy toward the same task.

There are four sources of efficacy: "performance accomplishments, vicarious experiences, verbal persuasion, and physiological states" (Bandura, 1977, p. 195). Feelings of performance accomplishment derive from personal mastery experiences. Bandura stated that "successes raise mastery expectations; repeated failures lowers them" (1977, p. 195). Vicarious experiences help a person build self-efficacy by watching others complete a task with success (Bandura, 1977). Bandura (1977) explained that the more people someone observes being successful with a specific task, the more likely that someone's self-efficacy increases for that same task. Another source of self-efficacy is verbal persuasion, in which a person is led to believe he or she can complete a task. Bandura suggested that verbal persuasion has less influence on efficacy than performance accomplishments. People performing a task successfully increase their self-efficacy to a higher degree than having someone else state that they will be successful at completing the task. A final source of efficacy is physiological state or emotional arousal. A person uses his or her physiological state to determine the stress and vulnerability he or she is experiencing (Bandura, 1977). Bandura stated that decreasing emotional arousal can lessen avoidance behavior and increase one's efficacy towards completing a task.

The seminal source, Bandura, Barbaranelli, Caprara, and Pastorelli (1996), discovered self-efficacy influenced various aspects of one's belief system, such as strength of commitment, level of motivation and perseverance, resilience to adversity, and quality of thinking. Bandura's (1997) statement, "People's level of motivation, affective states, and actions are based more on what they believe than on what is objectively true" (p. 2) indicated that examining teachers' affective domain is important to determine how it influences their actions and decisions in the classroom. According to Tschannen-Morgan and Hoy's (2001) research, a teacher's self-efficacy is related to a teacher's behavior in the classroom and student achievement. Another important source stated that teacher self-efficacy was determined to be context and subject matter specific, and it can affect how teachers teach each subject area (Hoy & Spero, 2005). Hoy and Spero (2005) indicated that teachers with high self-efficacy for their subject matter spent more time on task, exhibited greater levels of planning, and were open to experimenting with new ideas to better meet the needs of their students. Therefore, it is important to examine teachers' ARM since self-efficacy is subject matter specific and can influence teachers' instructional decisions. Examining teachers' perceptions of their ARM and the influence it has on their instructional decisions is also important because teachers' self-efficacy towards a task influences their level of commitment and motivation, perseverance, and quality of thinking.

Bandura's (1977) framework is appropriate to define the variables in this study. The sources of self-efficacy relate to teachers' years of experience, grade level taught, and past experiences, and differ in generality for each person and situation. This study also relates to the framework because self-efficacy is one's beliefs about one's confidence, such as ARM, to complete a specific task, and those beliefs can affect whether a task is completed and to what degree, which, for the purposed study, is mathematics instruction. It is essential to examine instructional practices because self-efficacy is a factor that may influence teachers' instructional practices.

Mathematical Instructional Practices

Instructional practices are decisions teachers make and actions taken by teachers to promote the development of conceptual knowledge and skills (Firmender et. al, 2014). Instructional decisions are made during lesson planning, classroom instruction, and reflection after instruction, and these decisions are what influences teachers' instructional practices. (Goldsmith, Doerr, & Lewis, 2014). Mathematical instructional practices may promote or hinder student achievement, and they are influenced by teachers' ARM.

Mathematical instructional practices that influence achievement. Teachers' instructional decisions and the practices they implement affect student achievement

(Firmender et. al, 2014). NCTM's (2000) committee of teachers suggested that mathematics instructional practices should be grounded in learning concepts and practices that include understanding of concepts and practices learned, not rote memorization of steps. Cribbs' and Linder's (2013) research connected to NCTM's recommendation by demonstrating that teachers who encouraged mathematical discourse and used real-world situations and relevant mathematics and tools created mathematical communities in their classrooms. The school district in this study had low mathematics achievement scores on the state assessment in 2015 and 2016 (SCDOE, 2015; 2016), and teachers were observed providing whole group direct instruction for most of the instructional period (Elementary Administrator, personal communication, June 27, 2016). The information and research presented indicates that whole group, direct instruction was a less effective instructional practice than practices focused on understanding and real-world, relevant mathematics.

However, according to Polly et al. (2013), teachers who used a discovery/connectionist (student centered) approach to mathematics instruction had students with greater mathematics achievement than teacher centered classrooms. Students who experienced discovery/connectionist instruction were projected to gain 17 percentage points between the pretest and posttest of the end of unit mathematics assessments when compared to students who experienced transmission-oriented instruction (Polly et al., 2013). Similarly, Jones et al. (2012) found that student achievement improved when teachers included content with cognitive demand, mastery-oriented learning, multiple solutions to problems, and literacy strategies in their instructional practices. Also, researchers found that student understanding, not just achievement, increased when instructional practices included cognitively demanding tasks and supportive mathematical communication (Jones et al., 2012; Polly et al., 2014). SCCCR include seven mathematical process standards that focus on the effective instructional practices mentioned above. Therefore, this study examined how teachers' ARM influences their use of the SCCCR seven mathematical process standards.

Effective mathematical instruction comes from teachers using best instructional practices that included student centered instruction, discovery learning that requires students to think deeply, and student mathematical discussions that require evidence of their mathematical thinking (Jones et al., 2012; Polly et al., 2014). An elementary administrator and ADEPT evaluator in this study's school district indicated that not all teachers in the district are utilizing best instructional practices in their mathematics teaching (Elementary Administrator, personal communication, June 27, 2016; ADEPT evaluator, personal communication, October 27, 2016). This study focused on identifying whether teachers use these mathematical practices and whether ARM influences their practices and decision making.

Factors that influence instructional practices. The results in the literature indicated that teachers' ARM, their dislike or like of mathematics, influenced instructional practices through the amount of time for mathematical instruction and through decisions about instruction and implementation of instruction (Etheridge, 2016; Geist, 2015; Haciomeroglu, 2013). For students to learn mathematics at a high level, they need consistent exposure to mathematics concepts and sufficient opportunities to practice

(Ottmar et al., 2013). Therefore, it is important for mathematics elementary teachers to have a positive ARM. Teachers who were fearful of mathematics or do not feel comfortable teaching it were less likely to include mathematics into their day-to-day plans and they relied more on teaching skills and facts, especially in elementary grades when teachers teach all subjects (Geist, 2015). Teachers who had a negative relationship with mathematics tended to employ instructional practices that focused on skills not concepts, they gave more seatwork in lieu of small group instruction, and students were less involved in problem solving (Hughes, 2016). Conversely, teachers who had a positive relationship with mathematics had a tendency to employ instructional strategies that encouraged student initiative and independence (Hughes, 2016). Teachers' with a lower ARM seemed to spend less time on task, and they did not incorporate best mathematical instructional practices.

The qualitative portion of this study investigated if teachers' ARM influences the amount of time used for mathematics instruction and whether it influences the use of SCCR seven mathematical process standards deemed effective for instruction. Teachers' affective domain may be an influential factor to the amount of time spent on mathematical tasks and the type of mathematical practices that are used in the classroom.

Affective Domain

Teaching and learning of mathematics involves both cognitive and affective factors (Hannula, 2016; Hughes, 2016; Laschke, 2013). However, it is only in the last few decades that a deeper understanding of the affective domain and its impact on mathematics instruction began to take form (Hughes, 2016). The affective domain encompasses emotions or feelings that are attached to an idea or object (Jong & Hodges, 2013). It includes the interrelated dimensions of beliefs, values, attitudes, and emotions (Lomas et al., 2012). Grootenboer and Marshman (2016) extended this idea and stated that these four dimensions assimilated the constructs of confidence, anxiety, dispositions, and efficacy and included the facets of motivation and engagement. Aspects of the affective domain can be evaluated separately, but they are also an interrelated complex whole (Grootenboer & Marshman, 2016). Therefore, it is necessary to identify and analyze multiple components when examining a person's affective domain.

Lomas et al. (2012) suggested that components, referred to as dimensions, of the affective domain can be inferred from actions, it can be directly related to what a person states, it can be affected by stimuli, and it can be used to make decisions and choices. Affective responses to stimuli are both informational and reward functions (Hannula, 2016). Positive affective responses elicited feelings of accomplishment and effectiveness which motivated someone to do more of that activity (Hannula, 2016). However, negative affective responses encoded information or stimuli as being ineffective or as having little value, which motivated someone to do less of that activity (Hannula, 2016). Affective responses, either positive or negative, determine how people find value, or lack of value, in the work they do, which motivates them to do more or less of that work accordingly.

Affective responses apply to mathematics instructional practices as well. Hannula (2016) stated that "human beings have interests, goals, and preferences, and these structures serve as templates for whether to put forth effort towards mathematical activity and the extent to which efforts are seen as efficacious" (p.18). Therefore, positive affective responses to mathematics increased effort towards mathematical activities (Hannula, 2016). Thus, if a teacher has a high ARM, then effort towards mathematics instruction should be greater than a person with a low ARM.

Researchers believe that mathematics education can be strengthened if there is a greater focus on the affective domain and the integration of it in teaching, rather than a focus on content and pedagogical knowledge alone (Abed et al., 2014; Coppola et al., 2012; Hughes, 2016; Putman, 2012). Teachers' affective domain, which includes beliefs, emotions, and attitudes, are a potent force and strongly affect the quality of instruction and student learning in the mathematics classroom (Coppola et al., 2012). It is human nature for people to avoid things they do not like and to engage more in the things they like doing. Teachers who were fearful of mathematics or did not feel comfortable teaching it, a negative ARM, were less likely to include mathematics into their daily plans, especially in elementary grades when teachers teach all subjects (Geist, 2015). Teachers' ARM, whether positive or negative, influences instructional decisions made in the mathematics classroom. It also influences the amount of time on task particularly in elementary grades when all core subjects are taught daily. The concern is that teachers at the elementary level with low ARM, when faced with a day with shortened instructional time, may choose to spend less time teaching mathematics, or they do not teach it at all.

As I conducted an extensive search for this literature review, no current opposing views were found to discredit examining a teacher's affective domain as it relates to mathematics instructional practices. The first research conducted on the affective domain and how it pertained to mathematics education was in the early 1950s (Hannula, 2016). During that time, most researchers looked at creating a scale score to quantify the affective domain versus how the affective domain may influence instruction (Hannula, 2016). However, in the last few decades, more researchers identified the affective domain as one of the three main components for educational research along with content knowledge and pedagogy knowledge (Coppola et al., 2012; Hannula, 2016; Hughes 2016). Therefore, since the school district in this study already focused on teachers' content and pedagogy development, it was important to examine teachers' affective domain.

Attitudes and teaching mathematics. A component of a person's affective domain is a person's attitude. Attitude is a learned construct that develops over time, and it is reflected in a person's positive or negative response to a situation or object (Lomas et al., 2012). A person's mathematics attitude encompasses the like or dislike of mathematics, beliefs about whether he or she is "good or bad at mathematics, and beliefs that mathematics is important or not" (Aslan, 2013, p.225), all of which influences a person's ARM (Salzer, 2010). Attitude also includes one's anxiety level towards mathematics, whether someone avoids or engages in mathematics, as well as one's confidence level (Aslan, 2013). The liking or disliking of mathematics, along with levels of anxiety towards mathematics, influence how a person interacts and responds to mathematical situations.

Di Martino and Zan (2014) conducted a qualitative study of mathematics students from grade 1 to 13 that identified the three dimensions of mathematics attitudes and how they were interrelated. Three main dimensions that were deeply interrelated were emotional disposition towards mathematics, perception of mathematics, and supposed capability in mathematics (Di Martino & Zan, 2014). Di Martino and Zan determined that a negative attitude toward mathematics was a person who had an emotional dislike for mathematics, a procedural view of mathematics, and believed he or she was not capable of completing mathematical tasks. Conversely, a positive relationship among these three dimension correlated to a positive attitude towards mathematics. These three dimensions influenced teachers' ARM determining whether they liked or disliked mathematics.

Teachers' attitudes towards mathematics develop when they are students creating a dormant culture that resurfaces when becoming a teacher (Jong & Hodges, 2013). Jong and Hodges (2013) conducted a study to determine how preservice elementary teachers' former schooling and their mathematics methods classes affected their mathematics attitude. They discovered that 80% of participants believed that their former schooling and methods classes impacted their mathematics attitude and anticipated teaching practices (Jong & Hodges, 2013). Jong and Hodges also noted that participants who perceived themselves proficient in mathematics also expressed a strong positive attitude towards the subject. Finally, participants who had a higher positive attitude towards mathematics demonstrated a greater confidence in their capabilities to teach mathematics (Jong & Hodges, 2013). Past experiences with mathematics, perceptions of mathematics ability, and a positive or negative relationship with mathematics influenced people's confidence levels toward mathematical tasks including the ability to teach mathematics.

Similar to Jong and Hodges' study, Coppola et al. (2012) found that prior experiences for preservice and in-service primary teachers influenced teachers' attitudes toward mathematics. They found that only 20% of preservice and in-service teachers in their study reported a positive attitude toward mathematics (Coppola et al., 2012). Coppola et al. stated that this was the case for primary teachers who usually did not specialize in mathematics, and they found high negative feelings towards mathematics in preservice and in-service primary teachers. Coppola et al. also indicated that a negative past relationship or negative disposition towards mathematics could sometimes cause a teacher to have positive feelings towards teaching mathematics due to wanting to break the cycle of negativity. A teacher's negative experience with mathematics negatively influences and shapes a person's mathematical attitude. The quantitative portion of this study examined teachers' past experiences to see if there is a relationship with their ARM. These experiences include years of experience, grade levels taught, and experiences in and out of school before becoming a teacher and during their teaching career.

Beliefs and teaching mathematics. Beliefs are views held by a person which he or she believes to be true, and these beliefs are inferred from a person's actions (Grootenboer & Marshman, 2016; Lomas et al., 2012). They are another integral component of a person's affective domain. Beliefs can be considered a lens that influences people's views of the world and their motivations towards action (Grootenboer & Marshman, 2016). Individual beliefs become a collection that constitutes a person's belief system (Hannula, 2016).

Beliefs may also be formed around specific context as in the beliefs that teachers hold about mathematics teaching and learning. Mathematical beliefs are defined as “the personal judgments which they gained through their experiences regarding mathematics, and it includes the beliefs regarding the nature of mathematics and the significance of mathematics teaching and learning” (Baspinar & Peker, 2016, pp. 2-3). Teachers’ beliefs seem to originate from previous school experiences, personal experiences, and experiences with formal knowledge (Hannula, 2016), and they are another influential factor of their ARM (Salzer, 2010). Hannula’s and Salzer’s ideas are reflected in Haciomeroglu’s (2013) study that found preservice elementary teachers with positive mathematical beliefs had higher confidence in their mathematical skills and their abilities to effectively teach elementary mathematics. Therefore, personal judgments influenced by past interactions with mathematical situations continue to influence how a person will interact, positively or negatively, with mathematics. Examining teachers’ ARM and its relationship to teachers’ experiences may determine factors that influence mathematics instructional practices.

There are many beliefs related to teachers’ mathematics instructional practices. Teachers’ beliefs towards mathematics range from transmission-oriented, where mathematics is a delivery of a set of facts, to discovery-oriented, where mathematics is knowledge learned through exploration and effective classroom experiences (Polly et al., 2013). However, teachers’ beliefs do not fit into a single category, and they can have varying components from each category, depending on context and task (Beswick, 2011). Beswick (2011) suggested that teachers’ beliefs about mathematics and the way they teach mathematics act together as a matrix from which instructional practices evolve. Teachers' thinking and behaviors are influenced by their beliefs, which include the choice of curriculum and instructional practices (Aslan, 2013; Campbell et al., 2014; Polly et al., 2013; Swars, 2015). Since beliefs are a component of teachers' ARM, instructional practices can be influenced by the complex interweaving of a teachers' belief system since beliefs may fit into multiple categories based on context.

Differences in experiences and education can influence a teacher's belief system (Aslan, 2013). In a study comparing preservice and in-service teachers, Aslan (2013) found that first grade preservice teachers had the lowest belief scores, the least number of mathematics courses, and the least experience teaching mathematics. There was also evidence of differing beliefs and methods of mathematics teaching that showed a misalignment between beliefs and practices (Cross Francis, 2015; Lomas et al., 2012). For example, teachers stated the importance of group work, yet in classroom observations, there was little evidence of students participating in group work (Lomas et al., 2012). Beliefs are a construct of the affective domain that influence how and what a teacher teaches in the mathematics classroom (Hannula, 2016). Exploring teachers' affective domain enabled me to identify how teachers' ARM influences their mathematical instructional decisions.

Mathematics Anxiety and Instructional Practices

Mathematics anxiety is the tension and fear that inhibit a person's ability to perform mathematical tasks such as computing numbers or solving problems in life and academic situations (Evans, 2013; Hughes, 2016; Peker, 2016). When teachers experience tension and fear toward mathematics in their classroom, it is called "mathematics teaching anxiety" (Peker, 2016, p. 99). Mathematics anxiety seemed to be more internally focused, whereas mathematics teaching anxiety was an external focus that reflected how effectively teachers engaged students in learning mathematics (Hughes, 2016). Humans tend to avoid things that cause discomfort, so if teachers are mathematics anxious or are afraid of mathematics, they are more likely to avoid mathematics in the classroom (Geist 2015; Iyer & Wang, 2013; Jaggernauth & Jameson-Charles, 2015).

Teachers' mathematics anxiety and negative self-assessments of their mathematical abilities affect their instructional decisions and practices (Geist, 2015). In a study of preschool teachers, Geist (2015) discovered that the more mathematics anxiety teachers had, the lower they believed their mathematics ability to be. Due to this belief, mathematics anxious teachers struggled during lesson planning and instruction due to negative self-talk, difficulty concentrating, and feelings of tension and nervousness (Jaggernauth & Jameson-Charles, 2015). Geist (2015) also found positive correlations in his study to mathematics confidence and ability. Geist showed that higher levels of mathematics confidence contributed to more mathematics instruction in the classroom, along with teachers using more developmentally appropriate methods for teaching mathematics. Researchers indicated that teachers with less mathematics anxiety had a positive ARM, therefore, they confidently taught mathematics using best mathematical instructional practices.

Mathematics anxiety was prevalent among preservice elementary and early childhood majors, and it was the highest among majors when it was compared to all other college majors. (Etheridge, 2016; Geist, 2015; Hughes, 2016). Preservice teachers' mathematics anxiety lead to avoidance of mathematics courses or poor performance in mathematics courses, and it continued to influence their mathematics instruction once they became teachers (Etheridge, 2016; Geist, 2015). Researchers found that preservice teachers with high mathematics anxiety taught differently from teachers with low mathematics anxiety (Geist, 2015; Haciomeroglu, 2013; Peker & Ertekin, 2011). These high mathematics anxiety teachers used more whole group instruction, and they spent less time teaching mathematics (Geist, 2015; Haciomeroglu, 2013; Peker & Ertekin, 2011) which decreases students' exposure to mathematical concepts that is needed for student achievement (Ottmar et al., 2013). Therefore, many new teachers begin their teaching careers with mathematics anxiety and a dislike of mathematics. In turn, their mathematics anxiety and dislike for mathematics may influence their instructional decisions and practices. This study intended to determine if low ARM, possibly due to anxiety or a dislike of mathematics, may negatively influence elementary teachers' with less experience teaching mathematical instruction.

The same instructional practices were found among high mathematics anxious in-service preschool and elementary teachers, with instruction taking a lecture and basic skills approach rather than a student centered, problem-solving approach (Aslan, 2013; Etheridge, 2016). Teachers with a large amount of mathematics anxiety tended to devote less time planning mathematics instruction, and they used their mathematics instructional time on other subjects (Hughes, 2016; Iyer & Wang, 2013; Jaggernauth & Jameson-Charles, 2015). Elementary teachers with high mathematics anxiety fostered dependency among their mathematics students, in which students became dependent upon their teacher and made the teacher the main source of information (Iyer & Wang, 2013). Consequently, Hadley and Dorward (2011) found that some teachers with high mathematics anxiety were motivated to improve their mathematics instruction because they did not want their students to become mathematics anxious like themselves. Despite these teachers having high mathematics anxiety, they focused on using best instructional practices to help decrease their students' mathematics anxiety (Hadley & Dorward, 2011). This study indicated that even though there were a high number of elementary education majors with high levels of mathematics anxiety, some teachers overcame their anxiety in order to provide better mathematical instruction to their students.

Hadley and Dorward (2011) also found that upper elementary teachers had a tendency to have less mathematics anxiety than lower elementary teachers. They suggested that this could be due to teachers choosing a grade level in which they are more comfortable with the content taught leading to less mathematics anxiety (Hadley & Dorward, 2011). Thus, the grade level taught might be connected to a teacher's mathematics anxiety level. In another study, Wilkins (2010) ranked elementary teachers enjoyment of teaching specific subject areas by grade level. Kindergarten through fourth grade teachers chose reading as the subject they enjoyed the most, and fifth grade teachers chose mathematics (Wilkins, 2010). Kindergarten, third, and fourth grade teachers ranked mathematics second for the subject they enjoyed teaching, and first and second grade teachers ranked mathematics third (Wilkins, 2010). For this reason, my study investigated to see if there is a significant difference between elementary teachers' ARM and the grade level they teach.

Efficacy

Self-efficacy is considered part of the affective domain, and it influences a person's behavior (Grootenboer & Marshman, 2016; Unlu & Ertekin, 2013). Bandura's (1977) theory defined self-efficacy as the belief that people have in themselves to successfully complete a task, and self-efficacy is context-specific. Bandura stated that self-efficacy influenced whether a person started or completed an activity and how a person managed distinctive situations. People with high self-efficacy toward a task put forth more effort. They were flexible, persisted longer, and they reached a higher level of success (Chang, 2012). Self-efficacy is another component of a person's ARM because self-efficacy influences how a person perceives his or her abilities to persevere and complete a mathematical task.

Teacher efficacy is a factor in how a teacher provides instruction to his or her students. It is defined as the belief that one is capable of successfully organizing and executing a teaching task in a specific context (Chang, 2015). Teacher efficacy varied depending on the subject taught, and it can influence time and effort spent on each subject (Hunt-Ruiz & Watson, 2015; Shi, 2014). A majority of elementary teachers teach all subjects, and the variant of teaching efficacy toward subject areas can influence instructional decisions based on what teachers enjoy and prefer teaching (Ramirez, 2015).

This study examined whether teachers' ARM influences their time spent teaching elementary mathematics when faced with teaching all subjects daily.

A teacher's degree of efficacy directly influenced classroom behaviors (Unlu & Ertekin, 2013) through teachers' dedication, motivation, commitment, instructional strategies, and willingness to try new methods (Hunt-Ruiz & Watson, 2015). Mathematics teachers with high efficacy were optimistic in their teaching; they focused on individual student needs, and they provided opportunities for deep learning (Schillinger, 2016). Low efficacious mathematics teachers had negative teaching behaviors, and they gave up on their students (Schillinger, 2016). They tended to teach using direct teaching methods, while those with high efficacy used more student centered and inquiry-based teaching methods (Mji & Arigbabu, 2012). Both the elementary administrator and the ADEPT evaluator in the district in this study noticed that teachers with low confidence levels for teaching mathematics spent more time on direct instruction and less time on individual students' needs as indicated in the presented studies (Elementary Administrator, personal communication, June 27, 2016; ADEPT evaluator, person communication, October 27, 2016). These factors signify the importance of examining elementary teachers' ARM to determine if instructional practices are being positively or negatively influenced by their ARM.

In a study of elementary preservice teachers, Briley (2012) found that mathematics teaching efficacy related to teachers' mathematics beliefs about doing and learning mathematics as well as the usefulness of mathematics. Briley discovered that preservice teachers who had higher mathematics teaching efficacy had more sophisticated mathematics beliefs. Preservice teachers' higher teaching efficacy positively correlated to teachers having high mathematics self-efficacy, and they demonstrated greater confidence in problem-solving (Briley, 2012). In another study of elementary preservice teachers, Incikabi (2013) also found that preservice teachers' prior mathematics experiences affected their attitudes and beliefs towards mathematics, which, in turn, influenced their mathematics teaching efficacy. Bandura (1977) stated self-efficacy was influenced by performance accomplishments also known as personal mastery experiences. Therefore, preservice teachers' prior mathematics experiences continued to influence their ARM when they became teachers.

Researchers found that the higher teaching efficacy mathematics teachers had, the better mathematics self-efficacy their students had, leading to higher motivation and mathematics achievement (Incikabi, 2013; Nurlu, 2015; Schillinger, 2016; Son et al., 2016). Nurlu (2015) investigated primary school teachers' mathematics teaching efficacy, and she found that teachers with greater teaching efficacy were more open to new ideas and strategies, they believed their students could achieve at high levels, they attempted to change students' negative attitude towards mathematics, and they were more supportive of low achieving students. Son et al. (2016) compared the relationship between teachers' mathematics self-efficacy and student achievement and found that teachers' efficacy impacted instructional practices, and, therefore, impacted student achievement. Additionally, teachers' efficacy determined the confidence teachers had in their abilities to develop an in-depth understanding for their students, which shaped the effectiveness of mathematics instruction (Schillinger, 2016). For these reasons, teachers' affective relationship with the subject they teach, such as mathematics, should be regularly examined (Abed et al., 2014). I conducted this study to identify factors that influenced a teacher's ARM and then explored how teachers' ARM influenced their instructional decisions and practice.

Implications

Researchers studied improving elementary students' mathematics achievement by enhancing teachers' content and pedagogical knowledge (Coppola et al., 2012; Putman, 2012). Many professional development programs were developed to enhance teachers' content and pedagogical knowledge. However, teachers' affective domain is as important as their cognitive domain (Abed at al., 2014; Coppola et al., 2012; Coppola, Di Martino, Pacelli, & Sabena, 2013; Putman, 2012). The target school district has not examined teachers' ARM (Elementary Administrator, personal communication, June 27, 2016) even though teachers' ARM influences instructional decisions through their thinking, motivation, and behavior (Bates et al., 2013; Uswatte, 2013). It is critical to understand teachers' perspectives of mathematics, the relationships they form with mathematics, and how these influences their instructional practices (Coppola et al., 2012; Putman, 2012). This mixed method study may provide more information about teachers' affective domain as it pertains to mathematics and how it may influence their instructional practices. Results of this study may be used by the school district's administration to create a professional development program that enhances teachers' perspective of, and their relationship with, mathematics, so that their instructional practices may be influenced positively by increasing their ARM. This professional development may lead to focusing on strategies and skills to initiate or enhance a positive relationship with mathematics for teachers. In turn, the possible outcome of this professional development program may influence elementary teachers' instructional decisions, and it may lead to greater student achievement in mathematics.

Summary

This mixed method study explored which factors may influence elementary mathematics teachers' ARM, and how teachers believe their affective relationships influence their instructional practices. Although preservice teachers' ARM and its influence on their instructional practices have been studied, there is insufficient literature that addresses this same relationship with regard to in-service teachers. The local school district's administrators have worked to address improving teachers' content knowledge and pedagogy, but they have not addressed the issue of teachers' ARM and how it may influence instructional practices.

In Section 2, I describe the methodology for this study, including both quantitative and qualitative components. This section also contains the analysis of the collected data. Finally, it includes a discussion of both the quantitative and qualitative findings.

Section 2: The Methodology

The purpose of this mixed methods study was to investigate which factors influence elementary mathematics teachers' ARM, and to explore teachers' perceptions of their ARM in their instruction. The target school district's strategic plan indicated that student mathematics achievement declined for the past 4 years at a steady rate. Based on past mathematics performance, administrators determined that mathematics instruction was ineffective. Professional development was provided to address improving teachers' content knowledge and pedagogy, but it did not address the issue of teachers' ARM and how it may have influenced instructional practices. In the current research, most studies focused on preservice teachers' ARM, and not as much on in-service teachers' ARM. Most researchers focused on quantifying a teacher's ARM, with only a few examining ARM from a qualitative perspective, and this is why a mixed methods approach was the best design for this study.

Mixed Methods Design and Approach

Within the last decade, researchers have determined that there is a greater need to conduct mixed methods studies to examine teachers' affective domain and how it influences their teaching practices (Di Martino & Sabena, 2010; Hannula, 2016). The perception is that using only quantitative data in questionnaires alone does not fully explain the concepts and possible relationships between the affective domain and instructional practices (Hannula, 2016). Also, quantitative data alone provides arbitrary numbers that leaves the participants' responses to the questions open to the researcher's interpretation (Di Martino & Sabena, 2010). The nature of this study was a mixed methods design involving a sequential collection of quantitative data through a modified, preestablished survey, followed by collecting qualitative data through interviews. Combining quantitative and qualitative methods provided a more complex and complete analysis of the phenomena (Frels & Onwuegbuzie, 2013). A quantitative-qualitative sequential design used the qualitative data to elaborate on the quantitative data by developing, informing, and expanding the data collected (Frels & Onwuegbuzie, 2013). The quantitative component examined factors that influenced elementary teachers' ARM, and the qualitative component examined how teachers believed their ARM influenced their instructional decisions. For the quantitative analysis, I used one-way ANOVA tests and a simple linear regression to determine if there were correlations between elementary teachers' ARM and years of experience, grade level taught, and previous experience with mathematics. Next, for the qualitative research, I conducted interviews with nine elementary mathematics teachers who participated in the quantitative portion of the study to gain information about their perceptions on how their ARM influenced their instructional decisions. I analyzed the data by coding reoccurring themes and then presented the data using rich descriptions of emerging themes. By using both quantitative and qualitative data, I developed a deeper understanding of how teachers' ARM influenced their instructional decisions and practices.

Setting and Sample

The school district is located in upstate South Carolina and enrolls approximately 12,700 students from prekindergarten to 12th grade. The school district's strategic plan characterized the student population as diverse with "44.8% minority population, a poverty index of over 68.22% and 708 English Speakers of Other Languages (ESOL) students, representing 30 different languages" (p. 16). The focus of this study was limited to the 11 elementary schools within the district because they contained the study's population criterion of kindergarten through fifth grade mathematics teachers. For the quantitative portion of the study, I used a representative sample of participants because a representative sample selects individuals who are characteristic of the population being studied (Creswell, 2012). There were approximately 262 teachers who taught kindergarten through fifth grade. However, a few schools departmentalized fifth grade content in which teachers only taught one or two subjects instead of all subject areas. Departmentalization excluded a few teachers in this population because some teachers did not teach mathematics. All teachers who taught kindergarten through fifth grade mathematics were invited to participate. Inviting all teachers increased the possible number of participants, which allowed for greater generalization of the data (Leedy & Ormond, 2015). It was unlikely that there would be 100% participation, and I anticipated having 157 teachers participating in the quantitative study and 12 to 15 teachers participating in the qualitative portion of the study.

To gain access to participants, I first contacted the district's assistant superintendent for elementary instruction through district email to obtain permission to conduct the study within the school district and to acquire a letter of cooperation. Next, I used school district email to contact potential participants and their administrators to notify them of the study. School district email addresses were only used to notify participants of the study. When participants completed the survey, they used an external, data-encrypted website and from there, any communication with the participant was through their personal email addresses and my Walden University email address. A week after I notified teachers, I sent a second email that provided detailed information about the study including participants' rights, and I provided a link to the survey (Appendix B). By clicking on the survey link, participants provided implied consent. However, once participants linked to the survey, they were provided with their rights as a participant again, and they were asked if they wished to participate in the survey. Participants clicked "next" to indicate consent to participate. I maintained confidentiality by not asking participants for their names or school locations. Survey participants' data was numbered to help track the data. Assigning numbers to each participant eliminated risk to participants based on their survey responses. These procedures ensured standardization, which helped to eliminate bias and aid in the accuracy of analysis (Creswell, 2012). Walden University's approval number for this study is 08-04-17-0018400.

For the qualitative component, after participants completed the survey, they had the option to click on the survey to identify if they were willing to be interviewed. I collected 15 participants' names, school locations, and personal email addresses from the teachers who volunteered to be interviewed. Of these participants, no participant had a low ARM, four had a mid-level ARM, and eleven had a high ARM. I invited all participants who volunteered to be interviewed. One participant with a mid-level ARM declined to be interviewed, and the other three agreed to be interviewed. For the high ARM, six agreed to be interviewed while the other five never responded to requests to be interviewed. From this participant pool, I interviewed a purposeful sample of nine teachers. A purposeful sample is used to choose participants who represent a typical population of the sampling pool (Leedy & Ormond, 2015). This small sample number allowed me to more deeply investigate the instructional practices of the participants and how it influenced their ARM. I contacted participants through their personal email to schedule a time to interview them, and I provided them with a consent form to sign before the interview. The interviews took place at a private location for the participant, and I allotted 1 hour of time for each interview. To maintain confidentiality, I assigned each participant a pseudonym, and I used that pseudonym to identify his or her interview data.

Sequential Data Collection Strategies

Quantitative Sequence

For the quantitative portion of this study, I gathered quantitative data through a modified preestablished survey that quantified elementary teachers' ARM. Then, elementary teachers' ARM was compared to their years of teaching experience, the grade level they taught, and their past mathematics experiences to determine if there was a statistically significant difference between elementary teachers' ARM and these factors.

Data collection instrument. The source of data was a preestablished teacher survey designed and validated by Salzer in 2010 entitled *Teacher Survey*. I obtained permission from Salzer to use, modify, and publish his survey, and I used only the portions of the survey that aligned with my research questions (Appendix B). The original survey consisted of 60 questions in five sections: Section 1, "My Math Experience" Section 2, "My Personal Feelings About Math," Section 3, "Basic

Demographics," Section 4 "Changes in My Personal Feelings About Math," and Section 5 "Services." (Salzer, 2010). I kept Sections 1and 2, I eliminated Section 3 and Section 5, and I used a portion of Section 4. This survey was appropriate for my study because it pertained to identifying teachers' level of ARM, it included information about years of teaching experience, it included grade level taught, and it included their past experiences with mathematics. I used the information to determine any statistically significant relationships.

Survey Instrument Section 1: My Math Experience. This section included 10 questions that I modified to fit the demographics of my study and to obtain information necessary to answer my quantitative research questions.

Survey Questions 1 through 3 asked the participants information about their years of experience teaching. I used this information to determine if there was a statistically significant difference between years of experience and a teacher's ARM.

Survey Question 4 asked participants to identify the current grade level they taught. I modified this question to exclude grade levels that were not at the elementary level, and I only included kindergarten through fifth grade. Question 5 asked participants to identify the previous grade levels they have taught. These two questions were used to determine if there was a statistically significant difference between grade level taught and a teacher's ARM.

Survey Question 6 asked the participants to identify what type of settings they have taught mathematics: self-contained classroom (teaching all subjects), departmentalized classroom (teaching one to two subjects), coteaching (teaching with two teachers in the classroom), and resource (teaching students with learning disabilities). Questions 7 through 10 asked participants about courses or workshops relating to mathematics or mathematics education that they have attended since becoming teachers and when they attended these workshops or courses. I used these questions to determine if there was a statistically significant difference between past mathematics experiences and a teacher's ARM.

Survey Instrument Section 2: My Personal Feelings About Math. For this section of the survey instrument, Salzer (2010) took questions from Aiken's Revised Math Attitudes Scale (RMAS), and he slightly revised Questions 11, 12, and 28 to better fit his study. I used all the questions in this section as written by Salzer. Survey Questions 11 through 30 used a 5-point Likert scale with the categories of Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA). For 10 of the 20 questions, Strongly Disagree was valued at 0 points, Disagree was valued at 1 point, Undecided was valued at 2 points, Agree was valued at 3 points, and Strongly Agree was valued at 4 points. The other 10 questions were reverse-coded. In Salzer's study, these questions produced a total score ranging from 0 to 80. A zero total score indicated a strong negative attitude toward mathematics, a total score of 40 indicated a neutral attitude, and a total score of 80 indicated a strong positive attitude toward mathematics (Salzer, 2010). For this study, I classified teachers' ARM into three groups: low-level, mid-level, and high-level. A low-level ARM equaled a score of 0 to 26, a mid-level ARM equaled a score of 27 to 53, and a high-level ARM equaled a score of 54 to 80. I used these data in the inferential analysis of the quantitative portion of the study to find if there were any statistically significant difference between teachers' ARM and their years of experience, grade level taught, and previous experiences with mathematics. I also identified participants for the qualitative interviews based on their level of ARM, and I compared their level of ARM to the information gathered during the interviews.

Survey Instrument Section 3: Changes in My Personal Feelings About Math. This portion of my survey was originally Salzer's (2010) fourth section. I eliminated the first seven questions in this portion of Salzer's survey. Question 33 related to state testing, and I modified it to change the name of the state test to South Carolina's state assessment. Question 34 asked participants to rank how instructional feedback from their principal or dean influenced their attitude. Since the study site does not have deans, I removed "or dean" from Question 34.

Survey Questions 31 through 36 used a 5-point Likert scale with categories of Very Negative (VN), Negative (N), No Influence (=), Positive (P), and Very Positive (VP). Very Negative was scored at 2 points, Negative was scored at 1 point, No Influence was scored at 0 points, Positive was scored at 3 points, and Very Positive was scored at 4 points. A score of 0 indicated that there was no influence on teachers' ARM. A score ranging from 1 to 2 indicated a negative impact on a teacher's ARM, and a score ranging from 3 to 4 indicated a positive impact on a teacher's ARM. Questions in this section asked the participants to identify factors that related to their ARM. I also used these questions to determine if there was a statistically significant difference between the past mathematics experiences mentioned in the questions and a teacher's ARM.

Reliability and validity of survey. By using a preestablished survey, reliability and validity of the survey have been verified. Section 1 of the survey identified demographic information about each participant. The information asked pertained to years of teaching experience, the grade levels taught, and the workshops or courses attended. For Section 2, Salzer (2010) used RMAS which is a 20-question instrument developed by Aiken and Dreger in 1961. They reported a "reliability of $r = .94$ for test-retest, and a test of independence confirmed that attitudes specific to mathematics were being measured ($X^2 = .80$, $df = 1$)" (as cited in Salzer, 2010, p. 12). Salzer found that RMAS had a Cronbach's Alpha score of 0.977 indicating a very high internal reliability. Cronbach's Alpha score determines the internal consistency of items on a survey by obtaining a score ranging from 0 to 1 with a score of 1 indicating the highest reliability (as cited in Santos, 1999). Finally, Section 3 collected perception information about the teachers' experiences. Participants were asked how specific scenarios may have influenced their attitudes towards mathematics such as professional development, standardized testing, feedback from their principal, and interactions with parents. Since Sections 1 and 3 of the survey instrument provided demographic and other perception variables, they did not have reliability measures attached (Larson-Hall & Plonsky, 2015). However, Salzer used content validity measures to validate these portions of the survey instrument.

Participant completion of the survey. I emailed participants notification of the study. A week later, I sent a second email informing participants of their rights and a link to the survey. The second email contained a notice of consent and the survey link. When participants clicked on the survey link, they provided implied consent. Participants were given 2 weeks to complete the survey. I sent a third email a week later to remind participants about completing the study.

A link in the email directed participants to the survey in SurveyMonkey®. The first page of the survey restated the consent notice and participants clicked the “next” button indicating they were giving consent to participate in this portion of the study. The second page of the study gave instructions and information about the survey. Participants clicked the “next” button to proceed to the survey. Participants clicked on their chosen answers throughout the survey. On the final page of the survey, participants indicated if they would like to volunteer to be interviewed for the qualitative portion of the study. The page included a brief overview of the interview procedures. Participants either clicked the “no” or “yes” button indicating their preference. If the participant clicked “yes,” they were asked to enter their name, school location, and personal email address.

Once the participants completed their survey, raw data was housed on the data-encrypted SurveyMonkey® website as well as my personal, password-protected computer. I selected participants for the interviews based on their ARM level – low, mid, or high. I then chose four to five participants from each category for my purposeful sample for the qualitative portion of the study.

Qualitative Sequence

For the qualitative portion of this study, I gathered data through face-to-face, semistructured interviews that explored the influence elementary teachers’ ARM had on their instructional decisions and practices. Participants from the survey portion of this study indicated on their survey if they wished to be selected for the interviews. From the participant volunteers, I emailed all 15 teachers to invite to be interviewed.

Data collection instrument. I used face-to-face, semistructured interviews for collecting the qualitative data. Face-to-face interviews yield the highest response rate because the researcher can establish a rapport with the participants, leading to greater cooperation (Leedy & Ormond, 2015). In semistructured interviews, the researcher has guiding questions in which he or she can vary the wording, change the order, or even omit questions during the interview process (Lodico, Spaulding, & Voegtle, 2010). By using a semistructured interview, the researcher asks key interview questions to gain the data needed to address his or her research questions, but also has the flexibility to follow the direction the interview takes based on the participant's answers (Lodico et al., 2010). A semistructured format enabled me to guide the interview but at the same time allowed me to explore deeper any new insights that emerged. I created the interview protocol (Appendix C) that I used for my interviews so that my qualitative research question and subquestions were addressed. The interview protocol also aligned with the identified conceptual framework: Bandura's (1977) theory of self-efficacy.

Interview protocol. The interview protocol I created addressed my qualitative research question and subquestions in alignment with the conceptual framework. I began the interview by reminding participants of the purpose of the study and their rights as participants. They signed a consent form for this portion of the study and agreed to be audio recorded. The interview protocol was broken into three sections: Background Questions, Affective Relationship with Mathematics, and Instructional Practices. To collect background information about each participant, I asked how long they have taught mathematics, what grade levels they have taught mathematics, and what grade level and subjects they taught last year. These questions were to gain simple background knowledge about the participants, but also to help build rapport with the participant.

The second section focused on the participants' ARM. I asked the participants about their favorite subject to teach, how they felt when they taught mathematics, and how they ranked their ARM: high, medium, or low. I asked about their mathematics teaching efficacy and factors that might have influenced it. These questions connected to the conceptual framework by focusing on the participants' confidence to perform the task of teaching mathematics. Bandura (1977) stated that there are four sources of efficacy: "performance accomplishments, vicarious experiences, verbal persuasion, and physiological states" (p. 195). The probing questions addressed these four sources as factors influencing the participants' teaching efficacy. The final part of this section asked participants how their ARM influenced their instructional decisions such as the time they chose to spend on mathematical tasks. This section connected to my qualitative research question and Subquestion 1a because the interview questions addressed how their ARM influenced their instructional decisions and their time spent on mathematics instruction.

The third section of the interview protocol focused on participants' instructional practices. I asked participants to describe a typical mathematics lesson they taught the previous school year. I also asked participants to explain what factors influenced the instructional strategies they used. This section connected to Bandura's (1977) theory by asking the participants probing questions that reflected their teaching efficacy and the four sources of efficacy. I then asked participants about the SCCCR seven mathematical process standards and how they used them for instruction. Finally, I asked participants to reflect on how their ARM influenced their everyday instructional practices. This section connected to my qualitative research question and Subquestion 1b because the questions addressed how ARM influenced their instructional practices and the use of the SCCCR seven mathematical process standards.

After asking questions, I thanked the participants for letting me interview them and told them that I appreciated the time they allotted me. I also reminded the participants that I would transcribe their interview, and I would send them a summary through their personal email for them to review and verify for accuracy.

Conducting the interviews. The anticipated number of participants for the qualitative portion of my study was 12 to 15. However, a total of 15 participants volunteered to be interviewed. Of these participants, no participant had a low ARM, four had a mid-level ARM, and 11 had a high ARM. I invited all participants who volunteered to be interviewed with only nine participant agreeing to be interviewed. Using multiple participants in different ARM level groups allowed for triangulation to be built into the data collection and analysis. Triangulation allows the researcher to collect data from multiple sources to find consistencies and inconsistencies among the data with the hope that they will lead to or support a hypothesis (Leedy & Ormond, 2015).

Each interview lasted approximately 30 minutes including setting up and answering any questions participants may have had before the formal interview began. During the interview, I took brief notes and also audio recorded each interview. After the interview, I transcribed the interviews on my personal, password-protected computer. I then created an interview summary of my findings that I emailed to the participant for them to review and verify for accuracy. This procedure is known as member checking. Member checking ensures that the researcher has accurately captured the participants' meaning (Merriam, 2009). I then viewed participants' feedback to determine if I needed to adjust my interpretation of their interview data.

Researcher's role and bias. I am currently a fifth grade mathematics teacher for the study site. I have taught for 16 years in the same school district, the same school, and the same grade level. I have taught all subjects in fifth grade and also taught the fifth grade gifted and talented program in previous years. Because of the extensive years that I have taught at this location, I have developed friendships at my school as well as among other teachers in the district. However, I have no supervisory role within my school or the school district. My role in the district and my person relationships did not affect my data collection method.

The bias I brought to this study was that I have a strong passion for mathematics and mathematics education. I chose this topic because I wanted to improve mathematics education within this school district. I was fully aware of my role as the researcher in this study. I was able to set aside my bias to conduct this study by acknowledging it upfront and using member checking to ensure that I interpreted the data as the interviewees intended. I followed the procedures outlined by each method and design and adhered to the protocols that I established to ensure validity in my data collection and analysis.

Data Analysis

The purpose of this mixed method study was to determine which factors influenced elementary mathematics teachers' ARM, and how teachers believed this relationship influenced their instructional practices. The design of this study involved a sequential collection of quantitative data through a modified preestablished survey, followed by collecting qualitative data through interviews.

Quantitative Analysis

I gathered quantitative data through a modified preestablished survey that quantified elementary teachers' ARM. Then, elementary teachers' ARM was compared to their years of teaching experience, the grade level they taught, and their past mathematics experiences to determine if there was a statistically significant difference between elementary teachers' ARM and these factors. I used the secure website SurveyMonkey® to deliver the survey. I then emailed the survey link to the participants for them to complete the survey online. SurveyMonkey® securely stored the survey data as well as enabled me to perform descriptive and inferential statistical analysis. The data were exported to IBM SPSS Statistics version 21 to aid in the descriptive and inferential statistical analysis.

First, I completed a descriptive statistical analysis to determine participants' ARM. The survey instrument contained three sections; Section 2 used RMAS to determine the participants' levels of ARM. To quantify participants' ARM, a total score was calculated ranging from 0 to 80. A low-level ARM equaled a score of 0 to 26; a mid-level ARM equaled a score of 27 to 53; and a high-level ARM equaled a score of 54 to

80. In addition to the mean total score, I calculated the median, standard deviation, minimum, maximum, and skewness of scores. I used these data in the inferential analysis of the quantitative portion of the study to find if there were any statistically significant difference between teachers' ARM and their years of experience, grade level taught, and previous experiences with mathematics.

Next, I conducted an inferential analysis using data collected from Sections 1 and 3 to determine if there were any statistically significant difference between the demographic and experience information collected and participants' levels of ARM. Research Question 1 asked if there was a statistically significant difference between elementary teachers' years of experience (1 to 6 years, 7 to 15 years, and 16+ years) and their ARM. Two survey questions (SQ) asked participants about their teaching experience: the number of years taught (SQ1) and the number of years teaching mathematics (SQ3). For each survey question, I completed a one-way ANOVA test to determine if there was a statistically significant difference between participants' various years of experiences and their ARM. A one-way ANOVA test compares the means of two groups to determine if the difference between them is by chance or due to a real relationship (Fink, 2013).

Research Question 2 asked if there was a statistically significant difference between elementary teachers' grade level taught and their ARM. SQ 4 asked participants what grade levels they taught mathematics last year. I used a one-way ANOVA test to determine if there was a statistically significant difference between teachers' grade levels and levels of ARM.

Research Question 3 asked if there was a statistically significant difference between elementary teachers' past experiences with mathematics and their ARM. Multiple questions in Sections 1 and 3 of the survey collected information about teachers' past experiences with mathematics. In Section 1, SQ 6 asked participants to identify whether they have taught in a self-contained, departmentalized, coteaching, or resource setting. I completed a one-way ANOVA test to determine if the setting in which a teacher has taught mathematics influenced his or her ARM. Survey questions 7 through 10 asked participants about college courses or workshops related to mathematics or mathematics teaching they have taken. I used one-way ANOVA tests to determine if there was a relationship between teachers participating in courses or workshops and levels of ARM.

In Section 3 of the survey, SQ 31 to 36 asked participants to rate the influence of six factors on their attitudes towards mathematics. A total scale score was obtained to quantify how much participants believed the six factors influenced their attitudes toward mathematics. I then used a simple linear regression to determine if a relationship existed between the level of influence of the factors and levels of teachers' ARM. A simple linear regression is used to determine if there is a correlation between two variables (Leedy & Ormond, 2015).

I analyzed the survey data using descriptive and inferential statistics, and then I began collecting qualitative data through interviews.

Qualitative Analysis

For the qualitative portion of this study, I gathered data through face-to-face, semistructured interviews that explored the influence elementary teachers' ARM had on their instructional decisions and practices. Participants from the survey portion of this study indicated if they wished to be selected for the interviews. I used the survey data of the participants who volunteered to be interviewed to identify participants based on their ARM level – low, mid, or high.

The interview protocol was broken into three sections: Background Questions, Affective Relationship with Mathematics, and Instructional Practices. The first section collected background information about each participant's teaching experience. The second section focused on the participants' ARM. It connected to my qualitative research question and Subquestion 1a because it addressed how their ARM influenced their instructional decisions and their time spent on mathematics instruction. The third section of the interview protocol focused on the participants' instructional practices. It connected to my qualitative research question and Subquestion 1b because the questions addressed how ARM influenced their instructional practices and the use of the SCCCR seven mathematical process standards.

After conducting the interviews, I transcribed the audio recordings of the interviews using the secure software program NVivo®. NVivo® is a qualitative data analysis software program produced by QSR International (2016) that is used by academic researchers to aid in organizing and analyzing qualitative data. I used NVivo® to open code the data to identify consistent themes and reoccurring patterns. Then, I used the NVivo® software to axial code the data to compress the initial findings into clusters of ideas. Finally, I used thematic analysis to identify the pertinent emergent themes for the final analysis that were used in my findings. During this process, I purposefully looked for any discrepant data or differences of opinions that could unexpectedly influence my findings. This awareness increased the openness to all possible interpretations and increased the validity of the analysis process.

Validity and Trustworthiness of the Data

Several steps were taken to ensure the validity and trustworthiness of the data. Before starting this study, an extensive search of what is already known about the topic was conducted. I used this information to develop my research questions, to find a survey instrument, and to create my interview protocol. In addition, I collected quantitative and qualitative data which allowed for a more complete and complex analysis of the phenomena. The survey instrument I used was preestablished and validity and reliability were confirmed. Another method to establish validity and trustworthiness of the data was triangulation. For the qualitative portion of the study, I collected data from multiple sources. I identified three groups of participants, and within those three groups, I invited participants to be interviewed to represent each category. However, no participant in the low-level category agreed to be interviewed, and this lack of participation limited my findings to mid-level and high-level participants. The interview findings were compared within each ARM level group as well as across groups. I also used member checking to increase the trustworthiness of the data by having each participant review my findings from his or her interview to check for accuracy of my interpretation. Finally, I identified my personal bias and strictly followed the data collection and analysis procedures to guard against my personal bias. Using the multiple steps that I have outlined ensured the validity and trustworthiness of the data.

Data Analysis Results

For this mixed method study, I gathered the quantitative survey results through the encrypted SurveyMonkey® website and then exported to IBM SPSS Statistics version 21 for analysis using descriptive and inferential statistics. The dependent variable was teachers' ARM that was measured using a 5-point Likert scale. A total ARM score was calculated ranging from 0 to 80. A low-level ARM equaled a score of 0 to 26, a mid-level ARM equaled a score of 27 to 53, and a high-level ARM equaled a score of 54 to 80. The independent variables were teachers' years of experience, grade levels taught, and past experiences.

I gathered the qualitative results through face-to-face, semistructured interviews that explored the influence elementary teachers' ARM had on their instructional decisions and practices. Participants volunteered to be interviewed when they completed the quantitative survey. Once I transcribed the interviews, the secure software program NVivo® was used to analyze the interview data to identify consistent themes and reoccurring patterns. These results were then triangulated with the quantitative data to compare the qualitative themes with the statistical analysis of the quantitative data.

Quantitative Findings

The sample for this study consisted of elementary mathematics teachers within the study site. The survey was sent to 272 elementary mathematics teachers through email with details of the study and purpose. The participants were allowed 2 weeks to respond, and I sent a follow-up email after the first week. However, I had not achieved the anticipated response rate of 60% of the sample population; therefore, the data collection continued for another week with another reminder email sent to participants.

A total ARM score was calculated using Section 2 of the survey which was Aiken's Revised Math Attitudes Scale (RMAS). These survey questions used a 5-point Likert scale with the categories of Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA). From this score, I classified teachers' ARM into three groups: low-level, mid-level, and high-level. A low-level ARM equaled a score of 0 to 26, a mid-level ARM equaled a score of 27 to 53, and a high-level ARM equaled a score of 54 to 80. I tabulated these scores in SPSS. The descriptive statistics for teachers' ARM score include range, mean, variance, and standard deviation. A histogram was also included to provide visuals of the shape and spread of the data set.

I used the total ARM score for the inferential statistics portion of the study. This phase of data analysis used one-way ANOVA tests and simple linear regression test by the SPSS program, with a significance level of .05. These were used to answer the research questions and reveal if there was a significant relationship between the mean scores.

Statistical analysis. I sent the survey to 272 elementary mathematics teachers within the study site. SurveyMonkey® website reported 162 responses. However, two participants completed only Section 1 of the survey, and two more participants completed Sections 1 and 2 but did not complete Section 3. There were 160 participants whose ARM score was totaled. The RMAS scale that indicates a teachers' ARM produces a total score ranging from 0 to 80. A zero total score indicates a strong negative attitude toward mathematics and a total score of 80 indicates a strong positive attitude. The mean responses for teachers' ARM score was 54.95 with a standard deviation of 17.62. More information of the descriptive statistics is presented in Table 1.

Table 1

Descriptive Statistics of Teachers' ARM Score

N	Valid	160
	Missing	2
Mean		54.95
Median		58.00
Std. Deviation		17.62
Range		78.00
Minimum		2.00
Maximum		80.00

ARM Category Ranges from 0 to 80

The mean score classifies teachers' average ARM score to be in the high-level category. However, the beginning cut off score for the high-level category is 54. The mean of 54.95 is just over the high-level cut off score placing it at the low end of the higher level just on the border between the high and mid-level groups. The median score is a 58 showing that there is a shift in scores towards the higher level category as indicated in the histogram in Figure 1. The mean and median were higher than anticipated based on the research conducted prior to this study. However, a limitation may be that participants answered the survey based on what they thought would be socially acceptable versus what they truly felt.

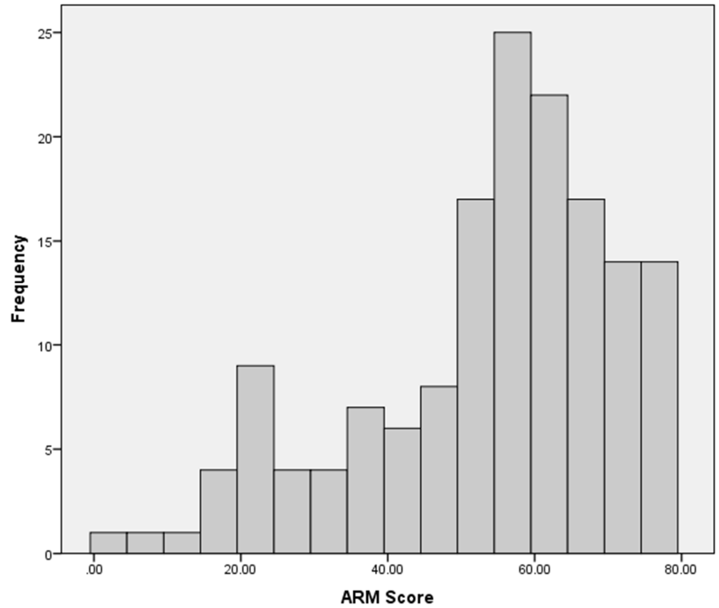

Figure 1. Histogram of teachers' ARM score.

I used the SPSS program for hypothesis testing for each research question. One-way ANOVA tests and a simple linear regression were used to determine if there were any statistically significant difference between the independent variables (years of experience, grade level taught, and past experiences) and the dependent variable (teachers' ARM).

Research Question 1 asked if there was a statistically significant difference between elementary teachers' years of experience (1 to 6 years, 7 to 15 years, and 16+ years) and their ARM. SQ 1 asked teachers how many years they taught overall, and SQ 3 asked how many years they have taught mathematics. These two questions were used to determine if there was a statistically significant difference in the relationship. For SQ 1, an analysis was conducted to determine if there was a difference in a teachers' ARM based on total years of experience (1 to 6 years, 7 to 15 years, and 16+ years). The analysis resulted that there was no statistically significant difference in the relationship as determined by the one-way ANOVA [F(2, 157) = .033, p = .967] (Table 2).

Table 2

ANOVA between elementary teachers' years of experience and their ARM

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	21.029	2	10.514	0.033	0.967
Within Groups	49330.571	157	314.207		
Total	49351.600	159			

A Tukey post hoc test revealed that teachers' ARM was not statistically significant between 1 to 6 years compared to 7 to 15 years (p = .996), between 1 to 6 years compared to 16+ (p = .966), and 7 to 15 years compared to 16+ years (p = .981). For SQ 3, an analysis was conducted to determine if there was a difference in a teachers' ARM based on total years of teaching mathematics (1 to 6 years, 7 to 15 years, and 16+ years). The analysis resulted that there was no statistically significant difference in the relationship as determined by the one-way ANOVA [F(2, 157) = .077, p = .926] (Table 3).

Table 3

ANOVA between elementary teachers' years of experience teaching mathematics and their ARM

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	48.262	2	24.131	0.077	0.926
Within Groups	49303.338	157	314.034		
Total	49351.600	159			

A Tukey post hoc test revealed that teachers' ARM was not statistically significant between 1 to 6 years compared to 7 to 15 years (p = .921), between 1 to 6 years compared to 16+ (p = .969) and 7 to 15 years compared to 16+ years (p = .993). The null hypothesis was accepted for Research Question 1.

Research Question 2 asked if there was a statistically significant difference between elementary teachers' grade level taught and their ARM. SQ 4 asked teachers what grade level they taught mathematics last school year. An analysis determined if there was a difference in a teachers' ARM based on the grade level they taught: kindergarten, first, second, third, fourth, fifth, and multiple grade levels. The analysis resulted that there was no statistically significant difference in the relationship as determined by the one-way ANOVA [F(6, 153) = 1.106, p = .361] (Table 4).

Table 4

ANOVA between elementary teachers' grade level taught and their ARM

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	2052.104	6	342.017	1.106	0.361
Within Groups	47299.496	153	309.147		
Total	49351.600	159			

A Tukey post hoc test revealed that teachers' ARM was not statistically significant between the various grade level with the significance levels ranging from p = .477 to p = 1.00. The null hypothesis was accepted for Research Question 2.

Research Question 3 asked if there was a statistically significant difference between elementary teachers' past experiences with mathematics and their ARM. Section 3 of the survey asked participants to what degree did various experiences influenced their attitude towards mathematics. These experiences included professional development, feedback from administration, experiences teaching, focusing on standardized testing, interactions with parents, and their own life experiences. I used a 5-point Likert scale with categories of Very Negative (VN), Negative (N), No Influence (=), Positive (P), and Very Positive (VP). Each response was given a point value to obtain a total influential score of these factors. I conducted a simple linear regression test to investigate Research Question 3. The predictor was teachers' past experience score, and the outcome was teachers' ARM score. The predictor variable was found to be statistically significant [B = .695, 95% C.I. (.125, 1.265), $p < .05$], indicating that for every 1 unit increase in teachers' past experience score, teachers' ARM score changed by (+/-) .695 units (Table 5). The model returned an R-squared value of 0.189 for the past experience score, which indicates a low statistical difference the coefficient is closer to 0 than 1. A coefficient that is closer to 1 indicates a large effect versus closer to 0 indicates a small effect (Statistics Solutions, 2017). The null hypothesis is rejected and the alternative hypothesis is retained.

Table 5

Linear regression model for elementary teachers' past experience score compared to their ARM

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	45.545	4.140		11.000	0.000	37.367	53.724
	Past Experience Score	0.695	0.289	0.189	2.409	0.017	0.125	1.265

a. Dependent Variable: ARM Score

Qualitative Findings Overview

I selected the sample for the qualitative data from the participants who volunteered to be interviewed when they completed the quantitative survey. Fifteen participants volunteered, and I invited them all by email to be interviewed. Nine participants agreed to be interviewed. Participants were assigned a pseudonym using the letters A through I to protect their privacy. An ARM score from the survey was used to categorize participants into low, middle, and high relationships with mathematics. Of the nine participants, no one had a low ARM (score of 0 to 26), three had a mid-level ARM (score of 27 to 53), and six had a high-level ARM (score of 54 to 80). The three participants who were classified mid-level (Teachers A, B, and D) had ARM scores of 51, 53, and 52 respectively. All three of these scores are at the very top end of the mid-level ARM score of 27 to 53. The six participants who were classified high-level (Teachers C, E, F, G, H, and I) had ARM scores of 73, 58, 55, 69, 66, and 63 respectively. These scores had a wider range of distribution with two participants being close to mid-level and another being close to the highest total score of 80.

The participants in the study do not accurately reflect the full spectrum of the levels of ARM that a teacher may have and is a limitation to the study. All nine participants were close to the high-level range (54 to 80) of a person's ARM. No participants had a low-level ARM or even a mid-level ARM that falls near the low-level. As Figure 2 shows, there is a significant percentage of the participants in the quantitative data that fall in the low-level category (0 to 26) and the lower end of the mid-level category (27 to 40).

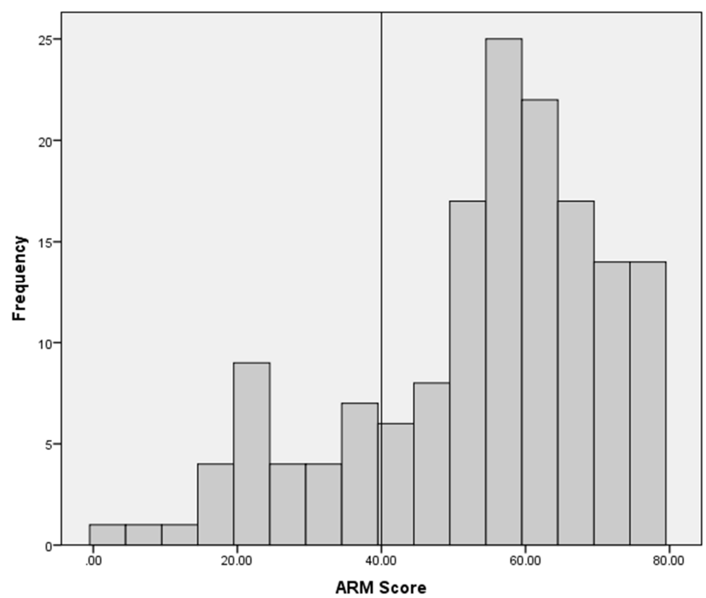

Figure 2. Histogram of teachers' ARM score showing distribution of scores above and below the score of 40.

None of these participants volunteered to be interviewed and are not reflected in the qualitative data.

The secure software program NVivo® was used to analyze the interview data to identify consistent themes and reoccurring patterns. First, I open coded the data for all participants by interview questions and by participants' ARM level groups. I read through the interview data and highlighted phrases. Each phrase was then assigned a code (Appendix D). Twenty-seven codes were identified during this process. Next, the codes were combined based on reoccurring patterns. I accomplished this by comparing the interview findings of each participant in the same ARM level group to identify similar patterns and discrepant ideas among participants. Next, I compared the interview findings across different ARM level groups to identify similar patterns and discrepant ideas among participants across ARM level groups. The open coding process revealed that participants' primarily discussed their previous mathematics experiences, how those experiences developed their instructional practices, current influences on the instructional practices, and mandated curriculum and time constraints (Appendix E).

For the next step in the analysis, I used NVivo® to axial code the initial findings into clusters of ideas. The clusters that emerged were participants' affective relationship with mathematics, participants' instructional practices, and how these two phenomena overlapped (Table 6).

Table 6

Clusters of Ideas

	Clusters	Reoccurring Patterns	
		Mid-level	High-Level
1	Participants' Affective Relationship with Mathematics (ARM)	Preferred to teach reading. Frustrated with childhood mathematics but had positive mathematics experiences that followed. Feelings have positively shifted due to working with and learning from colleagues through college courses, workshops, and professional development. Feedback and collaboration has increased their relationship with mathematics the most.	Preferred to teach mathematics. Had some bad experiences with childhood mathematics, but had positive mathematics experiences to follow. Very positive and confident towards mathematics teaching. These feelings have grown overtime due to feedback from and collaboration with colleagues. Feelings towards mathematics has strengthened due to college courses, workshops, and professional development.
2	Participants' Instructional Practices	Mandated time and curriculum set by administration. Instructional practices are influenced by collaboration with colleagues and their personal experiences with mathematics. Instruction focused on understanding and making sure that mathematics does not become a weakness for their students.	Mandated time and curriculum set by administration but viewed mathematics as a high priority in their classrooms. Instructional practices based on students' needs and collaborating with colleagues. Instruction focused on understanding but avoids strategies they don't feel are valuable for their students.
3	Interaction of Participants' ARM and Their Instructional Practices	Bad experiences influenced teachers to create positive experiences for their students. Want positive experiences for students. Focus on concrete and understanding.	High-priority in classroom. Teach for understanding. Focus on higher level, real world connections, and teaching for understanding due to negative experiences with math.

Next, I thematically coded the interview findings by identifying overlapping patterns and ideas across the three clusters. The themes that emerged were acknowledging childhood experiences in mathematics and collaborating with colleagues. These two themes relate to a subtheme of teaching for understanding. These final themes were determined by identifying where the clusters created in the axial coding overlapped and which ideas reoccurred most often. Finally, I compared the themes identified in the qualitative analysis to the inferential statistical analysis results of the quantitative data to find similarities and differences among both sets of data.

The qualitative data were used to address the research question and sub questions:

1. What are elementary teachers' perceptions on how their ARM influences their mathematical instructional decisions and practices?

a. What are elementary teachers' perceptions of their ARM regarding their mathematical instructional time?

b. What are elementary teachers' perceptions of their ARM regarding their use of the SCCCR seven mathematical process standards during instruction?

The following is a two-part discussion that first focuses on the qualitative and quantitative findings organized by the clusters of ideas that emerged from the axial coding process. The second part of the discussion focuses on the themes that emerged to address the qualitative research question and sub questions.

Discussion of Qualitative Findings

Once the interviews took place, and I transcribed them, participants were sent a summary of their interview findings to conduct a member check. One participant requested for two items to be changed, and the rest of the participants approved their summary as is. The qualitative data were first open coded for all participants by interview questions to identify reoccurring patterns and then collapsed into clusters of ideas through axial coding. The final analysis involved thematic coding to determine the overall themes. The qualitative findings were then compared to the quantitative findings to determine if there were similarities and differences between the two types of findings. The following is an in-depth discussion of the qualitative findings, how some of the findings related to the quantitative findings, and the clusters of ideas determined by the axial coding.

Demographic data. I divided the interview protocol into three sections: Background Questions, Affective Relationship with Mathematics, and Instructional Practices (Appendix C). Background questions were used to gather data about the participants' years of experience, grade level taught, and subjects they taught. The high-level ARM participants' total years of experiences ranged from 5 years to 27 years with the mean being 15 years. The mid-level ARM participant total years of experience ranged from 3 years to 12 years with a mean of 9 years. The high-level ARM participants' mean years of experience was higher than the mid-level participants, but both groups of participants still fell in the years of experience range of 7 to 15 years. These results correlate with the results of Putman's (2012) study indicating that experienced teachers had a higher teaching efficacy in specific domains than novice teachers (1 to 6 years). However, quantitative Research Question 1 indicated that there was no statistically significant difference between teachers' years of experience and their ARM as evidenced in Table 2.

As for the grade level participants taught, almost all participants taught upper elementary (third through fifth grade) the last school year with one teacher having taught second grade. Quantitative Research Question 2 indicated that there was no statistically significant difference between teachers' grade level taught and their ARM as evidence in Table 3.

Two participants in the mid-level participants group taught all subject areas last year, and the other taught reading, writing, and mathematics. For the high-level participants group, four participants taught mathematics along with one other subject, one participant taught all subject areas, and the other taught reading, writing, and mathematics. Most elementary teachers have to teach all subject areas and need to become masters of content and pedagogy for all subject areas (Abed et al., 2014). Almost all the participants in the high-level participant group did not teach all subject areas. Not teaching every subject may be a contributing factor to a higher level ARM since the participants stated that it allowed them to focus on fewer subjects.

Affective relationship with mathematics. For this portion of the interview, I asked participants to discuss their relationship with mathematics including factors that might have influenced their feelings, and how they felt when they taught mathematics. Participants started with discussing their favorite subject to teach. There was a difference in responses between the participant groups. All the participants in the mid-level participants group identified reading as their favorite subject because they believe it is the basis for all learning. Conversely, four of the six participants in the high-level participants group stated mathematics as their favorite with one participant stating science because they enjoyed the hands-on aspect of teaching. All these participants teach third through fifth grade. However, one participant in the high-level participants group stated reading and taught second grade. This response is consistent with Wilkins' (2010) findings in which elementary teachers ranked their enjoyment of teaching specific subject areas by grade level. Upper elementary teachers (third through fifth grade) leaned towards mathematics and science for their favorite subjects to teach; whereas, lower elementary teachers (kindergarten through second grade) leaned towards reading as their favorite subject (Wilkins, 2010). Ramirez's (2015) findings stated that teachers' instructional decisions could be influenced by whether teachers enjoyed or preferred teaching a particular subject. The qualitative findings of this study show that four of the participants of the high-level participants group prefer mathematics and may indicate a positive influence on their mathematical instructional decisions and practices.

I asked participants to discuss how they felt when teaching mathematics and what their confidence level was during mathematics instruction. All of them expressed a positive and confident feeling when teaching mathematics. However, three participants discussed situations in which their confidence teaching mathematics would lessen. Teacher B (mid-level) stated "When I teach third grade math, it makes me feel more comfortable. Fifth grade math is scary. I think [the third grade] makes me feel comfortable because we are teaching just the very basics." Teacher I (high-level) had a similar response in that she enjoys teaching second grade mathematics, but would not enjoy teaching a higher grade level because the content is “heavier.” Teacher H (high-level) stated that she felt confident teaching elementary mathematics but would not be as confident teaching any content above seventh grade mathematics. Strohl et al. (2014) suggested that teachers, over time, became content specialists in their grade level and became proficient at teaching those areas and thus had a positive impact on an individual’s beliefs in his or her abilities. Bandura (1982) stated that people are more self-assured to complete an activity they believe themselves capable of versus an activity that exceeds their coping capabilities. These participants’ thoughts demonstrate that, in this setting, teachers are more confident in specific content in which they have the most experience in and confidence declines with lack of experience.

Instructional practices. I asked participants to discuss their instructional practices and how their ARM might influence their practices, addressing as well the subquestions of time on task and using mathematical process standards. I asked teachers to describe a typical mathematics lesson. Most of the participants described Guided Math as the framework for their mathematics lesson due to the study sites requirement for elementary mathematics. Guided Math, also known as Math Workshop, is a framework for instruction in which each lesson starts with an energizer activity, then a whole-class mini lesson, then small groups and workstations, and the lesson ends with a closing activity (Newton, 2013). Teachers A, F, and H did not describe this exact framework because they pull students out of their regular classroom for 45 minutes of in-depth small group instruction.

While describing their instructional practices, three instructional strategies consistently reoccurred in their discussions: using manipulatives, a focus on vocabulary, and connecting lessons to the real world. Participants stated that their past experiences with mathematics and collaborating with their colleagues influenced their use of these strategies. These strategies reinforce Cribbs' and Linder's (2013) findings that teachers who use real-world situations, relevant mathematics tools, and mathematical discourse created mathematical communities in their classrooms. Teachers with a positive ARM encouraged student initiative and mathematical communication, focused on conceptual understanding, and connected mathematics understanding to practical applications (Hughes, 2016). The majority of the interview participants have a high-level ARM with the three participants with a mid-level ARM bordering on the high-level category. All the participants described the need to teach for understanding and believed the greatest influences have been their past experiences with mathematics and collaborating with their colleagues.

When examining teachers' perception of their ARM and how it relates to their mathematics instructional decisions, time on task time is a factor of instruction that is influenced by teachers' ARM. Teacher efficacy varies depending on the subject taught, and it can influence time and effort spent on each subject (Hunt-Ruiz & Watson, 2015; Shi, 2014). Teachers with a negative ARM were less likely to include mathematics into their daily plans, and teachers with a positive ARM were more likely to include more mathematics, especially in elementary grades when teachers teach all subjects (Geist, 2015). When discussing time on task, four of the participants referred to the district's required minutes for mathematical instruction and the required minutes for other subject areas. Despite the district's time requirements, three participants admitted to going over their time requirements for mathematics. Teacher C stated, "I think I spend more time on it because I want to get everybody to have the same feelings about it that I have." Teacher H did state that in prior years when she taught in a self-contained format, she would "definitely spend more time on math. If math ran over, that was a good thing." Teacher I said, "I do enjoy it sometimes a little too much, and I have to set timers for myself." All three of these participants have a high-level ARM and support what researchers have found. Teachers with a positive ARM were more likely to spend added time on mathematics instruction (Geist, 2015; Hunt-Ruiz & Watson, 2015; Shi, 2014).

ARM and instructional decisions and practices. I asked participants to discuss how they perceived their ARM influenced their mathematical instructional decisions and practices. Immediately, participants began to discuss how their childhood mathematics positively or negatively influenced the type of mathematics person they are today. Five of the nine participants discussed negative experiences and the impact it has on their teaching today. Teachers A and D (mid-level ARM) discussed how negative past experiences had encouraged them to improve their teaching. Teacher A stated that "I know what frustrated me in math when I was in elementary school, so I try to avoid those kinds of things in my lessons." Teacher D is using her negative experiences to help her "learn stuff as a teacher and to make the experience better for my kids. So it is still something that I'm learning how to do with them. How to build that confidence and to be positive." Teachers F and I (high-level ARM) shared that their struggles in mathematics helped them connect with their students. "I see a child struggling with something, it is easier to see for me why they are struggling" (Teacher F). Teachers C, G, and H (high-level ARM) did not have negative experiences when learning mathematics and have always felt positively towards mathematics. They believe their ARM influences their instructional practices by being able to pass on their positive relationship to their students. They enjoy problem-solving and higher-level engaging activities, and they lean towards those types of activities in their classrooms. Teacher H stated how much she "loves" problem-solving and logic problems, so those are the types of activities she tends to have her students do because she loves working out the mathematics with them.

Qualitative Findings: Themes

The final stage of the qualitative analysis involved thematically coding the interview findings by identifying overlapping patterns and ideas across the three clusters. The themes that emerged were teaching acknowledging childhood experiences in mathematics and collaborating with colleagues. These two themes relate to a subtheme of teaching for understanding. Participants stated that due to childhood experiences and collaborating with colleagues they have identified teaching for understanding as the most effective mathematics instructional practice.

Theme 1: Acknowledging childhood experiences in mathematics. The participants in this study stated that their childhood experiences in mathematics influenced positively and negatively their ARM and continually influences their mathematical instructional decisions and practices. The participants, excluding Teacher G, discussed negative experiences that influenced their ARM when they were in middle school or high school. Teacher A stated that her high school teachers "turned her off from math." Teacher C stated that he struggled with problem-solving in middle school. Teacher I expressed that she always had to work harder in mathematics than any other subject. Teacher B experienced a teacher making her feel stupid in high school because she was not catching on as quickly as her classmates. A study by Jackson and Leffingwell (1999), showed that only 7% of preservice teachers described their prior mathematics experiences as positive; whereas, 93% had mixed experiences or completely negative experiences. Zager (2017) stated that the exception in education is teachers who have had completely positive childhood mathematics experiences. However, most of the participants in this study had a positive experience that followed a negative experience that helped to change their attitudes towards mathematics. Teacher C had a mathematics teacher who helped her through her troubles in seventh grade. She stated "We sat down, and she said, 'Let's work through it. Let's see what is wrong.'" Her teacher's willingness to take the extra time to explain the mathematics processes and help her learn the mathematics positively influenced her ARM. Teacher F shared the same experience with a teacher who took the extra time to help her realize what she needed to do to improve her mathematics ability.

Participants' acknowledging and reflecting on past experiences with mathematics have influenced their perception of their ARM and influenced their mathematics instructional decisions and practices. All the participants stated that acknowledging and being aware of these mathematics experiences shaped them as teachers because these experiences helped them to understand mathematics and themselves as a mathematician.

Some of the participants said that reflecting on what it was like to not understand something helped them connect with their students on a new level of empathy. Other participants said that they wanted to make sure that their students' experiences were much better than their childhood experiences. Reflective thinking is an important component of a teacher's skill set that enhances the effectiveness of instruction. (Yilmaz & Gokcek, 2016).

Theme 2: Collaborating with colleagues. Eight of the nine participants discussed how collaborating with colleagues positively increased their ARM and influenced their mathematics instructional decisions and practices. Teacher B shared there was a teacher in her district who was a "fabulous mathematics teacher" and that working with her changed her whole attitude towards mathematics. Teachers C and F discussed how working and talking with their peers helped them to get "excited" about mathematics and to see mathematics in different ways. Teachers D and G shared how working with colleagues helped them expand their resources and helped them have more strategies to teach their students. Teachers E and I discussed how administrators encouraged them to build their content knowledge and provided feedback that positively influenced their ARM. Several participants shared that their ARM had evolved due to experiences with colleagues.

Other factors some participants mentioned as influencing their ARM and instructional decisions were college courses and professional development. Through college courses and professional development, participants stated that they were given the opportunity to collaborate with others in their field but outside of their home school.

Several participants said they avoided mathematics courses in college due to their prior experiences until they had to take their mathematics methods courses. Teacher F stated that her first mathematics methods course scared her because she did not feel that she understood mathematics enough to teach it. Teachers D and I also reflected on their mathematics methods course but saw them as a positive influence versus a negative. Other teachers, A, B, and C, had recently taken college mathematics courses and felt that these courses improved their ARM through learning new instructional strategies by working with the professor and fellow students. Teacher C also stated that recent professional development helped him increase his positivity towards mathematics by allowing time for talking and sharing with colleagues. Teacher E specifically mentioned professional development in which she was able to have lessons modeled for her by colleagues to see what instruction should look like. This experience helped her gain a better understanding of mathematics and increase her ARM. Participants believed that through collaboration their perception of their ARM was positively influenced leading to better mathematics instruction.

Subtheme: Teaching for understanding. Participants discussed that the main influence their ARM has had on their mathematics instructional practice is teaching for understanding. Participants stated that either their childhood experiences with mathematics or collaborating with colleagues had influenced them to make sure that they are teaching for understanding. Teacher E stated that when reflecting on her elementary mathematics experiences, she realized that her experiences were very negative. She decided to make sure her students did not have the same experience by making sure she was not teaching "step-by-step memorizing processes," but teaching the concepts behind the steps. Teacher I acknowledged that she had to work a little harder as a mathematics student and believes that reflecting on her struggles helped her relate to her students better. She tries to increase their understanding of mathematics content through the use of manipulatives.

As for collaboration, Teacher B stated that collaborating with a colleague changed her "whole attitude because [I] learned that math is not paper and pencil." She stated that her colleague taught her to provide more mathematics experiences for her students to help them understand the concept and not just do the skill. Participants also discussed how working with colleagues helped them incorporate the SCCCR seven mathematical process standards during mathematics instruction. These mathematical process standards are:

1. Make sense of problems and persevere in solving them.
2. Reason both contextually and abstractly.
3. Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.
4. Connect mathematical ideas and real-world situations through modeling.
5. Use a variety of mathematical tools effectively and strategically.
6. Communicate mathematically and approach mathematical situations with precision.
7. Identify and utilize structure and patterns. (SCDOE, 2017, pp. 7-8)

These process standards foster cognitively demanding tasks and supportive mathematical communication that increases student understanding, not just achievement (Jones et al., 2012; Polly et al., 2014). Teachers with a higher-level ARM are more likely to use these types of instructional strategies in their classroom than teachers with a lower-level ARM (Hughes, 2016). All participants recognized the SCCCR seven mathematical process standards, and eight of the participants stated they used them regularly in their instructional practices. Teachers B and I stated that they regularly plan with their colleagues to integrate the process standards into their mathematics instruction to help increase student understanding.

Summary

The quantitative findings for Research Question 3 support that there this is a statistically significant difference between elementary teachers' past experiences with mathematics and their ARM. These experiences included childhood mathematics experiences and collaborating with colleagues. This relationship is also evident in the qualitative data. Participants stated multiple scenarios in which their experiences have indeed positively or negatively influenced their ARM. The qualitative and quantitative data connects to Bandura's (1977) four sources of self-efficacy: performance accomplishments, vicarious experiences, verbal persuasion, and physiological states. Performing tasks successfully and positive vicarious experiences increase self-efficacy, and mastery experiences increase with success and lower with failure (Bandura, 1977). Negative childhood experiences with mathematics had the highest negative effect on a teacher's ARM; however, collaborating with colleagues had the highest positive effect on a teacher’s ARM. Acknowledging these experience and reflecting on them, enables a teacher to overcome any negative influence and use this knowledge to positively influence their mathematics instructional practices (Jackson, 2015; Zager, 2017).

According to the qualitative findings, the participants in this study acknowledged that they had experiences before becoming a teacher that influenced how they feel towards and relate to mathematics. Some participants in this study had negative experiences that have caused them to want to be better for their students, and others had positive experiences that they want to continue to share with their students. Nevertheless, all the participants stated that working with colleagues and attending professional development has enabled them to grow as mathematicians, therefore, influencing their ARM and in turn having a positive influence on their instructional practices. Bandura’s (1977) acknowledges that the four sources of self-efficacy, “performance accomplishments, vicarious experiences, verbal persuasion, and physiological states,” (p. 195) influence how a person feels towards successfully completing a task. The more successful someone feels, the more likely they will take on the task (Bandura, 1977). An appropriate outcome of this study would be a professional development program to help teachers reflect on their past experiences and the sources of efficacy that influences their ARM as well as opportunities for collaboration that would aid in influencing the four sources of self-efficacy. Professional development programs provide opportunities for teachers to grow as professionals through a unified vision that provides a focus to help improve teachers’ instructional practices (Gee & Whaley, 2016). The purpose of the purposed professional development program is to enable teachers to connect with their feelings toward mathematics and acknowledge their ARM level, reflect on how it influences their instructional practices, and be able to work with colleagues to increase their ARM and implement more effective instructional practices.

Section 3: The Project

Introduction

The purpose of this mixed methods study was to investigate which factors influence elementary mathematics teachers' ARM, and to explore teachers' perceptions of their ARM in their instruction. Based on the findings from this study, it is evident that professional development is needed to address teachers' ARM and how it is influencing instructional practices. The quantitative data from this study showed that there was a significant percentage of the participants that fell in the low-level ARM category and the lower end of the mid-level ARM category (Figure 2). The quantitative data also showed that there was a statistically significant relationship between an elementary teachers' past experiences with mathematics and their ARM. Due to this, teachers need to be given the opportunity to reflect on these experiences and determine how it influences their ARM and instructional practices. The qualitative findings also showed that participants had mixed feelings about their ARM and that past experiences were a large influence on teachers' ARM and their instructional practices. The qualitative findings also showed that collaboration was an essential component to mathematical instructional decisions as well an influential factor of teachers' ARM. The findings of both the quantitative and qualitative data show that past experiences with mathematics, which included childhood mathematics and collaborating with colleagues daily and through workshops and courses, have the greatest influence on a teachers' ARM and their mathematical instructional decisions and practices.

I created a professional development program that focuses on reflection and collaboration to enhance teachers' ability to change how they feel about mathematics through a growth mindset approach. First, teachers need to become aware of their ARM and the past experiences that have positively or negatively influenced their ARM. The quantitative results of the study showed that past experiences had an influence on teachers' ARM, and the qualitative data showed that past and current experiences continually influence the way teachers think and work in their mathematics classroom. Next, teachers need to develop strategies to help them overcome any experiences that may have negatively influenced their ARM and learn to use those same strategies to increase their ARM positively. Finally, teachers need time to reflect on their mathematics teaching as well as the opportunity to collaborate and learn from their colleagues. The goal of this professional development program is to increase the effectiveness of mathematics instruction by helping teachers understand how they feel about mathematics, recognize how it influences their instructional practices, and learn from reflective and collaborative experiences that will positively increase their ARM.

Rationale

Although there was not a statistically significant difference between teachers' years of experience or grade level taught and their ARM, there was a statistically significant difference shown between teachers' past experiences and their ARM. Additionally, one theme that emerged from the qualitative data showed that the most influential factor on their ARM was their experiences with mathematics during their childhood. All the participants agreed that their ARM influenced their instructional practices and decisions. However, they all stated that working with colleagues and attending professional development has enabled them to grow as mathematicians, therefore, influencing their ARM and having a positive influence on their instructional practices. As acknowledged earlier, the participants in the study were near the high-level range of a person's ARM and no one identified in the low-level ARM range. Despite this, professional development would be beneficial to those not represented in the study because prior studies have found that a large portion of teachers have had negative or mixed experiences with mathematics prior to teaching (Jackson and Leffingwell, 1999; Zager, 2017). Boaler (2016) found that mathematics trauma hinders one's mathematics performance by creating a long-lasting negative relationship with mathematics. However, Boaler also stated that these negative pathways can be reversed at any time by changing the message that people receive about mathematics. The findings of this study showed that teachers' past mathematical experiences influenced their ARM and most teachers either had negative or mixed past experiences. However, teachers' ARM has been positively influenced by collaborating with colleagues and attending professional development.

Bandura's (1977) theory of self-efficacy stated that psychological processes create and strengthen how a person perceives their efficacy towards a task. The strength of one's efficacy can affect whether a person can or try to manage a specific situation and influences choice of activities (Bandura, 1977). Bandura's statements suggest that no matter a teacher's initial ARM level, by increasing his or her ARM their belief in their mathematical ability may increase. Using this professional development program as a means to increase teachers' ARM and influence their instructional practices will engage teachers' four sources of efficacy: "performance accomplishments, vicarious experiences, verbal persuasion, and physiological states" (Bandura, 1977, p. 195). Teachers acknowledging and reflecting on their mathematical experiences may engage the source of performance accomplishments because they may begin to see how their ARM has influenced their instructional practices. Teachers developing and using strategies to increase their ARM also engage performance accomplishments as well as physiological states because increasing teachers ARM may positively increase their feeling towards mathematics and strengthen their confidence levels during instruction. Finally, through collaboration in this program, teachers involve the sources of vicarious experiences and verbal persuasion. Collaboration provides opportunity for discussing effective instructional strategies and instructional practices that have worked in the past for colleagues, which in turn engages vicarious experiences and verbal persuasion. Stevens et al. (2013) discovered that using all four sources of self-efficacy increased teachers' mathematics self-efficacy no matter their level of mathematical content knowledge or background. Using all four sources of self-efficacy in this professional development program to help increase teachers' ARM may positively influence all teachers' instructional practices.

Review of the Literature

I collected and analyzed research from peer-reviewed articles and journals, and books to conduct the literature review. I conducted an exhaustive search using Walden University's metasearch resources including searching ERIC and Education Research

Complete databases. I also conducted basic Internet searches using Google and Google Scholar. Keywords included *professional development, effective professional development, elementary mathematics professional development, reflective mathematics, collaboration and professional development growth mindset, growth mindset in mathematics instruction,* and *mathematical mindset.* After I reached saturation, these resources were used to develop a professional development program that met the needs indicated by the data collected in the study.

The participants in this study indicated that past experiences molded their ARM and that current experiences collaborating with their colleagues influenced their ARM regularly. Understanding this information led me to create a professional development program that helped teachers understand how they felt about mathematics, recognize how it influenced their instructional practices, and learn from reflective and collaborative experiences that positively increase their ARM.

Professional Development

Professional development is a means to help educators grow as professionals. It creates a unified vision for all stakeholders that provides direction for increasing student achievement (Gee & Whaley, 2016). Professional development is a learning process that takes place throughout educators' professional lives and includes self-examination and reflection to help educators expand their instructional knowledge and practices (Shriki & Patkin, 2016). Shriki and Patkin (2016) stated that professional development should empower teachers to make complex decisions and to develop their teaching abilities.

Professional development should also present opportunities for teachers to reflect and engage in professional dialogue (McNeill, Butt, & Armstrong, 2016).

Effective professional development requires a focus on teachers' needs (Beswick, 2014). In a study of elementary school mathematics teachers' opinions of their professional needs, Shriki and Patkin (2016) discovered that professional development was more effective when instructors were aware of teachers' needs. They began their study surveying teachers' needs and considering participants' opinions (Shriki & Patkin, 2016). This information was used to personalize the teachers' professional development, and Shriki and Patkin believed it aided in teachers adapting themselves to the change that was being asked of them.

Another component of effective professional development is focusing on the emotional intelligence of the participants (McNeill et al., 2016). In a quantitative study of middle-level mathematics teachers, Stevens et al. (2013) determined that professional development that concentrated on knowledge alone was not as successful as a program that included a focus on the emotional (self-efficacy) needs of the participants. Participants in this investigation partook in a 2-year professional development program that concentrated on mathematics teaching knowledge as well as mathematics self-efficacy (Stevens et al., 2013). Self-efficacy scores improved for all participants in this study; however, teachers with higher mathematical content knowledge had higher gains in their self-efficacy scores than the other participants (Stevens et al., 2013). Stevens et al.'s findings showed that simply understanding mathematics content knowledge did not guarantee self-efficacy in mathematics instruction. An effective professional development program tends to be more successful when teachers' emotional intelligence is enhanced through the process.

Professional development that includes the development of teachers' self-efficacy tends to lead to improvement in mathematics instruction and student achievement. Hunzicker (2013) conducted a case study of eight elementary and middle school teachers and found that teachers with higher self-efficacy tended to be more open to change, willing to try new approaches, and were more engaged in professional learning activities. These characteristics are attributed to higher student achievement and can be enhanced through professional development that incorporates self-efficacy (Hunzicker, 2013). Polly et al. (2015) conducted a 3-year study that examined the influence of elementary teachers' professional development on teachers' instruction and student achievement. Their findings showed that there was a change in teachers' practice from teacher centered to student centered (Polly et al., 2015). From their findings, they determined that professional development increased self-efficacy, beliefs about instructional practices, and student performance, which in turn increased student achievement (Polly et al., 2015). Through professional development, teachers' beliefs and attitudes can change because teachers are provided the opportunity to challenge and reflect on their beliefs (Beswick, 2014). The goal of mathematics professional development should be developing the sense of self as a mathematics teacher (Beswick, 2014).

A final component of effective professional development is providing a progression of workshops versus a one-time delivery of information, allowing substantial time for reflection and collaboration (Goldsmith, Doerr, & Lewis, 2014; Kafyulilo, 2013;

Stevens et al., 2013). Kafyulilo (2013) reviewed and analyzed various research papers to conclude that multiple studies discovered that professional development should not be restricted to a limited time frame but should be consistent and long-term. He stated that through long-term professional development, participants can spend more time reflecting on their learning and collaboration with colleagues (Kafyulilo, 2013). McNeill et al. (2016) interviewed teachers in three schools to determine the influence of on-going collaborative professional development across the schools. They determined that long-term professional development allowed for self-reflection and gave time for teachers to consolidate information into instructional practices (McNeill et al., 2016). Including collaboration and reflection in on-going professional development may lead to significant teacher professional development.

Reflection

Reflection in the mathematics classroom is the task of carefully considering experiences to gain a better understanding of mathematics perception and how these experiences influence teaching and learning (Jackson, 2015). Reflection allows for a deepened awareness of thoughts that are brought to the forefront of a person's mind. Reflection connects to one of Bandura's (1977) sources of self-efficacy by becoming aware of one's physiological state as it relates to a task. Cavanagh and McMaster (2015) stated that the process of reflection should involve

> recording events and considering what might have been done differently, looking back over time to ascertain common themes or issues that regularly emerge from practice, imagining future possibilities and considering situations where one

> might act in a new way, and describing and refining one's observations to validate them with others. (pp. 472-473)

Reflection should take place before, during, and after instruction (Posthuma, 2012).

Reflective thinking should be an important component of a teacher's skill set that enhances the effectiveness of instruction. (Gningue, Schroder, & Peach, 2014; Yilmaz & Gokcek, 2016). Gningue et al. (2014) studied two cohorts of mathematics teachers and their use of reflective inquiry. The researchers noted that reflection was an unfamiliar practice to both groups of teachers (Gningue et al., 2014). However, over time, the participants' reflections became more detailed with richer information to inform their practice. Yilmaz and Gokcek (2016) had similar findings in their study of mathematics teachers. They analyzed survey and interview data before implementing professional development and discovered that participants did not use reflective thinking and lacked the knowledge to implement it into their instructional practices (Yilmaz & Gokcek, 2016). However, after attending professional development, participants' knowledge about reflective thinking increased along with their use of it to inform their instruction (Yilmaz & Gokcek, 2016). In Breen, McCluskey, Meehan, O'Donovan, and O'Shea's (2014) study, the researchers themselves decided to use reflective practices for 1 academic year as a way to improve their mathematics lectures. Breen et al. (2014) discovered that the benefits of reflection were identifying themes and areas of their practices that needed improvement. Also, reflections provided them with a new perspective of their instruction and students. Breen et al. also noticed that a challenge to reflective practices is that it takes time to develop reflective skills. A person should not expect to be an expert right away, and reflection improves with time and practice.

Researchers have shown that professional development that includes reflective practices enhances teacher participation and promotes professional growth (Prestridge & Tondeur, 2015). Prestridge and Tondeur (2015) conducted a study of an online professional development program using reflection as a key component of the program. Participants in the study stated that reflection was therapeutic and influenced their instruction by connecting their classroom instruction to the professional development in the online community (Prestridge & Tondeur, 2015). Prestridge and Tondeur stated that a downfall of the reflection component in their study is that most reflection started in private discussions activated by the mentor. Since reflection was new to participants, they had to be encouraged to complete their reflections. Even though reflection may take time to initiate and become an expert at, the result of reflection influences an alteration of perspective which then changes behavior and leads to improvement of professional practices (Belvis, Pineda, Armengol, & Moreno, 2013; Menz & Xin, 2016).

Professional development programs should include both components of reflection and collaboration to help with the reflective process and encourage participants to begin the process (Dana, Pape, Griffin, & Prosser, 2017; Gee & Whaley, 2016). Posthuma (2012) shared that collaboration was essential to effective reflection because it created a supportive atmosphere in which colleagues challenged assumptions teachers might have in order to help colleagues view ideas from another perspective to create positive change.

Collaboration

Collaboration is when two or more people or organizations come together to work on a shared goal through deep interactions (Devlin-Sherer & Sardone, 2013; Harmon, 2017). Collaboration is the highest level of partnership because expertise from everyone involved is synthesized resulting in a new idea or product (Harmon, 2017). In a 2012 study, teachers were surveyed about their job satisfaction, and those that reported high job satisfaction worked in places that had on-going professional development and provided time for peer collaboration (Morel, 2014). Collaboration enables teachers to have shared goals and create a learning community in which everyone's ideas are synthesized into a product or solution that benefits the community.

An essential component of effective professional development is collaboration opportunities. Patton and Parker (2017) studied physical education teachers participating in professional development communities. Participants stated that collaboration made them feel part of a community and not isolated (Patton & Parker, 2017). Participants also stated that colleagues with similar interests provided a sounding board, emotional support, and enhanced feelings of self-efficacy which all led to their professional growth (Patton & Parker, 2017). Patton and Parker stated that collaboration helped to increase the participants' self-efficacy and their confidence in their instructional practices.

Collaboration aids in the effectiveness of professional development by allowing teachers to freely share experiences, attitudes, and beliefs in a supportive environment. A study of elementary school teachers by Acar and Yildiz (2016) showed that professional development with peer support had a positive effect on teacher growth through enhanced motivation and engagement. They stated that it allowed teachers to learn from each other, to exchange ideas, and to experience positive feelings due to improving personal and professional skills (Acar & Yildiz, 2016). Similar studies by Jao (2013) and McNeill et al., (2016) stated that participants shared that the most effective part of their professional development experiences were their collaborative practices. Gee and Whaley (2016) also researched how collaboration influenced elementary teachers' professional growth. They stated in their findings that "the sharing of ideas, planning lessons together, and reflecting on teaching and student learning in a supportive environment appears to have been critical to teacher growth" (Gee & Whaley, 2016, p.97). Collaboration is a key component of effectively implementing change and increasing opportunities for professional growth.

Growth Mindset

Dweck's (2016) groundbreaking research on fixed and growth mindset has shown educators different views of intelligence and what drives people to succeed. A person with a fixed mindset deems that intellect is predetermined and cannot be altered (Dweck, 2016). People with fixed mindsets avoid challenging tasks and tend to have a helpless response to challenges because they do not want to disconfirm their intelligence (Dweck, 2016). However, a person with a growth mindset believes intelligence and ability grow through persistence and effort (Dweck, 2016). A growth mindset person tends to take on challenging tasks because tasks do not define their intelligence (Dweck, 2016). When faced with failure, a growth mindset person continues to try and use new approaches (Yeager & Dweck, 2012). A person with a growth mindset tends to be resilient, responds positively and productively to challenges, and perseveres with sustained interest (Yeager & Dweck, 2012). A person's mindset is connected to his or her physiological state that determines stress or vulnerability during a task.

Furthermore, people can possess both mindsets and have the ability to change their mindset. Dweck (2016) stated that people tend to be a mixture of both mindsets, and mindset was context specific. For example, a person can have a growth mindset about their artistic ability but have a fixed mindset about their intellectual ability (Dweck, 2016). Even if the tendency was to have a fixed mindset, it could be changed to a growth mindset (Brock & Hundley, 2016). Neuroscientists have shown that the brain is plastic and can grow in response to effort (Boaler, 2013). In a recent experiment, scientists learned that when a person worked on a task a few minutes each day, the brain rewired itself and grew to perform the task better (Boaler, 2016). Since the brain can grow, changing one's mindset is as simple as trying new things and changing one's self-talk (Brock & Hundley, 2016; Dweck, 2016). When fixed mindset people work on a hard task, they should not give up and use positive self-talk to change themselves from a fixed to a growth mindset

Possessing a growth mindset is important to the mathematics classroom and is an essential component of teachers' professional development. Mathematics, of all subject areas, had the strongest fixed mindset through the type of thinking asked of students and the message sent by teachers (Boaler, 2013). Boaler's (2013) research on brain plasticity and growth mindset and how it relates to English schooling practices determined that different types of mindset were communicated through teacher practices, whether students were given a closed task (fixed) or an open task (growth). Boaler's findings showed that a growth mindset teacher valued deep thinking and mistake making versus a fixed mindset teacher valued speed and accuracy in a mathematics classroom. If teachers believed that students' abilities could grow, then students were given the opportunity to grow.

A teacher with a growth mindset has the tendency to take on new challenges, is willing to make changes, and positively influences student performance (Brock & Hundley, 2016). In a 2013 study, Gutshall gave participants hypothetical student scenarios to determine teachers' mindsets for each scenario. Gutshall (2013) found a correlation between teachers' mindset and students' mindset which influenced student achievement. The findings showed if a teacher's mindset was fixed, they believed the student's ability would be fixed, and if a teacher had a growth mindset, they believed the student's ability could increase (Gutshall, 2013). Lambert (2014) studied the implementation of growth mindset at a secondary school in England. His findings showed that when low achieving students had a teacher with a growth mindset, the students became high achievers by the end of the school year (Lambert, 2014). Helping teachers to improve their mindset through professional development enables teachers to develop a growth mindset and in turn, influences teachers' instructional practices and student achievement.

Project Description

The purpose of this professional development program (Appendix A) is to have teachers connect with their feelings toward mathematics and acknowledge their ARM level, reflect on how it influences their instructional practices, and work with colleagues to increase their ARM and implement more effective instructional practices. This program includes 3 full-day sessions with continuous monthly sessions to follow throughout the school year. The first component of the program includes identifying teachers' ARM and their feelings towards mathematics which includes writing their mathematics story to determine how they developed these feelings. The second component of the program has teachers learning about fixed and growth mindset, how it applies to their ARM, and developing strategies and goals for improving their ARM. The third component of the program has teachers examining growth mindset in the mathematics classroom and developing a plan to incorporate growth mindset in to their mathematics instruction. The fourth component is having teachers meet once a month to collaboratively plan and reflect on their ARM and how it is influencing their instruction. Throughout the professional development program and for the remainder of school year, teachers will also keep a reflective journal to continually reflect on their ARM and how it influences their instructional practices and decisions.

Potential Resources and Existing Supports

Most of the resources needed to implement this professional development program are readily available to each of the schools in this study. Teachers need a laptop and access to the internet to complete the ARM survey and evaluations. Teachers may use paper and pencil or their computers to answer discussion questions or to create a reflection journal. Art supplies are needed to complete the Growth Mindset Brain activity, and teachers may want to use these supplies for their reflection journals as well.

The presenter needs a laptop, projector, access to the internet, and copies of the handouts. The study site also has allotted professional development days built into the beginning and the middle of the school year. Additionally, teachers already meet weekly as a grade level, so no additional time would need to be taken away from the classroom. However, a possible barrier is that these professional development days and meetings times may already be scheduled for some other professional development, and the district's administrators will need to determine which program would be more beneficial for their teachers. Another possible barrier is that when teachers find out their ARM level, teachers with a low-level ARM may disengage due to developing anxiety or develop negative feels about their mathematics capability. Conversely, teachers with a high-level ARM may feel that they do not need the professional development since they are already at a high level. However, the activities that follow, Writing Their Mathematics Story, and Growth Mindset, should reengage the participants and give high-level participants new insight on the reasons behind their instructional decisions.

Proposal for Implementation and Timetable

The timeline for this professional development program is 1 school year with 3 full-days of professional development at the beginning of the school year and monthly meetings to follow. The first professional development day has teachers learning about their ARM and rediscovering their mathematics history. The second day has teachers learning about growth mindset, and the third day has teachers exploring ways to incorporate growth mindset into their mathematics instruction. The monthly meetings that follow have teachers reflecting on their ARM and instructional practices as well as working collaboratively to plan for future mathematical instruction.

Roles and Responsibilities

Several roles and responsibilities are needed for this program to be successful. First, the assistant superintendent for elementary instruction needs to approve the program and give permission for the programs to be used at the elementary schools. Under the guidance of the elementary and early childhood program coordinator, I will oversee the implementation of the program which includes training the trainers for each school and making sure each school has the necessary materials. Secondly, the trainers' responsibilities are to make sure they understand the program, feel confident enough to teach it, and have the materials ready at their school site to implement the program successfully. Finally, the teacher participants have the responsibility of approaching the program with the willingness to learn and follow through with completing their reflection journal between sessions and implementing what they learn into their instructional practices. These roles and responsibilities have to work cohesively in order for the goal of increasing the effectiveness of mathematics instruction to be met.

Project Evaluation Plan

The first activity of the professional development program is for teachers to complete the ARM survey to determine their level of ARM. Teachers will then take the survey on the last full-day of professional development to determine if there are any shifts in teachers' thinking in any of the categories on the survey. At the end of each day-long session, a formative evaluation will be given to teachers so that they can provide feedback on their experiences for that day. These formative evaluations will help the facilitator make any changes that are necessary prior to the next session. At the end of the last full-day session, teachers will fill out a summative evaluation to determine if the goal of the project was met in terms of increasing the effectiveness of mathematics instruction by helping teachers understand how they feel about mathematics, recognize how it influences their practices, and learn from reflective and collaborative experiences that will positively increase their ARM. After the 3 full-days of professional development, teachers will meet once a month to collaboratively plan and reflect on their ARM and how it is influencing their instruction. At the end of the school year, teachers will again complete the ARM survey to determine to what degree their ARM level has changed since the first professional development session. Teachers will complete a final summative evaluation to determine if the goal of the project was met. The key stakeholders of this professional development program are elementary mathematics teachers, elementary administrators, students, and parents, as well as the community surrounding the study site.

Project Implications

Social Change

This professional development program addresses improving teachers' understanding of their own confidence in mathematics instruction, which may lead to positive social change. Improving teachers' effectiveness in the classroom may improve students' mathematics achievement, and students may be better prepared for subsequent mathematics courses and may expand their career choices. Effective mathematics instruction is the tool for students to gain critical skills that are the foundation for vital careers in many fields such as finance, business, statistics, technology, education, and the sciences: medicine, engineering, aeronautics, genetics, etc. (Jaggernauth & Jameson-Charles, 2015; NCTM, 2000). Students' future college courses, degree type and completion along with career earnings are connected to students' mathematics performance (Shanley, 2015). By improving elementary mathematics teachers' ARM, their effectiveness in the classroom will increase, leading to greater student achievement in mathematics.

Local Stakeholders

The local community includes the key stakeholders of teachers, students, and parents, but also includes other residents and businesses that are dependent on students gaining the tools to be successful in and provide for the community. Students' ARM is influenced by teachers' ARM (Etheridge, 2016). By increasing teachers' ARM, teachers may become more effective in the classroom and pass on their positive relationship with mathematics to their students. Students who develop a positive ARM tend to take more mathematics courses (Shanley, 2015). Researchers have shown that the more mathematics courses students take, "the higher their earnings 10 years later, with advanced math courses predicting an increase in salary as high as 19.5% 10 years after high school" (Boaler, 2016, p. xi). Researchers have also shown that students who take more advanced courses learn to reason and think logically which makes them more productive in their careers (Boaler, 2016). Students' mathematical success enhances the community they live in by creating a sustainable workforce that positively impacts the community's economy and well-being.

Far-Reaching

Even though this study focuses on the local community, the premise of this professional development can be used beyond the study site. National data shows that mathematics achievement is low across the United States (NCES, 2015). Teacher professional development continues to focus on mathematical content and pedagogical knowledge. However, teachers should also possess positive beliefs, attitudes, and emotions towards mathematics (Coppola et al., 2012), which encompasses teachers' ARM. Effective professional development across the nation needs to include the affective domain to fully prepare elementary teachers to teach mathematics effectively. Therefore, this professional development program to increase teachers' ARM may have positive repercussions when implemented beyond the study site.

Conclusion

The purpose of this study was to determine factors that influenced teachers' ARM and to explore teachers' perceptions of their ARM in their instruction. The quantitative and qualitative data showed that past experiences were the most influential factor on a teacher's ARM and that working with colleagues and attending professional development enabled teachers to grow as mathematicians. From these findings, a professional development program was developed with the goal of increasing the effectiveness of mathematics instruction by helping teachers understand how they feel about mathematics, recognize how it influences their practices, and learn from reflective and collaborative experiences that will positively increase their ARM.

Section 4: Reflections and Conclusions

Introduction

At the study site and across the nation, elementary students' mathematics achievement is low compared to other nations (NCES, 2015). However, the globalization of United States' markets and economy require a workforce that is proficient in mathematics (NRC, 2001). To improve mathematics achievement, classrooms need an effective mathematics teacher who is not only a master of mathematics' content and pedagogy but also possess a positive ARM (Cross Francis, 2015; Jones et al., 2012; Polly et al., 2014; Swars, 2015). The purpose of this mixed methods study was to investigate which factors influence elementary mathematics teachers' ARM and to explore teachers' perceptions of their ARM in their instruction. Once the data were collected and analyzed, a professional development program was developed to improve teachers' ARM to influence their mathematics instruction positively.

This section includes a discussion of the project's strengths and limitations as well as recommendations for alternative approaches. It also includes a discussion on scholarship, project development, and leadership. I include personal reflections along with discussing implications, applications, and directions for future research.

Project Strengths and Limitations

The strengths of this project are that it is on-going and provides numerous opportunities for collaboration and reflection. Researchers have found that continual professional development allows participants time to consolidate information into their instructional practices (McNeill et al., 2016). The designed professional development includes 3 days of workshops along with monthly professional development throughout the year so that teachers are given the extended time for integration of knowledge through continuous support. Key components of the monthly professional development are engaging teachers in reflective and collaborative processes. These components support the development of teachers' ARM and the opportunity to discuss and improve their instructional practices.

However, the limitation of this project is that teacher evaluations and reflections are self-reported. Teachers take a survey to determine their ARM at multiple points in the study and again take various surveys to provide feedback to the effectiveness of the study. Surveys enable the researcher to collect data quickly, but are self-reported, allowing the participant to share what they think, but not always what they actually do (Creswell, 2012). Teachers' reflections also indicate how teachers feel, but this information cannot be verified from teachers' self-reflections alone. Therefore, the data collected may not be an actual indication of how teachers really feel about their ARM, their instructional practices, nor the professional development program.

Recommendations for Alternative Approaches

As mentioned, a limitation of this project is the collection of self-reported data. An alternative approach would be to add classroom observations as a component of the professional development. Observations would enable the researcher to observe, first-hand, teachers' instructional practices and behaviors during the lesson to determine the influence of ARM during actual instruction. This information could be used in conjunction with teachers' reflections to help teachers gain a clearer picture of how ARM is influencing their instructional practices.

The study could also be approached differently by including classroom observations as a component of data collection along with the survey and interviews. Adding the component of classroom observations would deepen the understanding of the phenomena that is being studied and would add to the data triangulation process. A deeper understanding of teachers' ARM and the influence on instructional practices would help in the development of the professional development program. For instance, researchers have found that teachers' self-efficacy is context and subject matter specific and can affect how teachers teach specific content (Hoy & Spero, 2005). Through classroom observations, the researcher may discover that teachers' ARM differs in each strand of mathematics. Teachers may have a higher ARM when teaching geometry but a lower ARM when teaching fractions. If this is the case, then the professional development program would be altered to reflect specific strands of mathematics in which teachers need help with improving their ARM and instructional practices. Also, adding classroom observations to the study may lead to the discovery of another area of weakness that may need to be strengthened to improve student mathematics achievement for this study site.

Scholarship, Project Development and Evaluation, and Leadership and Change

This study will provide stakeholders with information about elementary mathematics teachers' ARM and how it influences their instructional practices. Implementing a professional development program that focuses on improving teachers'

ARM and not just content and pedagogy may further develop elementary mathematics teachers. Including teachers' ARM with content and pedagogy development acknowledges the importance of the affective domain in the learning process for teachers as well as students.

Self-Analysis of Scholarship

This study revealed a strength and determination within me that I did not know I had. During the initial research process, I learned valuable information about the affective domain and how it relates to teaching and learning. I was able to apply this information to not only my role as a teacher but also to my role as a doctoral student. Knowing that feelings, emotions, and beliefs can help or hinder professional and personal practices enabled me to persevere during times of struggle with this process. During this process, I learned how to be a research practitioner by learning how to prepare and conduct a research study. Despite being a mathematics-oriented person, I found the quantitative analysis to be the biggest struggle. Being a statistician requires a different kind of mathematical skill set that I had not had the opportunity to develop. My struggle with the statistical analysis helped me to connect to my ARM and remind myself that I, too, still have areas of mathematics where my ARM may be lower than I would like. Finally, all the information that I have learned about ARM and conducting a research study has pushed me professionally to a different level in my career. I have stepped more outside of my classroom and have found a stronger drive to help teachers improve their mathematics instruction through a leadership role.

Self-Analysis of Project Development

At the time I was developing my professional development program for this study, I was given the role of conducting a series of professional development classes at my school. Having this role at the time gave me insight to how teachers reacted to different components of the required program that I was presenting. Through this, I determined strengths and weaknesses of the program I was presenting and used this information to help develop my program. Also, from the information that I gathered through my interviews, teachers want and need the time to reflect and collaborate. Therefore, it was important for me to not just focus on developing teachers' ARM but to give teachers the opportunity to reflect and collaborate throughout the professional development program. Gathering the information from the interviews and the feedback from teaching professional development at that time generated a positive feeling and enthusiasm towards creating my own program.

Self-Analysis of Leadership and Change

I began this doctoral process because it has always been a personal goal for me to obtain my doctoral degree. However, through the process, I now have the belief in myself and the drive to bring about change in mathematics education. Mathematics education is currently at a crossroad with the introduction of Common Core State Standards, the constantly growing global economy, and preparing students for jobs that do not exist yet (NCTM, 2000). From my doctoral journey, I have discovered the leadership potential in myself to help bring about positive change in mathematics education.

Reflection on Importance of the Work

As I reflect on the importance of my study, I am reminded of the journey that I undertook together with my family. My mantra has always been to take one step at a time and focus on that step. This mantra has kept me from getting overwhelmed and giving up. Along the way, I discovered the value and implication of my study. Through the literature review process, I realized how important it is for educators to study the affective domain and how it influences the learning process. Despite this importance, the affective domain is overlooked in most educational programs (Abed et al., 2014; Coppola et al., 2012; Hughes, 2016; Putman, 2012). This discovery made me even more determined to research how teachers' ARM influences their instructional practices. Knowing that the results of my study could potentially make a difference in mathematics instruction kept me going through the process. Now that I am at the end of this journey, it is inspiring to know that the information from this study could potentially impact mathematics education.

Implications, Applications, and Directions for Future Research

The professional development program was designed to address the concerns of the administrators of low elementary mathematics achievement at the local setting by increasing teachers' ARM and enhancing their instructional practices. The information from this study and the professional development program created can be used by the administrators to addresses improving teachers' understanding of their confidence in mathematics instruction, which may lead to positive social change. Improving teachers' effectiveness in the classroom influences student achievement, leading to the gain of critical mathematical skills. When students have high mathematics achievement, they are developing the foundation for future careers in fields related to mathematics (Jaggernauth & Jameson-Charles, 2015). This skill development may bring positive social change to the local community by creating a sustainable workforce that positively impacts the community's economy and well-being. A sustainable workforce is important to the local community because residents and businesses are dependent on students being given the tools to be successful in their careers and provide for the community.

Possible future implications and applications include additional professional development programs for teachers in the local setting that continually integrate the affective domain as an essential component of teachers' growth. Continually implementing reflection and collaboration in professional development at the local site would be another implication of this project. This study and professional development could also be implemented at the middle school level to help increase teachers' ARM at that level. Additionally, the information from this study and the information the school district gains through implementation and evaluation of the program could be shared with the two local universities' preservice teacher program. The application of this information to aid preservice teachers may increase beginning teachers' ARM and bring a stronger mathematical foundation to the classroom when they begin teaching.

As for further research, I recommend gaining a better understanding of teachers' ARM at the lower range of the ARM scale and to also include classroom observations as a component of further research. As stated earlier, no teachers with a low-level ARM volunteered to be interviewed for this study. Due to this, valuable information is missing from this study. Gaining information about how teachers with a low-level ARM think about their instructional practices and the factors that might influence their ARM would enhance the knowledge gained from this study. Additionally, adding classroom observations as a component of future research would give researchers the opportunity to observe teachers' behaviors as they deliver mathematics instruction. This additional information would add another layer to the data that was collected from this study to help improve teachers' ARM and their instructional practices.

Conclusion

This study focused on determining factors that influence teachers' ARM and exploring teachers' perceptions of their ARM in their mathematics instruction. From the findings gathered, I developed a professional development program that addressed teachers' ARM and how to increase their ARM to improve mathematical instruction. Researchers have shown that school administrators are providing opportunities to develop teachers' mathematical content and pedagogical knowledge but are overlooking developing teachers' affective domain as it relates to mathematics (Abed et al., 2014; Coppola et al., 2012; Coppola et al., 2013; Putman, 2012). The quantitative and qualitative data showed that past experiences were the most influential factor on a teacher's ARM and that working with colleagues and attending professional development enabled teachers to grow as mathematicians. The professional development program created focused on increasing the effectiveness of mathematics instruction by helping teachers understand how they feel about mathematics, recognize how it influences their practices, and learn from reflective and collaborative experiences to positively increase their ARM. By developing teachers' ARM, we are enhancing teachers' abilities to provide effective mathematics instruction to improve students' mathematical achievement. This impact will influence social change at the local school district and surrounding community.

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Appendix A: The Project

The project is a 3-day professional development program that addresses teachers' ARM and how it influences instructional practice with additional ongoing collaboration scheduled once a month throughout the school year. The target audience for this project is elementary mathematics teachers. The purpose of this professional development program is to have teachers connect with their feelings toward mathematics and acknowledge their ARM level, reflect on how it influences their instructional practices, and work with colleagues to increase their ARM and implement more effective instructional practices. The professional development program consists of 18 hours spread across 3 days determined by the study site's administrators. After these 3 professional development days, teachers will meet once a month to collaboratively plan and reflect on their ARM and how it is influencing their instruction. Throughout the professional development program and for the remainder of the school year, teachers will also keep a reflective journal to continually reflect on their ARM and how it influences their instructional practices and decisions. The goal of this professional development program is to increase the effectiveness of mathematics instruction by helping teachers understand how they feel about mathematics, recognize how it influences their practices, and learn from reflective and collaborative experiences that will positively increase their ARM. The learning outcomes for this professional development are that teachers will:

- Develop an understanding of their ARM level and determine what influenced them to develop their feelings towards mathematics.

- Define fixed and growth mindset and understand the implications of these two mindsets in their mathematics teaching.
- Develop strategies for utilizing growth mindset in their mathematics instruction.
- Reflect on their ARM and determine how it influences their mathematics instruction.
- Collaborate with fellow teachers to strengthen their ARM and to improve mathematics instructional practices.

These learning outcomes will aid teachers in acknowledging their ARM, determining how it influences their instructional practices, and collaborating with their colleagues to implement more effective instructional practices.

Table A1

Professional Development Timeline

Time	Day 1	Time	Day 2	Time	Day 3
8:00 - 8:15	Introduction	8:00 - 8:15	Introduction	8:00 - 8:15	Introduction
8:15 - 8:45	ARM Survey	8:15 - 8:45	Reflection Journal	8:15 - 8:45	Reflection Journal
8:45 - 9:15	Create Reflection Journal	8:45 - 9:15	Growth Mindset - ARM is Not Fixed!	8:45 - 9:45	Growth Mindset in Mathematics
9:15 - 10:00	Word Cloud	9:15 - 9:45	Mindset Activity: Past Experiences	9:45 - 10:00	Break
10:00 - 10:15	Break	9:45 - 10:00	Break	10:00 - 11:15	Incorporating Growth Mindset in the Mathematics Classroom
10:15 - 11:15	What is Mathematics? Is This a Difficult Question to Answer?	10:00 - 10:45	Growth Mindset: Brain Activity	11:15- 12:15	Lunch
11:15 - 12:15	Lunch	10:45 - 11:15	How Do We Develop a Growth Mindset?	12:15 - 1:45	Create a Lesson
12:15 - 2:15	Write Your Mathematics Story	11:15 - 12:15	Lunch	1:45 - 2:00	Break
2:15 - 2:30	Break	12:15 - 2:15	Developing a Growth Mindset	2:00 - 2:15	What is Next? Monthly Collaboration and Reflection Sessions
2:30 - 3:00	Prework and Evaluation	2:15 - 2:30	Break	2:15 - 3:00	ARM Survey and Evaluation
		2:30 - 3:00	Prework and Evaluation		

These professional development sessions will be followed by on-going 1 hour monthly sessions throughout the school year to include:

- Sharing reflection journal and asking for feedback and help
- Reflecting on new questions
- Working together to plan effective instructional practices that focus on understanding mathematics not just doing mathematics.

Teachers will use reflection, collaboration, and growth mindset as frameworks for the monthly sessions.

Day 1

Materials:

- White board/dry erase markers
- Paper/Pencils/Markers
- Laptop/Internet Connection/Projector
- Picture of Word Cloud: Figure 1.2 from *Becoming the Math Teacher You Wish You'd Had* by Tracy Zager
- Prework Article: "How One School Changed Its Math Culture, Starting with Teachers" https://ww2.kqed.org/mindshift/2016/11/02/how-one-school-changed-its-math-culture-starting-with-teachers/

Prework: Read Article

Facilitator Notes:

1. Prior to the first session, have participants read the article "How One School Changed Its Math Culture, Starting with Teachers" https://ww2.kqed.org/mindshift/2016/11/02/how-one-school-changed-its-math-culture-starting-with-teachers/

8:00 – 8:15: Introduction

Facilitator Notes:

1. Explain the purpose of the professional development program and the expected outcomes.
2. Explain the agenda for the day.

8:15 – 8:45: Complete ARM Classification Survey

Facilitator Notes:

1. Explain the ARM classification survey and what the score indicates. A low-level ARM equals a score of 0 to 26, a mid-level ARM equals a score of 27 to 53, and a high-level ARM equals a score of 54 to 80.

2. Send the link to the survey to the teachers. Monitor as teachers complete the survey.

8:45 – 9:15 Create Reflection Journal

Facilitator Notes:

1. Share the following information and discuss.
   - Reflection gives us a chance to deepen personal awareness as thoughts are brought to the forefront. Reflective practice improves classroom effectiveness. How you view yourself affects how you teach. (Jackson, 2015)
2. Have teachers set up a reflection journal. Teachers may choose their own format whether it is paper/pencil or electronic.

9:15 - 10:00 Word Cloud

Facilitator Notes:

1. Ask teachers to write down words to describe their experiences as a mathematics student.

2. Enter these words into a word cloud generator on laptop and display created cloud.

3. Compare generated word cloud to mathematicians' word cloud. (Figure 1.2 from *Becoming the Math Teacher You Wish You'd Had* by Tracy Zager. Copyright permission see Appendix F)
4. Discuss the similarities and differences, and why the teachers' word cloud might be different from mathematicians.

10:00 – 10:15 Break

10:15 – 11:15 What is Mathematics? Is This a Difficult Question to Answer?

Facilitator Notes:

1. Ask teachers to discuss the questions: What is mathematics? Is this a difficult question to answer? Why?

11:15 – 12:15 Lunch

12:15 – 2:15 Write Your Mathematics Story

Facilitator Notes:

1. Have teachers write down their feelings about mathematics and the people and experiences that contributed to those feelings.
2. Share and discuss teachers' Mathematics Story.
3. Share the following information and discuss.
   - According to Jackson (2015), "only awareness is educable" (p. 27). Adults can get over a negative disposition to mathematics.
   - Teachers are the product of the system they are being asked to change. Seven percent of teachers had completely positive mathematics experiences while

93% have had mixed experiences. Thirty-three percent of elementary teachers have mathematics anxiety (Zager, 2017).

2:15 – 2:30 Break

2:30 – 3:00 Assign Prework and Evaluation

Facilitator Notes:

1. Share the following information again.
   - Reflection gives us a chance to deepen personal awareness as thoughts are brought to the forefront. Reflective practice improves classroom effectiveness. How you view yourself affects how you teach. (Jackson, 2015)
2. Assign 3-4 reflection questions that teachers need to answer prior to the next session. Suggested questions a, b, c, and d below are recommended for teachers' first reflection response.
   - Suggested questions for reflection process:
     a. How do you feel when teaching mathematics?
     b. Has it changed since the last session?
     c. When did you feel the most positive? Least positive?
     d. What did you do when you did not feel positive?
3. Assign two videos for teachers to watch prior to the next session:
   - *Mindsets: Fixed Versus Growth* – 2:19 minutes
     https://www.youtube.com/watch?v=M1CHPnZfFmU
   - *4 Steps to Developing a Growth Mindset* – 3:54 minutes

https://www.youtube.com/watch?v=aNHas97iE78

4. Send the link to the PD Formative Evaluation Survey: Day 1

Day 1: Resources

Picture of Word Cloud: Figure 1.2 from *Becoming the Math Teacher You Wish You'd Had* by Tracy Zager (Appendix F – copyright permission).

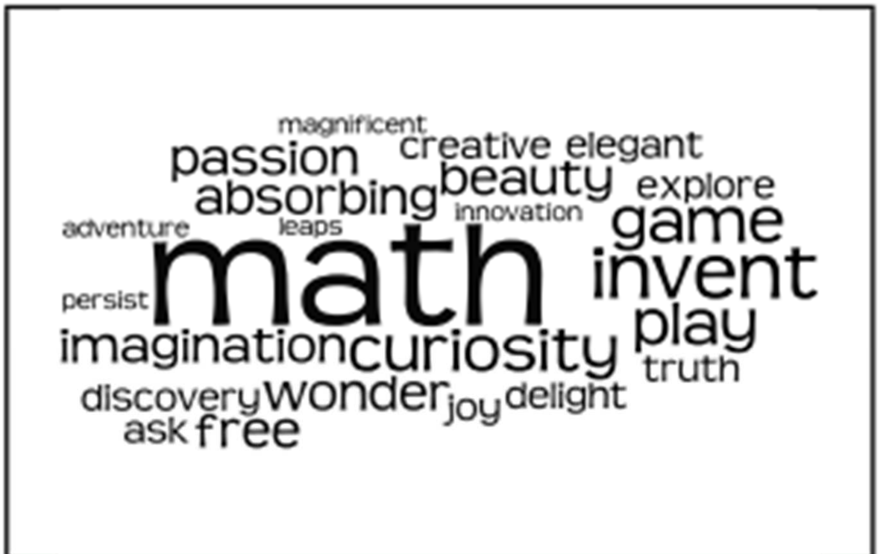


Figure 1.2 ***Words mathematicians use to describe mathematics***

Day 2

Materials:

- White board/dry erase markers
- Paper/Pencils/Markers
- Chart Paper
- Laptop/Internet Connection
- Reflection Journal
- Handout with two copies of a blank brain

8:00 – 8:15: Introduction

Facilitator Notes:

1. Explain the agenda for the day.

8:15 – 8:45: Reflection Journal

Facilitator Notes:

1. Have teachers discuss their journal reflections.

8:45 - 9:15 Growth Mindset – ARM is not fixed!!

Facilitator Notes:

1. Have teachers discuss their thoughts on the prework video: *Mindsets: Fixed Versus Growth* – 2:19 minutes https://www.youtube.com/watch?v=M1CHPnZfFmU. Below are some suggested questions to facilitate the discussion.
    a. What is a fixed mindset?
    b. What is a growth mindset?

c. How are failure and critical feedback viewed for each type of mindset?

d. What types of tasks are usually chosen for each type of mindset?

2. Have teachers discuss information from the video and how it may relate to themselves and their mathematics classroom.
3. Make sure teachers understand the difference between a growth mindset and a fixed mindset.

9:15 – 9:45 Mindset Activity: Past Experiences

Facilitator Notes:

1. Have teachers answer and discuss the following questions:

- Is there something negative in your past that may have caused you to develop a fixed mindset? Is there something positive in your past that may have caused you to develop a growth mindset? Have you ever been told you were bad at something? Have you ever been told you were good at something? What did you learn from these experiences? *Responses do not have to relate to mathematics or teaching.*

9:45 – 10:00 Break

10:00 – 10:45 Growth Mindset: Brain Activity

Facilitator Notes:

1. Distribute handout with two copies of a blank brain. Have participants decorate a fixed mindset brain and a growth mindset brain. They may decorate with words and symbols that represent each type of mindset.

2. Discuss teachers' drawings and how their drawings differ for each type of mindset.

10:45 – 11:15 How Do We Develop a Growth Mindset?

Facilitator Notes:

1. Have teachers discuss their thoughts on the prework video: *4 Steps to Developing a Growth Mindset* – 3:54 minutes https://www.youtube.com/watch?v=aNHas97iE78. Below are some suggested questions to facilitate the discussion.
    a. What is something you can do to help develop a growth mindset?
    b. What are somethings you can say to yourself when you have a setback?
    c. What should you say to yourself when receiving constructive feedback?

11:15 – 12:15 Lunch

12:15 – 2:15 Developing a Growth Mindset

Facilitator Notes:

1. Have teachers reflect and discuss how developing a growth mindset will improve themselves as a mathematician and as a mathematics teacher.
2. Give each group of teachers chart paper and have them list their essential tips for developing a growth mindset. Discuss each group's tips and display everyone's essential tips in the room.
3. Share the following information and discuss.

- Setting goals help to build a pathway to developing a growth mindset (Brock and Hundley, 2016).

4. Have teachers write 3-4 goals in their reflection journal that focus on building a growth mindset that may improve themselves as a mathematician and as a mathematics teacher. Then have teachers share their goals with each other.

2:15 – 2:30 Break

2:30 – 3:00 Assign Prework and Evaluation

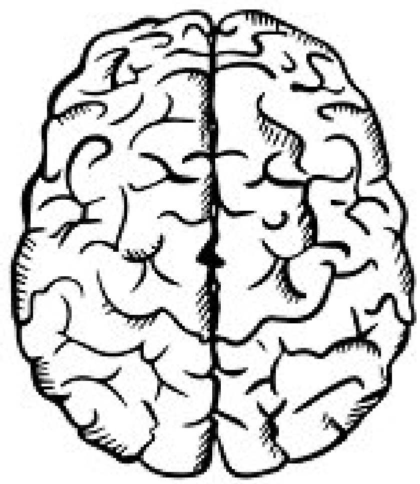
Facilitator Notes:

1. Pick 2-3 suggested reflection questions for teachers to reflect and write about for the next session.
2. Assign 2 videos for teachers to watch prior to the next session:
    - *Jo Boaler Growth Mindset* – 3:39 minutes
      https://www.youtube.com/watch?v=ipYlnY3F8y4
    - *Brains Grow and Change HD* – 3:07
      https://www.youtube.com/watch?v=Ukt4A5GCfQU
3. Send the link to the PD Formative Evaluation Survey: Day 2

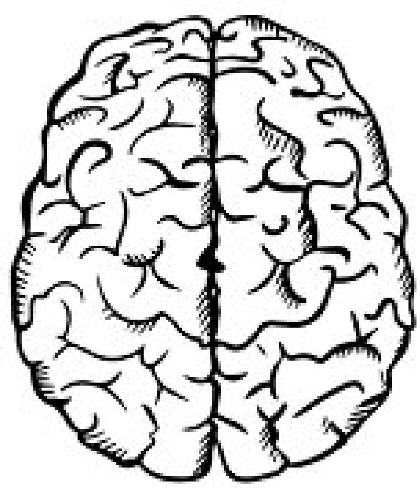
Day 2: Resources

Growth Mindset Brain Activity Handout

Fixed Mindset Brain



Growth Mindset Brain



Day 3

Materials:

- White board/dry erase markers
- Paper/Pencils/Markers
- Laptop/Internet Connection
- Reflection Journal
- Handout: Guiding Questions for Incorporating Growth Mindset in the Mathematics Classroom

8:00 – 8:15: Introduction

Facilitator Notes:

1. Explain the agenda for the day.

8:15 – 8:45: Reflection Journal

Facilitator Notes:

1. Have teachers discuss their journal reflections.

8:45 – 9:45: Growth Mindset in Mathematics

Facilitator Notes:

1. Have teachers discuss their thoughts on the prework videos: *Jo Boaler Growth Mindset* – 3:39 minutes https://www.youtube.com/watch?v=ipYlnY3F8y4 and *Brains Grow and Change HD* – 3:07 https://www.youtube.com/watch?v=Ukt4A5GCfQU. Below are some suggested questions to facilitate the discussion.

a. Is it possible for anyone's brain to grow and change to learn mathematics?
b. According to brain science, when is the best time for your brain to grow?
c. What should an ideal mathematics class or lesson look like?
d. How does certain types of feedback help people grow as mathematicians?
e. According to brain science, is there such a thing as a math person?

2. Have teachers answer the following questions in their reflection journals: How did the information in the video make you feel as a mathematician? How did it make you feel as a mathematics teacher? Have teachers discuss their reflections.

9:45 – 10:00 Break

10:00 – 11:15 Incorporating Growth Mindset in the Mathematics Classroom

Facilitator Notes:

1. Teachers will work with their grade level colleagues to determine how they will incorporate growth mindset in their mathematics classroom through their personal growth and mathematics instruction.
2. Provide the following questions to guide teachers into creating their plan.
   a. Describe the characteristics of a person who has a growth mindset towards mathematics.
   b. How will you know when you and your students are exhibiting a growth mindset?
   c. How will you change your classroom to reflect a growth mindset?
   d. How will learning about growth mindset change the way you interact with your students?

   e. What will you do to allow for struggle for yourself and for your students during mathematics lessons?
   f. How will you incorporate mistake making for yourself and your students into your mathematics instruction?
   g. How do you think your students will respond to growth mindset in the mathematics classroom?
   h. What are some growth mindset resources that may be available for you to use in your classroom?
3. Have teachers discuss their growth mindset plans.

11:15 – 12:15 Lunch

12:15 – 1:45 Create a Lesson

Facilitator Notes:

1. Remind teachers about the essential components of mathematics learning that Dr. Boaler mentioned in the videos they watched prior today's session.
   a. Focus on a growth mindset
   b. Use visual mathematics
   c. Allow for exploration and productive struggle
   d. Teach for understanding
   e. Emphasize depth and creativity
2. Have teachers connect these ideas to the growth mindset plan they created to incorporate growth mindset in their mathematics classroom.

3. Have teachers collaborate with their grade level colleagues to create a mathematics lesson that focuses on the components listed above.

1:45 – 2:00 Break

2:00 – 2:15 What is Next? Monthly Collaboration and Reflection Session

Facilitator Notes:

1. Discuss with teachers the monthly collaborative and reflection sessions.
2. Pick 2-3 suggested reflection questions for teachers to write about for the next session.

2:15 – 3:00 Assign ARM Survey and Evaluation

Facilitator Notes:

1. Explain the ARM classification survey and what the score indicates. A low-level ARM equals a score of 0 to 26, a mid-level ARM equals a score of 27 to 53, and a high-level ARM equals a score of 54 to 80.
2. Send the link to the ARM classification survey to the teachers.
3. Send the link to the PD Summative Evaluation Survey

Day 3: Resources

Guiding Questions for Incorporating Growth Mindset in the Mathematics Classroom

1. Describe the characteristics of a person who has a growth mindset towards mathematics.
2. How will you know when you and your students are exhibiting a growth mindset?
3. How will you change your classroom to reflect a growth mindset?
4. How will learning about growth mindset change the way you interact with your students?
5. What will you do to allow for struggle for yourself and for your students during mathematics lessons?
6. How will you incorporate mistake making for yourself and your students into your mathematics instruction?
7. How do you think your students will respond to growth mindset in the mathematics classroom?
8. What are some growth mindset resources that may be available for you to use in your classroom?

On-Going Professional Development throughout the Year Following Completion of Three PD Sessions

Materials:

- White board/dry erase markers
- Paper/pencils/markers
- Projector/laptop/Internet connection
- Reflection Journal

Facilitator Notes:

- Monthly Collaborative Planning and Reflection
    - Share reflection journal, ask for feedback/help
    - Reflect on new questions
        - Suggested questions for reflection process:
            a) How do you feel when teaching mathematics?
            b) Has it changed since the last session?
            c) When did you feel the most positive? Least positive?
            d) What did you do when you did not feel positive?
            e) Who or what has encouraged you?
            f) What motivates you to learn?
            g) Do you have any concerns about teaching mathematics or a specific skill? What might help you overcome those concerns?
            h) Are you avoiding any mathematical situations?
            i) What are coping strategies you have developed to overcome negative mathematical situations?

j) Have you given up on yourself mathematically?

k) How can you improve your engagement with mathematics?

l) Is it okay to be challenged by mathematics?

m) What do you value the most when teaching mathematics?

n) How confident do you feel in explaining mathematical content or skills? Why?

o) Is there an area of mathematics you feel you need to develop more in? What and why?

p) What do you believe mathematics is? How is this reflected in your everyday life?

q) How do you describe people who are good at mathematics? Is this the same way you felt as a student?

r) Is it socially acceptable in your classroom to admit being good at mathematics? Why?

- Work together to plan effective instructional practices that focus on understanding mathematics not just doing mathematics using growth mindset as their framework.

End of Year Evaluation: Complete ARM Classification Survey and PD Survey

Facilitator Notes:

1. Explain the ARM classification survey and what the score indicates. A low-level ARM equals a score of 0 to 26, a mid-level ARM equals a score of 27 to 53, and a high-level ARM equals a score of 54 to 80.

2. Send the link to the ARM classification survey to the teachers.

3. Send the link to the PD Summative Evaluation Survey

Formative Evaluation of Professional Development

Day 1 Session

1. What grade(s) do you teach?

   K 1st 2nd 3rd 4th 5th

Read each statement below and determine your level of agreement or disagreement.

Strongly Disagree (SD) | Disagree (D) | Agree (A) | Strongly Agree (SA)

2. The professional development was of quality.

   SD D A SA

3. The professional development was relevant to my needs.

   SD D A SA

4. The professional development enhanced my understanding of my relationship with mathematics.

   SD D A SA

5. The professional development helped me to reflect on my mathematics teaching.

   SD D A SA

6. How will you use what you learned?

Formative Evaluation of Professional Development

Day 2 Session

1. What grade(s) do you teach?

   K 1st 2nd 3rd 4th 5th

Read each statement below and determine your level of agreement or disagreement.

Strongly Disagree (SD) | Disagree (D) | Agree (A) | Strongly Agree (SA)

2. The professional development was of quality.

   SD D A SA

3. The professional development was relevant to my needs.

   SD D A SA

4. The professional development enhanced my understanding of the different types of mindsets.

   SD D A SA

5. The professional development enhanced my understanding of how different mindsets influence my mathematics instruction.

   SD D A SA

6. The professional development enhanced my understanding of how to develop a growth mindset.

   SD D A SA

7. The professional development helped me to reflect on my mathematics teaching.

   SD D A SA

8. How will you use what you learned?

Summative Evaluation of Professional Development

Day 3 Session and End of Year Evaluation

1. What grade(s) do you teach?

   K 1st 2nd 3rd 4th 5th

Read each statement below and determine your level of agreement or disagreement.

Strongly Disagree (SD) | Disagree (D) | Agree (A) | Strongly Agree (SA)

2. I was given sufficient opportunities to explore my relationship with mathematics.

   SD D A SA

3. I was given sufficient opportunities to explore what influenced me to feel the way I do towards mathematics.

   SD D A SA

4. I was given sufficient opportunities to explore how my relationship with mathematics influences my mathematics instruction.

   SD D A SA

5. I am able to define fixed and growth mindsets.

   SD D A SA

6. I understand how fixed and growth mindsets influence my mathematics instruction.

   SD D A SA

7. I developed strategies for utilizing growth mindset in my mathematics instruction.

   SD D A SA

8. I was able to collaborate with my colleagues to strengthen my relationship with mathematics.

   SD D A SA

9. I was able to collaborate with my colleagues to develop strategies to enhance my mathematics instruction.

   SD D A SA

10. I was able to reflect on myself as a mathematician.

    SD D A SA

11. I was able to use reflection to strengthen my mathematics instruction.

    SD D A SA

12. This professional development program has helped me to increase the effectiveness of my mathematics instruction.

    SD D A SA

Please answer the following questions:

13. What do you feel were the strengths to this professional development program?

14. What do you feel were the weaknesses to this professional development program?

15. How would you improve this professional development program?

References

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Appendix B: Teacher Survey

TEACHER SURVEY

Instructions

THANK YOU for taking the time to complete this survey. Your participation and insights are vital to the impact this study will have in our district.

The participants being invited to participate in this study are elementary mathematics teachers who teach within this school district.

Please take some time (approximately 10 minutes) to answer the 36 questions in this survey to the best of your ability.

Please attempt to answer all questions OPENLY and HONESTLY. Your building and district administrators will not see your individual responses. In fact, your survey cannot be traced back to your school.

Overall results and findings will be made available upon request. If you would like to receive a copy of the final report, contact:

Kelly Sutton
Your time and support are greatly appreciated!

My Math Experience

1. Including this year, how many years have you taught? ________

2. Including this year, how many years have you taught at your current grade level? ________

3. Including this year, how many years have you taught Math as a part of your assignment? ________

4. In what grade(s) did you teach math ***last*** school year?

K 1st 2nd 3rd 4th 5th

5. Please circle all grades in which you have taught math during your career.

K 1st 2nd 3rd 4th 5th 6th 7th 8th High

6. In what context(s) have you taught math during your career? (Circle all that apply)

Self-contained classroom Departmentalized classroom

Coteaching Resource

7. Since you began teaching, have you taken any college courses in mathematics or methods of teaching mathematics?

Yes No

8. If so, approximately how long ago was your last course?

This year or ________ year(s)

9. Since you began teaching, have you attended a full-day workshop focused on mathematics?

Yes No

10. If so, approximately how long ago was your last workshop?

My Personal Feelings About Math ***(This section © Aiken)***

Each of these statements expresses a feeling which a particular person may have toward mathematics. Please express, on a 5-point scale, the extent of agreement between the feeling expressed in each statement and your own personal feeling.

Strongly Disagree (SD) | Disagree (D) | Undecided (U) | Agree (A) | Strongly Agree (SA)

11. I am always under a terrible strain when learning mathematics.

SD D U A SA

12. I do not like mathematics, and it scares me to have to learn new math.

SD D U A SA

13. Mathematics is very interesting to me, and I enjoy math courses.

SD D U A SA

14. Mathematics is fascinating and fun.

SD D U A SA

15. Mathematics makes me feel secure, and at the same time, it is stimulating.

SD D U A SA

16. My mind goes blank, and I am unable to think clearly when working in math.

SD D U A SA

17. I feel a sense of insecurity when attempting mathematics.

SD D U A SA

18. Mathematics makes me feel uncomfortable, restless, irritable, and impatient.

SD D U A SA

19. The feeling that I have toward mathematics is a good feeling.

SD D U A SA

20. Mathematics makes me feel as though I'm lost in a jungle of numbers and can't find my way out.

SD D U A SA

21. Mathematics is something which I enjoy a great deal.

SD D U A SA

22. When I hear the word math, I have a feeling of dislike.

SD D U A SA

23. I approach math with a feeling of hesitation, resulting from a fear of not being able to do math.

SD D U A SA

24. I really like mathematics.

SD D U A SA

25. Mathematics is a course in school which I have always enjoyed studying.

SD D U A SA

26. It makes me nervous to even think about having to do a math problem.

SD D U A SA

27. I have never liked math, and it is my most dreaded subject.

SD D U A SA

28. I am happier learning about math than any other subject.

SD D U A SA

29. I feel at ease in mathematics, and I like it very much.

SD D U A SA

30. I feel a definite positive reaction to mathematics; it's enjoyable.

SD D U A SA

Changes in My Personal Feelings About Math

Please classify how the following have influenced your attitudes toward mathematics.

Very Negative (VN) | Negative (N) | No Influence (=) | Positive (P) | Very Positive (VP)

31. Experience teaching math to students.

VN N = P VP

32. Professional development workshops about math or teaching math.

VN N = P VP

33. The focus on improving SC READY and other standardized test scores.

VN N = P VP

34. Instructional feedback from my principal.

VN N = P VP

35. Interaction with parents.

VN N = P VP

36. My own life experience needing and using mathematics.

VN N = P VP

Part Two of Study: Interviews

The purpose of this study is to examine elementary teachers' affective relationship with mathematics (teachers' feelings, beliefs, attitudes, likes, and dislikes) and how it influences their mathematics instructional practice. For the second portion of this study, volunteers are needed to be interviewed.

If you volunteer to be interviewed, you will be asked to:

- Participate in one 60-minute interview
- Review the summary of your interview for accuracy (approximately 20 minutes).

Here are some sample interview questions:
How do you feel when you teach mathematics? Why?

- How does your relationship with mathematics influence your instructional decisions? Why?
- Please describe a typical mathematics lesson.

37. Would you like to be interviewed for the second portion of this study? If you choose yes, you will be notified through your email address of interview participation.

___ No thank you.
___ Yes, I would like to volunteer to be interviewed.
Enter your first and last name, the name of your school, and your personal email

Appendix C: Interview Protocol

Research Question:
What are elementary teachers' perceptions on how their ARM influences their mathematical instructional decisions and practices?

a. What are elementary teachers' perceptions of their ARM regarding their mathematical instructional time?
b. What are elementary teachers' perceptions of their ARM regarding their use of the SCCCR seven mathematical process standards during instruction?

Date:

Time:

Interviewee Pseudonym:

Opening Script:
Thank you for taking the time to allow me to interview you. The purpose of this study is to examine how elementary teachers' affective relationship with mathematics influences their instructional practices. Your participation is voluntary, and at any time there is a question you do not want answer or want to stop completely, just let me know. To protect your identity, I will use a pseudonym instead of your real name. I will take notes during the interview, and I will also record the interview to obtain a transcript of our conversation. Once I transcribe the interview, I will send you a summary to review for accuracy. Do you have any questions before we get started? (Pause for questions.) Please let me know when you are ready for me to begin recording.

Background Questions:

1. How long have you taught elementary mathematics?

2. What grade levels have you taught mathematics?

3. What grade level did you teach mathematics last year, and how long have you taught that grade level?

4. What subjects did you teach last year?

Affective Relationship with Mathematics:

5. What is your favorite subject to teach? Why?

6. I am examining teachers' affective relationship with mathematics. This relationship is influenced by your feelings, beliefs, attitudes, likes, and dislikes.

We can classify teachers into three levels: a low-level (negative) relationship, a mid-level (neutral) relationship, or a high-level (positive) relationship with mathematics. What do you think your level is? Why?

7. How do you feel when you teach mathematics? Why?

   Additional Probe:
   a. How confident do you feel teaching mathematics to your students? Why?
   b. What are some factors that might have influenced these feelings?
      i. Childhood mathematics?
      ii. College courses?
      iii. Experiences with mathematics outside of school?
      iv. Feedback from colleagues, administrators, parents, or students?
      v. Observing other colleagues classrooms?

8. How does your relationship with mathematics influence your instructional decisions?

   Additional Probe:

   a. How does it influence your time on task?
   b. How does it influence your time when faced with a shortened day, an interruption for an assembly, or something similar?

Instructional Practices

9. Since it is a new school year, I want you to think back to a typical mathematics lesson you taught last school year. Please describe a typical mathematics lesson.

   Additional Probe:

   a. How do you decide what instructional strategies to use?
   b. How do your feelings toward mathematics influence these decisions?

10. Have you heard of the seven mathematical process standards in South Carolina College- and Career-Ready Standards for Mathematics?

    Directions for interviewer: If no, read the list
    - Make sense of problems and persevere in solving them.
    - Reason both contextually and abstractly.
    - Use critical thinking skills to justify mathematical reasoning and critique the reasoning of others.
    - Connect mathematical ideas and real-world situations through modeling.
    - Use a variety of mathematical tools effectively and strategically.

- Communicate mathematically and approach mathematical situations with precision.
- Identify and utilize structure and patterns

  If yes, continue

11. Do you incorporate the mathematical process standards into your everyday lessons? If so, how? If no, why not?

    Additional Probe:

    a. How confident do you feel in your mathematics ability to use the mathematical process standards?

12. Does your relationship with mathematics influence the types of instructional practices you use regularly in your mathematics classroom? If no, why? If yes, how? What are some examples?

13. Are there any other thoughts or comments you would like to share about your relationship with mathematics and your instructional practices?

Concluding Script:
Thank you again for volunteering to be interviewed and for taking the time with me today. Remember, your responses are confidential. Once I transcribe this interview, I will send you a summary to review for accuracy and to verify that I captured your response as you intended.

Appendix D: Emergent Codes

Table D1
Emergent Codes

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
1	What is your favorite subject to teach?	I like specific content like teaching phonics	Reading	I like numbers	Mathematics
		I like to teach beginning mathematics	Mathematics	It is math	Mathematics
		Reading is the basis of everything	Reading	I am a math thinker	Mathematics
		Reading because you can tie it in with everything else	Reading	Transitioned into math because of the professional knowledge I have gained	Mathematics, Professional Development
				Science because it is hands-on	Science
				Math because it is hands-on	Mathematics
				I love to read	Reading
2	What do you think your level of ARM is?	Between the neutral and the positive	Mid-level	High level (4 participants)	High-level
		Elementary school, I loved math. Then by high school, there were teachers that really turned me off to it	Childhood mathematics	Feedback from the students	Feedback

(table continues)

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
		I didn't know why I was doing what I was doing	Childhood mathematics	Why we do our math	Understanding
		Middle level but trying to move into the high	Mid-level	Learned a lot from a math workshop	Professional Development
		She really made me change my whole attitude	Collaboration	Positive (2 participants)	High-level
		Took a class brought it into perspective	Professional Development	I was a good math student	Childhood mathematics
		Mid-level or neutral	Mid-level	Evolved throughout my teaching	Experiences
		Bad experiences as an elementary student, middle school, and high school	Childhood mathematics		
3	How do you feel when you teach mathematics?	I get really excited	Positive	I always feel good	Positive
		I like teaching math	Positive	Feel confident (4 participants)	Positive
		Fifth grade math is scary	Negative	Grown over time	Neutral
		It's growing on me	Neutral	Peers opened my eyes	Collaboration
		Sometimes feel hesitant	Negative	Excited and fairly confident	Positive

(table continues)

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
		I do feel confident but I have to prep	Positive	I feel positive	Positive
		Start freaking out	Negative	I enjoy doing it	Positive
				Depends on what I am teaching	Neutral
				Having a great time	Positive
				The kids are excited	Feedback
				Really enjoy teaching math	Positive
4	What are some factors that might have influenced these feelings?	Basic stuff came easy	Childhood mathematics: Positive	In middle school, struggled with word problems	Childhood mathematics: Negative
		Show it once, everyone got it but me	Childhood mathematics: Negative	Teacher sat down and helped	Childhood mathematics: Positive
		Just shut off	Childhood mathematics: Negative	Had bad experiences	Childhood mathematics: Negative
		Bad experiences as an elementary student	Childhood mathematics: Negative	Great math teachers that pushed me	Childhood mathematics: Positive
		Fellow teacher helped me change my attitude	Collaboration	Started out negative and then went to positive	Childhood mathematics: Transitional
		Like talking with other teachers	Collaboration	Always had an easy time in math	Childhood mathematics: Positive
		Definitely my colleagues	Collaboration	Positive until a junior	Childhood mathematics: Transitional

(table continues)

Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
	Took a statistics course and loved it	Professional Development	Always had to work hard in math	Childhood mathematics: Negative
			Feedback from students	Feedback
			Administrators built confidence	Feedback, Collaboration
			Feedback from instructional facilitator	Feedback, Collaboration
			Working with other colleagues	Collaboration
			Having conversations with colleagues	Collaboration
			Kids being excited	Feedback
			Professors opened my eyes to different things	Professional Development
			Avoided college math courses	Professional Development
			Math scared me in college	Professional Development
			Professional development helped me gain positivity	Professional Development
			Taking professional development	Professional Development

(table continues)

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
5	How does your relationship with mathematics influence your instructional decisions?	What frustrated me in math in elementary school, I try to avoid those kinds of things	Childhood mathematics	I want my students to have a better experience than me	Childhood mathematics
		If you don't like it, the kids will know you don't like it	Feelings towards mathematics	It is easier for me to see why they are struggling	Childhood mathematics
		Bad experiences as an elementary student, using that background to help me know	Childhood mathematics	I like math, I am not scared to teach it	Feelings towards mathematics
		Felt frustrated when I didn't understand what I was doing.	Childhood mathematics	Since it did not come naturally, I understand the student who have to work a little bit harder	Childhood mathematics
		My goals is to make sure that they understand	Understanding	I want to make sure it is not just we're going to step by step	Understanding
		I don't want it to be a weakness for them so I teach for understanding	Understanding	I like math and it makes sense to me	Feelings towards mathematics

(table continues)

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
		Even if it makes me uncomfortable, I still have to teach it	Feelings towards mathematics		
6	How does it influence your time on task?	Mandated 90 minutes	Mandated time	High-priority	High-priority
		You have to do it no matter what	Mandated time	Love math so much that sometimes I have to balance it out	Extended time
				If math ran over, that was a good thing	Extended time
				I have to set times for myself	Extended time
7	How do you decide what instructional strategies to use?	Progress monitoring sheets	Data	Based on weaknesses	Data
		As a team (2 participants)	Collaboration	Planning with team	Collaboration
		Pacing Guide	Set curriculum	Stifled with curriculum	Set curriculum
		Working with colleagues	Collaboration	As a team	Collaboration
8	How do your feelings toward mathematics influence these decisions?	I like building the skills	Understanding	Enjoy puzzles, so like to give tasks that are higher-level	Engaging
		Using manipulatives	Understanding	Concrete	Understanding
		Make math fun	Engaging	Related to the real world	Understanding
		Making real life connections	Understanding	Anything I can do to make it real world	Understanding

(table continues)

	Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
9	Do you incorporate the mathematical process standards into your everyday lessons?	Think we do it but we don't really say it	No intentional plan	Persevere contract	Process standard
		Persevere when solving	Process standard	Talk in a math language	Process standard
		Connecting real-world situations	Process standard	Relate to them	Process standard
		We have to write in lesson plans	Collaboration, Intentionally plan	Yes	Intentionally plan
		Don't intentionally	No intentional plan	Proper math vocabulary	Process standard
				Yes, we try to look at all of them.	Collaboration, Intentionally plan
10	Does your relationship with mathematics influence the types of instructional practices you use regularly in your mathematics classroom?	Like thinking abstractly, but I know that they need concrete	Understanding	I am visual learner, so I like visual hands-on	Childhood mathematics
		Influences in a positive way	Feelings towards mathematics	Professional development teaches me strategies	Professional development
		Things that I like that teachers did with me I do that with my students	Childhood mathematics	Talking to peers I have grown over time	Collaboration
				Past experiences with math, having a little math anxiety	Childhood mathematics
				I push towards high order	Understanding

(table continues)

Interview Questions	Phrases: Mid-Level	Codes for each Phrase	Phrases: High-Level	Codes for each Phrase
			I like to problem solve and that is what a lot of their strategies	Feelings towards mathematics
			I hear good ideas or I see good ideas	Collaboration
			Professional development and learning from others that directly influences me	Professional Development, Collaboration
			I saw what it was like for children who did not understand	Childhood mathematics

Appendix E: Results of Open Coding

Table E1

Interview Questions and Reoccurring Patterns

	Interview Questions	Reoccurring Patterns	
		Mid-level	High-Level
1	What is your favorite subject to teach?	Reading. It is the basis for learning.	Mathematics. It is hands-on, you can use different strategies, and teach for understanding.
2	What do you think your level of ARM is?	Mid-level. Frustrated with childhood mathematics. Recent shift due to working with colleagues.	High-level. Had some bad experiences with childhood mathematics. Colleagues, workshops, or students have improved mathematics teaching.
3	How do you feel when you teach mathematics?	Great and comfortable. Need to prepare ahead of time.	Positive and confident. Enjoy teaching mathematics and have grown over time due to attending workshops and working with colleagues.
4	What are some factors that might have influenced these feelings?	Childhood had bad experiences in mathematics class. Followed by positive experiences. College courses, workshops, and professional development positively influenced. Feedback and collaboration has increased feelings towards mathematics.	Childhood had bad experiences in mathematics class. Followed by positive experiences. College courses, workshops, and professional development positively influenced. Feedback and collaboration has increased feelings towards mathematics.

(table continues)

	Interview Questions	Reoccurring Patterns	
		Mid-level	High-Level
5	How does your relationship with mathematics influence your instructional decisions?	Bad experiences influenced teachers to create positive experiences for their students.	High-priority in classroom. Teach for understanding.
6	How does it influence your time on task?	Mandated time by administrators.	Mandated time by administrators. High-priority in classroom.
7	How do you decide what instructional strategies to use?	Follow set curriculum. Collaborating with colleagues.	Follow set curriculum. Collaborating with colleagues. Based on students' needs.
8	How do your feelings toward mathematics influence these decisions?	Focus on understanding. Don't want it to be a weakness for their students.	Focus on understanding. Avoid strategies they don't feel valuable.
9	Do you incorporate the mathematical process standards into your everyday lessons?	Don't intentionally plan for.	Intentionally plan for by collaborating with colleagues.
10	Does your relationship with mathematics influence the types of instructional practices you use regularly in your mathematics classroom?	Want positive experiences for students. Focus on concrete and understanding.	Focus on higher level, real world connections, and teaching for understanding due to negative experiences with mathematics.

Appendix F: Copyright permission from Tracy Zager for Mathematician Word Cloud

Kelly Sutton
xxxxxxxxxxxxxxxxxxxxxx
xxx-xxx-xxxx
November 25, 2017

Dear Tracy Zager:

I am completing a doctoral study at Walden University entitled "Elementary Teachers' Affective Relationship with Mathematics and its Influence on Mathematics Instruction." I would like your permission to reprint in my doctoral study an excerpt from the following:

Becoming the Math Teacher You Wish You'd Had

The excerpt to be reproduced is: Figure 1.2 *Words mathematicians use to describe mathematics.*

The figure would be used in the professional development program that I am creating for my doctoral study. Elementary teachers in the program would create a word cloud to describe how they feel about mathematics. Then, Figure 1.2 would be used so that teachers could compare theirs to mathematicians' feelings about mathematics.

The requested permission extends to any future revisions and editions of my doctoral study, including nonexclusive world rights in all languages, and to the prospective publication of my doctoral study by ProQuest® through its ProQuest® Dissertation Publishing business. ProQuest® may produce and sell copies of my doctoral study on demand and may make my doctoral study available for free internet download at my request. These rights will in no way restrict republication of the material in any other form by you or by others authorized by you. Your signing of this letter will also confirm that you own [or your company owns] the copyright to the above- described material.
If these arrangements meet with your approval, please sign this letter where indicated below and return it to me. Thank you very much.

Sincerely,

Kelly Sutton

PERMISSION GRANTED FOR THE USE REQUESTED ABOVE:

Tracy Zager Date: 11/27/17