THE IMPACT OF TEACHER AND STUDENT ATTITUDES ON MATH PERFORMANCE OF FOURTH- AND SIXTH-GRADE STUDENTS IN RURAL ARIZONA

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ABSTRACT

THE IMPACT OF TEACHER AND STUDENT ATTITUDES ON MATH PERFORMANCE OF FOURTH- AND SIXTH-GRADE STUDENTS

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The purpose of this research is to determine if there is any difference between teacher and student attitudes regarding academic achievement in math in three school districts of different socioeconomic status. The socioeconomic status of each school included in the study was determined based on the free and reduced lunch count of the school. A further research question assesses whether there is any difference between teacher attitudes and student attitudes concerning impact on the math performance of fourth- and sixth-grade students. The three school districts selected in rural Arizona are in one of the three categories measured by the free and reduced lunch count: 65% or less, 65–80%, or 80% and above.

This research had limitations regarding smaller sample size resulting from a requested focus on only K–8 schools. This was a condition, following my prospectus that limited my sample size dramatically. Additionally, COVID-19's impact the following year effected sample size, as some students left their school due to job loss in the family. Nevertheless, the surveys were distributed to all three K–8 schools with small class sizes. The surveys were returned by 21 out of 40 students that attended the school in the 2019–2020 school year.

All six teachers that had taught at the schools during the school year prior to conducting the study participated. The Galileo math data were taken from the August–December benchmark tests in the 2019–2020 school year. The six teachers completed a 14-item survey about their attitude towards

math using a Likert scale based on the following: 1 — Strongly Disagree, 2 — Disagree, 3 — Somewhat Disagree, 4 — Somewhat Agree, 5 — Agree, 6 — Strongly Agree. Further, the teachers were asked three interview questions designed to gain additional insight into their attitudes. The 30 students completed a 34-item survey using the following Likert scale: 1 — Strongly Disagree, 2 — Disagree, 3 — N/A, 4 — Agree, 5 — Strongly Agree. The study applied a Mixed-Methods Design.

The survey responses from the teachers' and students had some common themes and many of those themes were positive. The fourth-grade males responded that, overall, they *understand math* and the fourth-grade females felt that *My math teachers have always been nice to me*. The responses showed that the fourth-grade females' socioemotional connection to their teacher is more important than their understanding of math. The sixth-grade males responded that *My math teachers have always said that there can be more than one way to solve a problem correctly* and sixth-grade females said that *My math teachers have always been nice*. These answers demonstrate once again that the females surveyed feel it is important to connect with their teacher.

The common themes among the interviewed teachers were *Teachers do not have to be naturally good at math to teach math and students can be successful in any socioeconomic environment*. The teachers appeared positive toward any student regardless of their socioeconomic status. The researcher was not able to conduct any tests concerning correlation in student and teacher attitudes and math performance due to an insufficient sample size to test the related hypotheses statistically for significance.

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DEDICATION

This dissertation is dedicated to my wife, Denise. Thank you for always being there for me through this process. I will always appreciate your sacrifice over every summer that we could have been traveling or enjoying our lives. You were right there by my side keeping everything going, which provided me time to focus on my program. I cannot thank you enough for all your support. That takes love and dedication. I love you.

CHAPTER 1: INTRODUCTION

This research examines the impact of teacher and student attitudes on student math performance to determine if there is any difference between attitudes and performance as well as socioeconomic status. This research was accomplished by examining three different school districts in rural Arizona, which were measured based on the free and reduced lunch count for students, with one school selected from each the 65% or less, 65–80%, and 80% and above categories. The next sections introduce the background, statement of the problem, purpose of the study, research questions, significance, limitations, and delimitations of the study.

Background

There has been considerable attention to analyze and transform K–12 education, especially related to math performance. Significant research and intervention have aimed at helping improve instruction and determining where students continually struggle. In the state of Arizona, federal mandates force school districts to improve in academic proficiency, including math, through an annual high-stakes assessment. Arizona Measurement of Education Readiness or also known as AzMerit is the statewide achievement test for Arizona public school students in grades three thru eight and 10 (Arizona Department of Education, 2017). Furthermore, results of AzMerit assessment data determines the letter grade for school districts in Arizona. Additionally, the federal and state governments are continually assessing how to increase expectations to ensure improved rigor and that state standards are more closely aligned to a common core concept.

The notion behind this concept of a common core is that all states should teach the same standards and provide the same rigor in those standards. Such regulation would ensure that when

students move between states, they will not miss a step in their mastery of the standards. Regarding math, it is essential that students master math concepts by building one skill upon another.

It is reasonable to conclude that teacher and student attitudes have as much or more to do with students' math performance than the students' natural ability or aptitude for mathematics. This research specifically focuses on four main concepts: The measurement of math performance, the effect of high stakes standardized tests on teacher and student attitudes about how math needs to be taught, the negative outcomes standardized tests can have on a school, and the pressure on teachers to improve data at all costs.

Statement of the Problem

Numerous articles from the literature review in Chapter 2, have been written regarding how teacher and student attitudes affect the academic performance of students. In this case, the researcher examines whether there is any relationship between teacher and student attitudes and academic performance in math by comparing the performance of students in three school districts with differing free and reduced lunch count status. There is increasing pressure on teachers for students to perform well on a one-time high stake standardized test, whereby teacher evaluations are tied to student academic performance. More studies that assess if there is any relationship between teacher and student attitudes and academic performance are needed. Thus far, there have been no studies based on the difference of free and reduced lunch count status to teacher and student attitudes in connection with academic performance.

Purpose of the Study

The purpose of this research is to determine if there is any difference between teacher and

student attitudes concerning academic achievement in math in three different socioeconomic status school districts. The socioeconomic status of the schools included in the study were determined by the free and reduced lunch count of each. A second research question assesses whether there is any difference between teacher attitudes and student attitudes as relevant to the math performance of fourth and sixth grade students The three school districts chosen in rural Arizona are in one of three categories measured by free and reduced lunch count: 65% or less, 65–80%, or 80% and above.

From this research, a superintendent or principal could gain insight concerning the impact of teacher and student attitudes concerning math performance. Additionally, the impact of a school district's performance based on free and reduced lunch count on teacher and student attitudes can be assessed. As it relates to professionals in education, this research may help improve the academic performance of fourth and sixth grade students. The data at the school level may be used to create goals, strategies, and action steps to overcome any issues identified.

Research Questions

This research was guided by the following research questions:

1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?
3. What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
4. What, if any, difference exists between sixth-grade female students'

performance in mathematics and the attitudes they hold toward mathematics?

5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?
6. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?
7. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?
8. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?

Hypotheses

H0 Teachers will not show statistically significant between-group differences regarding their students' growth in mathematics.

H1 Teachers will show statistically significant between-group differences regarding their students' growth in mathematics.

H0 Male fourth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Male fourth grade students will show statistically significant between-group differences

regarding their individual growth in mathematics.

HO Female fourth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Female fourth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female sixth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female sixth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

H0 Male sixth grade students will not show statistically significant between group differences regarding their individual growth in mathematics.

H1 Male sixth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

H0 Attitudes of teachers and students from an 80% or more free and reduced lunch count school district will not show statistically significant between-group differences regarding math performance.

H1 Attitudes of teachers and students from an 80% or more free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

H0 Attitudes of teachers and students from a 65–80% free and reduced lunch count school district will not show statistically significant between-group differences regarding math

performance.

H1 Attitudes of teachers and students from a 65–80% free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

H0 Attitudes of teachers and students from a 65% or less free and reduced lunch count school district will not show statistically significant between-group differences regarding math performance.

H1 Attitudes of teachers and students from a 65% or less free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

Definitions and Terms

Math pretest to post-test: When students are tested at the start of the year (pretest) to assess knowledge as compared to how well they do at the end of the year (post-test) after they have been taught.

Galileo Benchmark: Each quarter, students are tested to see if they have mastered skills that have been taught in that quarter. Schools can opt to give students a quarterly benchmark only on the standards taught or a comprehensive quarterly benchmark that exposes the students to all the standards they will be taught each quarter throughout the year.

Confidence or self-efficacy: The ability of teachers to reflect on their own teaching practices driven by how they feel about their own ability to teach math.

Impacting factors on teacher attitudes and confidence about mathematics: How teachers' attitudes can affect students' academic achievement. Further, how teachers' confidence may affect

their ability to teach math effectively.

Free and reduced lunch count: These are based on determining the free and reduced lunch count by multiplying the 2018 federal income poverty guidelines by 1.30 and 1.85, respectively, and by rounding the result upward to the next whole dollar amount (Lipps, 2018).

AzMerit: Arizona Measurement of Educational Readiness which is the statewide achievement test which is the statewide achievement test for Arizona public school students in grades three–eight and 10 (Arizona Department of Education, 2017).

Significance of the Study

Negative or positive teacher and student attitudes will determine academic performance. This topic was chosen due to the impact the results may have on teachers' data in evaluations and students' data in high-stakes tests. Factors such as students feeling more confident and having a positive attitude may have a constructive impact on academic performance, and the same could apply to teachers. Is there a relationship between teacher attitudes and student attitudes and academic performance? Further, is there a difference evident in teacher and student attitudes between school districts with varying free and reduced lunch counts? Answering these questions may give insight into whether positive attitudes from both the teacher and student matter, with consideration for socioeconomic status an additional possibly relevant factor.

Limitations of the Study

The study followed a mixed method to gather data on students' performance in mathematics. Quantitative (surveys) and qualitative data (interviews) concerning student and teacher attitudes that

could have affected and resulted in negative or positive experiences for teachers or students relating to mathematics were collected.

The researcher faced limitations, which included additional outside influences such as teachers not feeling supported by their administrators. Further, the research could only be conducted in the researcher's own school district. Additionally, there may not have been a math curriculum or pacing guide for teachers at the different schools examined to better prepare the students. Also, the researcher was an employee and educator in one of the districts. Results may be generalized due to a small sample size.

Finally, a lack of parental support or increased parent support could have influenced the outcome of this study. Any of these limitations could have helped or hindered students' academic performance in mathematics or affected teachers' abilities to do their best.

Another limitation was the size of the schools, as each was very small and there were not a high number of teachers per grade level or many students in the specific grade levels analyzed. More information could be gained from an increase in the number of grade levels examined and by working with larger school districts that more accurately represent the three free and reduced lunch count populations. The last limitation would be teacher experience. A beginning teacher would also be a limitation.

Delimitations

The researcher conducted surveys and interviews from August 2020 to December 2020 in three rural districts in Arizona. The school districts were chosen based on the free and reduced lunch count. All students in the fourth and sixth grades in each school district were invited to participate in

the survey. The teachers were chosen from among those working with fourth or sixth grade in the three school districts.

Summary

There are several reasons this research is important. First, there exists increasing pressure on teachers for students to perform on a one-time high stake standardized test. Teacher evaluations are tied to student academic performance. The pressure that teachers experience must be studied to see if there is any difference between teacher and student attitudes regarding math performance. These data could be used for future professional development that may help academic performance. Second, there are no extant studies concerning how free and reduced lunch counts in rural school districts particularly its impact on teacher and student attitudes toward academic performance.

This research was conducted to help current and future superintendents and principals gain insight into teacher and student attitudes regarding math performance, and the findings may give direction to help improve these attitudes. Further, this research may give direction to educators and help improve the academic performance of fourth and sixth grade students. The data can be used to create goals, strategies, and action steps to overcome and address issues that may be identified by this research. Future studies could utilize these research questions and data collected to examine if the findings pertain only to rural Arizona. The research questions and hypotheses are causally related to the dissertation topic. The next chapter reviews and analyzes the literature on this dissertation topic.

CHAPTER 2: REVIEW OF EXISTING LITERATURE

This review analyzes past literature on how teacher and student attitudes and beliefs can affect math performance. Specifically, it focuses on four main concepts: How math performance is measured, how high-stakes standardized tests can affect teacher and student attitudes concerning how math should be taught, how the results of high-stakes standardized tests impact schools, and how teachers can sometimes feel stressed and anxious to improve the data related to standardized tests. Further, this literature review considers factors such as a school location in a high poverty area where there may not be much parental support and where the teachers' evaluations depend on how students perform on standardized tests.

AzMerit

AzMerit is a one-time high stakes standardized test given to students in grades 3 through 8 as well as in 10th grade in Arizona to show accountability. There is significant pressure placed on school districts to improve student performance in mathematics. Previously, the state used Arizona's Instrument to Measure Standards (AIMS). Both assessments are standardized tests used to measure student performance in mathematics and in other academic subject areas. Data from these tests are used by the Arizona Department of Education to assign letter grades for schools and their districts. Potentially, teachers could have a negative attitude about student performance in math because there is pressure to show continual growth from all students, as measured by quarterly assessments; the results of those quarterly assessments are also connected to teacher evaluations.

If students are progressing, teachers receive positive evaluations, however, if students are not progressing, teachers do not receive positive evaluations. This latter situation can lead to a tense

relationship between teachers and their attitudes toward math as well as their attitudes toward students learning and being successful in mathematics.

Effects of High-Stakes Assessments on Teacher and Student Attitudes

In education today, schools expect academic achievements that are often measured by high stakes standardized tests, which, in turn, can potentially lead to opportunities for students, teacher benefits, and school funding (Back, Polk, Keys, & McMahon, 2016). Should these one-time standardized assessments be used to judge whether one school is better than another? Should teacher benefits, opportunities for students, and school funding be tied so heavily to standardized tests? What is the purpose of these assessments? Some authors, highlighting the validation provided by a school letter grade, have concluded that such assessments are a tool for the dominant culture to assert that their schools and their students are better.

Standardized tests help to promote the concept of winners and losers in education. "Standardized tests are often used to decide who has access to the best schools" (Eisenberg, 2006, p. 12). Consequently, it can be argued that the current system has been created to demonstrate failure of the subordinate cultures. Assessments that are used to create an image that one school or district is better than another construct distinctive social lines and a social ranking between dominant and subordinate cultures.

Another issue identified in previous research on education focuses on fair and equitable treatment regardless of dependence on the "historical, cultural, and/or economic relation to the dominant group" (Eisenberg, 2006, p. 12). Using standardized tests has been shown to reaffirm the "differences amongst individuals as deviant or having less value" (Eisenberg, 2006, p. 12), as these

assessments are “not free of cultural standards and values, and if making them impartial is impossible, then they do not provide an unbiased means of determining who gets access to privileged positions” (Eisenberg, 2006, p. 12).

To ensure fair and equitable treatment as relating to the dominant culture, teachers have been asked to implement a new standards-based curriculum. However, this curriculum can influence teacher attitudes, especially as the curriculum is tied to a standardized test. This type of assessment, which is used to determine teachers’ effectiveness and is connected to their evaluation, could possibly add stress and anxiety for the teacher, which in turn could potentially be passed on to the student. In one study, teachers were selected randomly to be part of a professional development opportunity to increase knowledge and skills that would assist in improving their students’ academic achievement (McGee, Wang, & Polly, 2013). When teachers were taught new strategies to implement the standards-based math curriculum, they seemed to readily make the changes in their instruction and allow the students to take on more demanding tasks in the activities they were given (McGee, Wang, & Polly, 2013). However, in this researcher’s experience as an administrator, teachers experience such high levels of stress and anxiety concerning the standardized tests that they may revert to old teaching practices. Teachers want to ensure their students are prepared, even if it means sacrificing more unconventional, innovative methods of instructional practice that will help the students become more confident in mathematics in the long term.

One-way teachers can assess if students are performing and developing academically is through periodic assessments such as the quarterly Galileo benchmark test (ATI, 2017). The Galileo benchmark test helps teachers see where their students’ weaknesses are and identify where to focus

interventions. Additionally, the Galileo benchmark can help to ensure that teachers are keeping up with the core curriculum, guaranteeing that everything is addressed to prepare for that one-time high stake standardized test.

Teacher Evaluations

Another concern about the standardized test for accountability is its use for teacher evaluations. If teacher anxiety levels increase and lead to negative attitudes because of this test being connected to evaluations, those attitudes can be transferred to the students and affect their attitudes as well. Numerous variables can contribute to low test scores, and many of these may be outside the control of teachers, including poor attendance and behavior choices, or simply a student having a rough day. Research has found that "student test score gains are also strongly influenced by school attendance and a variety of out-of-school learning experiences at home, with peers, at museums and libraries, in summer programs, on-line, and in the community" (Shavelson, Linn, Baker, Ladd, Barton, & Ravitch, 2010, p.5). Evaluating teachers based on how students perform on standardized assessments does not take into consideration these other forms of learning that are beneficial to the success of both the student and the teacher.

> Student test score gains are also influenced by family resources, student health, family mobility, and the influence of neighborhood peers and of classmates who may be relatively more advantaged than disadvantaged. (Shavelson et al., 2010, p.5)

Any of these mentioned factors can be a barrier to teachers. Teachers are typically with students approximately six hours per day. In that time, teachers can engage in effective classroom

practices, but they might still be viewed as inadequate if their evaluation is based on a standardized test on which students perform poorly.

Quality Teachers

Having quality teachers in the classroom is a necessity. It can hurt students when a high-quality teacher who has completed higher education and a full teacher preparation program decides to leave the profession. The data on the practice of teacher effectiveness being connected to a single test score have highlighted some interesting considerations.

Teacher effectiveness and quality are not based only on the content learned by the teacher and from what program but, in addition, how well the teacher can manage a classroom. Managing a classroom may not seem like an important skill, however, to build confidence in students who are learning mathematics, those students need to feel calm and well-adjusted, especially in those larger classrooms where student numbers and meeting diverse needs may be a factor (Back, Polk, Keys, & McMahon, 2016). Additionally, a lack of adequate classroom management skills has been highlighted as one reason teachers feel stressed, which can lead to burnout (Back et al., 2016).

Types of Schools Served in Arizona

There are many different types of schools with diverse demographics in Arizona. According to the Arizona Department of Education, schools are classified as rural, rural remote, suburban, and urban. There are students from diverse cultures and different socioeconomic statuses in many of the schools in Arizona, yet the state uses a one-size-fits-all method for the standardized test and letter grade for accountability. The curriculum in the standardized test is based on the dominant culture's ideology of what is important for students to succeed and become productive citizens (AZED,

2017).

Socioeconomic Status and Its Impact on Academic Performance

According to the Arizona Department of Education website, the state has 216 school districts, 1,924 schools, 1,112,146 students, and 525 charter schools attended by 157,438 students (AZED, 2017). The school districts are further divided by category. Many schools in the rural and rural remote categories have a high number of students who are on a free or reduced lunch, which is also evident within the urban category. To receive Title I funds, a school must have more than 40% of students who qualify for free or reduced lunch.

Students are in school for six hours per day across 180 days per year. The standardized test criteria are created by people who are not necessarily well-informed of the students especially from low socioeconomic backgrounds and who set rules to continue to benefit the dominant culture, which can have a crippling effect on a school that is working to receive the best letter grade possible.

One roadblock to improving the K–12 accountability system with considerable consequence has been the use of the media to promote the dominant culture's interests. The issue of the media's influence on society is far from a new topic. The mainstream culture can play a role in incorporating the working class into existing society in the new media culture that was forming. Both have viewed culture as a reflection of educational institutions, which can shape the thoughts and behaviors that convince individuals to adapt to the conditions of the times (Kellner, 1989). This concept regarding the future of how media would influence the working class was very prophetic.

Today, the media remains a significant influencer regarding what people think. The power

and control of media corporations to promote the dominant culture's agenda has been very influential. Freire stated that "it is extremely urgent that the power in effects of the media should be subjected to serious debate. As educators with open minds, we cannot ignore the television. We must, in fact use it, but above all, we must discuss what is going on, what is being said and shown" (Freire, 1998, p. 123). As the media still has considerable influence, educators need to continue to be aware of this medium and any negative impact it may have on promoting multiculturalism.

The focus of education should be dependent on what a community, school board, parents, staff, and students collaboratively determine is important for students to gain from attending school. Another idea that should be considered when creating a vision statement to encourage change and move away from the dominant class and culture is critical theory. Critical theory aims to "emphasize the importance of critique, reflexivity, and the achievement of emancipatory consciousness, free from indoctrination and socialization" (Kellner, 1989, p. 166). Freire stated that the "most important task of critical educational practice is to make possible the conditions in which the learners, in their interaction with one another and with their teachers, engage in the experience of assuming themselves as social, historical, thinking, communicating, transformative, creative person; dreamers of possible utopias, capable of being angry because of the capacity to love" (Freire, 1998, p. 45). Change and conversations can be reshaped when these individuals come together and create a vision; only then can significant change that moves away from the dominant class be accomplished. Such a divergence from the dominant class would greatly improve teacher attitudes at school, which would in turn positively affect student attitudes.

Student Attitudes

There are many factors that shape students' attitudes toward academic achievement. One such factor is teacher efficacy: How teachers feel about their ability to teach and their own experiences in learning math when they were students. Other factors include student motivation, student engagement, and student learning strategies. Several studies have found that it is not only important to ensure that teachers are proficient in math themselves but that they have positive attitudes toward their students, which then helps students stay engaged and feel confident that they too can become excellent mathematicians (Looney & Steck, 2017). The way students feel about themselves and the way teachers feel about students are two elements just as important as teachers' beliefs and attitudes about themselves as math teachers. In a qualitative study, preservice teachers were interviewed and asked about how they felt as students when they were being taught math.

> One teacher said, I felt as though the teachers just taught the material to get it done rather than to actually teach it. Another teacher said, in school I never had a teacher that really went out of their way to make math exciting. My sister comes home with songs that her teacher created to help them remember formulas. The only thing I can remember about math was always doing worksheets. Another teacher expressed that their teacher who is moving to stay on schedule no matter whether the majority the students were getting it or not. I was one of the 30 students in the class not getting it. (Looney, Perry, & Steck, 2017, p. 32)

These statements that teachers made about how they felt when they were being taught math are very insightful, because they provide insight into how the teachers themselves felt about math

and how this could have hindered their ability to educate. An added question participants from this qualitative study were asked was whether they had a higher level of confidence in math after they were taught strategies. One participant said “the strategies I have been taught throughout this course have helped me gain a deeper understanding of math. Another participant felt that they had improved their capabilities and confidence to teach math” (Looney, Perry, & Steck, 2017, p. 33). The participants who were math teachers but lacking confidence in the beginning of the study attributed some of the changes in their attitudes to the new strategies they learned to teach mathematics.

> One participant felt that the first thing this class did for me was teach me new strategies for doing mathematics. I was taught strategies I should have been taught 20 years ago. The second thing this class gave me confidence by giving me hundreds of activities and lesson ideas. What I feel has helped me the most in this course is learning a different variation on teaching math. Since learning that there is not just one way to solve the problem, I feel a lot more confident teaching math. (Looney, Perry, & Steck, 2017, p. 34)

These teacher insights reflect what students are probably feeling when they are being taught math and show that students’ confidence can be increasingly built by a great math teacher.

Understanding how teachers feel about teaching math is an important component in improving math instruction. However, improving understanding of how students’ attitudes affect their progress in math may be a more effective approach to increase student achievement in math. Before there is an understanding of student attitudes toward their own achievement, there should be

an understanding of motivation, because motivation and attitudes have been demonstrated to build on each other in the process of achievement (Bakar, Tarmizi, Mahyuddin, Elias, Laun, & Ayub, 2010). Student academic achievement has been closely connected to attitudes toward learning (Bakar et al., 2010). If a student has a poor attitude toward learning, including on a specific subject such as math, that student will most likely not have achievement gains comparable to a student who has a positive attitude about learning. Student attitudes toward math and how students feel about learning have been outlined as the primary factors in math achievement (Bakar et al., 2010). Furthermore, motivation — the reasons behind people's actions — can make the learning environment more complicated. Motivation, as it relates to student achievement, may have a part in explaining why a student does or does not do well academically. If a student comes to a teacher with a lack of motivation to succeed in math along with an attitude that they cannot succeed in math, pairing that with a teacher who does not believe in their own ability to teach math creates a complicated situation to understand and improve.

Student Motivation

Understanding motivation and self-regulated learning strategies can be important for understanding what affects student attitudes. Self-regulated learning is the process a student uses to acquire a new skill; the concept includes goal setting and monitoring self-progress (Janssen & O'Brien, 2014). Students with more effective self-regulated learning strategies tend to perform better and are more motivated to do well because they establish a productive work environment for themselves and hold positive motivational beliefs about their abilities (Janssen & O'Brien, 2014). In the reverse, when students lack motivation or self-regulated learning strategies, they have been

shown to input less effort, which in turn leads to lower academic performance (Janssen & O'Brien, 2014). It is fair to assume motivation influences performance through self-regulated strategies (Janssen & O'Brien, 2014). Further, it has been demonstrated that students who have strong self-regulated strategies make an increased effort in managing time and seeking help in solving problems (Janssen & O'Brien, 2014). Students who are not as motivated and do not have those self-regulated skills may not have strong academic performance. Additionally, it has been found that self-efficacy in students is important for increased achievement. (Janssen & O'Brien, 2014). If a student has the attitude that they cannot learn math, that may affect their performance in math in general no matter what the teacher's attitude is concerning the student's abilities. If students are not motivated to apply themselves in the face of difficulty, they will not succeed (Janssen & O'Brien, 2014). Thus, motivation is an important factor in understanding what contributes to student attitudes.

Student Engagement

Motivation on the part of a student can be linked with engagement as it pertains to learning. For this study, the three types of student engagement discussed are: Behavioral, cognitive, and emotional (Lee & Shute, 2010). Behavioral engagement is related to a student's outward behavior, interests, and investment in what they are teaching (Lee & Shute, 2010). Basic behavioral engagement includes following school rules, coming to school on time, and turning in homework (Lee & Shute, 2010). An increased level of behavioral engagement may include students working hard to achieve good grades, paying attention in class, seeking information on their own, and attempting to solve problems (Lee & Shute, 2010). Finally, the highest level of behavioral engagement is a student initiating discussion with teachers and other students on the subject matter

being taught and participating in learning activities outside school (Lee & Shute, 2010). Therefore, teachers should pay attention to the types of outward behaviors students display to better understand how to help them become more successful in their math achievement.

Cognitive engagement includes students' decisions, beliefs, and willingness to expand their efforts to learn and overcome challenging situations (Lee & Shute, 2010). This can be imperative in the student achievement process, especially when it comes to willingness to learn new things. Students who are willing to dedicate extra effort to their schoolwork may record higher achievement (Lee & Shute, 2010). It is important to understand the difference between students who want to do well simply to attain good grades and students who show preferences for challenging work or persist in the face of failure; the latter group of students may have stronger achievement overall (Lee & Shute, 2010).

Emotional engagement is reflected in students' reactions and feelings toward learning new things, their teachers, and their peers (Lee & Shute, 2010). Positive feelings such as happiness or enthusiasm versus negative feelings alongside boredom and anxiety have been shown to have a significant impact on whether students perform well (Lee & Shute, 2010). Therefore, understanding students' beliefs toward learning involves more than examining where the teacher is coming from; factors such as student motivation and level of engagement in learning new things are also critical.

Student Learning Strategies

Coupled with student motivation and learning engagement, learning strategies may affect student achievement. Learning strategies — whether cognitive, metacognitive, or behavioral — can affect how students obtain new information and how teachers can meet informational demands to

increase student achievement. Cognitive learning strategies are internal processes whereby students can perform difficult tasks (Lee and Shute, 2010). If students struggle with the process of how to learn something new, it then can be understood that learning in general will be difficult for these students. Metacognitive strategies involve students being able to access and monitor their own learning abilities (Lee & Shute, 2010). If students have difficulty with the act of learning, then it can be assumed they would struggle with understanding why they are not able to learn something new. Behavioral learning strategies refer to the habitual activities of students to manage their own behaviors while learning new things (Lee & Shute 2010). There are other specific factors regarding how behavioral learning strategies can affect student progress, such as time management, test-taking strategies, help seeking, homework management, and note-taking skills (Lee & Shute, 2010).

Generally speaking, there are numerous factors that contribute to the complexity of student beliefs surrounding their own learning and how those beliefs are created. As outlined, student attitudes and beliefs can be shaped by external forces such as teachers and parents along with internal forces such as student motivation, different types of student engagement, and various learning strategies.

Teacher Attitudes

There are a variety of factors that may impact teacher attitudes when it comes to teaching mathematics, including teacher-student relationships, early exposure to mathematics, professional development in mathematics, relationships between teachers and with administrators, and school climate. Teacher attitudes can engage or disengage students in their mathematical achievement. A study published in 2012 outlined that teacher self-efficacy regarding student math performance can

improve their students' capacity to learn (Archambault, Janosz, & Chouinard, 2012).

> When students presented academic difficulties especially if they were from a low socioeconomic background, they were less likely to receive the support they need from teachers to be engaged in learning. Because the students feel less positive about their abilities, they might rely more on teacher's perceptions for motivation and thus might be negatively affected by teacher's pessimistic beliefs than less vulnerable children who already possess a good general sense of self-worth. (Archambault, Janosz, & Chouinard, 2012, p. 320)

On the other hand, the study showed that when positive results are expected from "students, teachers interact more with them and provide them more positive feedback which ultimately promotes their engagement and achievement. Teachers of high achieving students are more likely to experience success with them and that repeated success may, in turn, contribute to and consolidate the student's positive beliefs" (Archambault, Janosz & Chouinard, 2012, p. 321).

The study showed that it is especially important that the student-teacher relationship is strong and that there is engagement and active learning in the classroom. Positive relationships were demonstrated to help influence any past experiences with students with low socioeconomic status and change teacher beliefs to generate a more positive effect in the classroom, which in turn contribute to improving math performance (Archambault, Janosz, & Chouinard, 2012). At the end of the study, the results suggested that teachers can promote engagement and academic achievement in students with low socioeconomic status "but are probably not sufficient to bring about differential and more significantly change the academic pathway student with difficulties. To observe real

transformation in the students, there is not only a need to implement intensive and multimodal interventions targeting the development of student skills, knowledge, and competency, but also the improvement of teacher's instructional strategies" (Archambault, Janosz, & Chouinard, 2012, p. 326).

Rattan et al., report on teacher attitudes found that instructors with a fixed idea of math intelligence more readily judged students to have low ability in math than teachers who had a malleable idea of math intelligence, which proposes that people can improve their abilities through practice. Another finding was that instructors who had a fixed idea of math intelligence were more likely to determine that a student has limited ability based on a single initial poor performance. Further, such instructors were shown to be more likely to comfort students for their apparent lack of ability and use well-meaning strategies that fail to motivate the students to improve, such as assigning less homework and not calling on them in class. An additional finding of this study was that students who received comfort-oriented feedback as opposed to more strategic feedback assumed that the instructor had low expectations for what they might accomplish and thereby the student developed increasingly lower engagement in their learning even when the feedback was expressed positively (Rattan, Good, & Dweck, 2012, p. 8).

Early exposure to mathematics should improve student attitudes toward the subject. The attitude of the preschool teacher can greatly contribute to the attitude a young child has regarding feeling confident about math. When researching two different teachers at the pre-K level, a study by Graham, Nash, and Paul (1997) found that one teacher felt it was difficult to get the students to focus for more than a short amount of time, therefore, being purposeful and preparing for direct

lessons seemed excessively time-consuming in comparison with the achieved result. The other teacher interviewed felt that interacting with the students less and being very prepared for the activity could produce better results. One of the teachers in the study taught three-year-olds and the other taught four- and five-year-olds. Structure and planning are important even at the three-year-old level, although these students may be in the program for a short time. This study found that even a lack of structure can affect a teacher's attitude. A follow-up study would be interesting to assess whether these different attitudes had any impact on future math performance of the students.

Professional Development

A study on teacher professional development and student mathematics achievement focused on belief systems concerning teachers and student learning (Kutaka, Smith, Albano, Edwards, Ren, Beattie, & Stroup, 2017). This study "identified past learning experiences as primary sources of mathematics related beliefs for elementary teachers, and the suggested beliefs constructed early in life have the power to persevere even against contradiction's cost by reason, time, schooling, and experience" (Kutaka et al., 2017, p. 141). Professional development in mathematics was expected to improve teacher attitudes toward teaching mathematics and thereby student performance in mathematics. Some of the conclusions from the study demonstrated teachers "need time to process new ideas, consolidate skills, and begin to make changes to their teaching practices" (Kutaka et al., 2017, p. 150). When teachers feel more competent about teaching mathematics as a result of professional development, this can result in increased confidence, which can reduce the stress and anxiety of teaching to the standardized math test and positively affect the students and their ability to have a positive attitude about mathematics (Kutaka et al., 2017).

Teacher Relationships: Coworkers and Administration

In addition to the teacher-student relationship as it concerns mathematics, early exposure to mathematics, and professional development in mathematics for teachers, staff relationships can develop or possibly hinder negative teacher attitudes. Staff relationships have been shown to make a difference in how a teacher feels in the classroom; for example, cooperation with other teachers for the sharing of ideas or different methods to teach math as well as principal/administrator relationships in terms of data and support in the classroom (Back, Polk, Keys, & McMahon, 2016). If teachers work collaboratively with administrators, it has been demonstrated that there is a higher chance of creating a more cohesive environment that can lead to increased student achievement (Back et al., 2016). Therefore, how well teachers cooperate both with other teachers and administrators can affect teacher attitudes and job performance (Back et al., 2016).

School Climate

School climate — how a school feels and in which direction it develops — can influence teacher attitudes in terms of increasing student achievement (Back et al., 2016). As noted with regard to highly effective teachers, utilizing positive classroom management strategies not only supports growth in the classroom but can assist in a positive or negative teacher attitude toward the school climate, which can in turn influence others within the school system (Back et al., 2016). Teachers and administrators can positively or negatively affect a school climate through their cooperation with one another and their individual attitudes concerning teaching in general.

Teacher Self-Efficacy

An additional relevant factor here is teacher attitudes toward their own abilities in teaching

mathematics. The concept of self-efficacy is generally based on how people feel about their own abilities; examining how abilities can affect behavior, effort, and persistence can help to understand what a teacher's attitude may be toward teaching mathematics (Senler, 2016). Whether teachers believe they can or cannot teach math, their thought process can affect their students' academic outcomes and next steps in terms of achievement in mathematics. Self-efficacy relates to the teacher's belief in their own ability to organize a path to optimize their students' results (Senler, 2016). If teachers themselves do not feel comfortable with their abilities to teach math, their students may not develop a positive attitude toward their own success in math. There is a direct correlation between positive self-efficacy and being able to analyze teaching strategies and student academic performance (Senler, 2016).

Teacher Locus of Control

In the discussion surrounding teacher attitudes, locus of control, whether internal or external, is an important factor. A teacher's attitude can be manipulated by the perception of control. If teachers have an internal locus of control, they believe they can effect change on an outcome with hard work and effort, which stands in strong contrast to someone who holds an external locus of control and places blame or the effects of change on other people (Senler, 2016). Teachers with an internal locus of control have been shown to be more reflective and open to examining their own teaching practices, whereas teachers with an external locus of control tend to hold more negative attitudes toward educating in general (Senler, 2016).

Subsequently, anxiety can be a byproduct of individual perceptions of self-efficacy and locus of control. If teachers are afraid to develop the proper self-efficacy strategies needed to be

successful, which can lead to an external locus of control attitude in that these teachers believe they cannot effect change, the student achievement outcomes can be lower than for teachers with more positive self-efficacy strategies and an internal locus of control. Teachers with anxiety surrounding their instructional abilities toward math can create anxiety in students and decrease their student's confidence in their own math abilities (Senler, 2016).

Perceptions vs. Beliefs

In order to reach a comprehensive understanding of teacher and student beliefs, one should attempt to understand the difference between belief and perception. A perception is a way to view or understand something, and that understanding usually comes from getting a feeling or sense. Perceptions can change over time and with the accumulation of experience; on the other hand, a belief is an acceptance of something without evidence or proof. A person may hold very strongly to a belief and possibly be incapable of changing that. To understand teacher and student beliefs, it is necessary to understand that beliefs have been shown to be deep-seated and exceedingly difficult or even impossible to change (Cirillo & Herbel-Eisenmann, 2011). For example, if a teacher believes a student can improve in math with dedication and focus, the student may also believe, and the two can begin to work together to make that happen. However, if a teacher believes a student cannot improve their ability, which can result in the student believing they cannot improve, thus leading to a lack of improvement as a consequence of disbelief on both sides.

This questioning can intimidate elementary teachers who may not have a strong foundation in math and can do the same to students who feel they do not identify with this stereotype of a math teacher. In one related study, students were asked to draw what mathematicians do. "They found

that most students believe that mathematicians do hard problems that other people don't know" (Cirillo & Herbel-Eisenmann, 2011, p. 69). Another student felt that math problems do not automatically equal a difficult situation but can most often be solved in 10 minutes or less (Cirillo & Herbel-Eisenmann, 2011). Other students stated that the mathematician is someone who is truly gifted, and that the intelligence required to be a mathematician is something present at birth that cannot be taught (Cirillo & Herbel-Eisenmann, 2011).

This research emphasized that it can be extremely difficult for students to identify with the stereotypes of mathematicians or perceive them as obtainable for themselves, which may lead to a poor attitude about mathematics. The teachers in this study generally found their belief systems stemmed from literature, and they also expressed that mathematics does not require much effort or hard work (Cirillo & Herbel-Eisenmann, 2011). When teacher belief systems and student belief systems include these stereotypes, it becomes clear why math may not connect with everyone.

Other research has highlighted that students' belief in themselves is an extremely powerful tool that can be of great help to their education. A lack of confidence can be extremely detrimental to a student and a fixed mindset where a student believes there is a barrier that will hinder them from achieving greatness in an academic subject can affect that student to the point where they feel they can develop no further (Lee, 2009). Parents of students in this situation may say "he missed the basics at primary, so he always feels out of his depth. When people act as though they have a fixed mindset theory of learning, they act as though they only have the ability to learn just so much and no more' (Lee, 2009, p. 44). This can cause people to think that there is a fixed level to the learning they can do in mathematics they may not in other subjects" (Lee, 2009, p. 44). However, when

students have a growth mindset where they feel they can break the invisible barrier if they could simply put in a little more effort or hours toward studying or practice, this is where development has been shown to become unlimited (Lee, 2009).

Student beliefs can be one of the reasons students do not perform well from the beginning in mathematics. In this researcher's personal experience as an educator, this fixed mindset can be very debilitating and difficult to overcome, especially when it is self-reflected in a negative way. "People who have developed a growth mindset firmly believe that effort leads to success" (Lee, 2009, p. 45). This is not to say that everybody can ultimately reach the same outcome — rather that everybody can improve their current ability to engage with and learn mathematical ideas.

Student Confidence vs. Finding Value in a Skill

If students feel confident in certain skills, they usually perform better on those skills; however, feeling confident in a skill may not always lead to improved student performance (Liddell & Davidson, 2004). The student's perceived value of a skill has been shown to be what drives academic achievement to a greater extent than the confidence of the student surrounding the skill, as students are more likely to perform better if they believe the skills, they are learning are important than if they find low value in the skill being taught (Liddell & Davidson, 2004). That is not to say there is no value in confidence; indeed, it has been demonstrated that it is vital to obtain an improved understanding of how confidence in a skill affects student attitudes or beliefs in attempting to learn a new skill (Liddell & Davidson, 2004). For example, if students do not have confidence in their ability to learn a new skill, they will shy away from learning that skill, which reduces the number of new learning opportunities (Liddell & Davidson, 2004). The right amount of

confidence is also important; for example, an overconfident student may make many silly errors.

Ultimately, understanding the difference between perceptions and beliefs and analyzing the teacher as a student when they were learning math provide tremendous insight into how to effect change from the educator's point of view. Showing the difference between growth and fixed mindsets, understanding how the correct amount of confidence in a student can affect change, and emphasizing value in learning new skills are all important factors in shaping student beliefs and encouraging students to be open to learning new and difficult subjects.

The emphasis placed on one-time high-stakes standardized tests results in the issue of how students are faring in a social-emotional arena receiving too little attention. These types of assessments have been written to help advance the dominant culture and are set up to continue to separate the social classes. The focus should be on social-emotional well-being and what helps build confidence in students of lower socioeconomic status. Schools should be structured to provide what is best for the students, however, at present it appears schools are mainly set up for what is best for the dominant culture.

Summary of Existing Literature

K–12 education has evolved to its current status due to contributing factors of media influence and what the dominant culture dictated was important for everyone to learn. Another influential factor in teacher attitudes is the academic performance of students being connected to teacher evaluations, which can affect a teacher's future employment and therefore be of great consequence to the individual. The school that the teacher works at receives a letter grade based upon that one-time high stake standardized test, and this can inadvertently contribute to a negative

attitude toward students and their math performance.

Further, research has shown that how teachers were taught math in school and how well they were prepared in college can potentially affect their attitudes toward their students' performance in math. Previous research has indicated that students and even teachers may have certain stereotypes of the typical person who is good at math, which can make students feel that they may not be successful at math if they are not like this individual. Finally, the socioeconomic status of students may have an influence not only on those students but the teachers who instruct them, who may sometimes feel it is acceptable not to push students of certain socioeconomic status.

This research provides ideas as to how to create stronger interventions and strategies for teachers to use in the classroom. Finding the root causes for the different issues surrounding math performance can connect and provide direction as to how to improve for both students and teachers. From these identified root causes, professional development strategies could be created to help teachers and students find success in the classroom. The next chapter describes the methodology of this mixed-method study.

CHAPTER 3: METHODOLOGY

Introduction

This chapter reviews the research methodology, research design, and population and sample. Next, the instrumentation is introduced, with copies of the surveys and interview scripts included as appendices and referenced. The approval of the dissertation review board can be found in Appendix A, the Match of Research Questions in Appendix B, and the Mixed Methods Convergence Table in Appendix C. Last, the data collection procedures for this research are detailed, followed by the data analysis procedures.

Purpose

The purpose of this research is to determine if there is any difference between teacher and student attitudes regarding academic achievement in math at three different socioeconomic status school districts. The socioeconomic status of each school was determined based on the free and reduced lunch count. The second research question assesses whether there is any correlation between teacher attitudes and student attitudes concerning the math performance of fourth- and sixth-grade students specifically. The three school districts chosen in rural Arizona are in one of the three categories measured by the free and reduced lunch count: 65% or less, 65–80%, and 80% and above.

From this study, a superintendent or principal could gain insight into the impact of teacher and student attitudes regarding math performance. Additionally, the impact on teacher and student attitudes of a school district based on free and reduced lunch count can be assessed. This research, as it relates to professionals in education, may help improve the academic performance of fourth-

and sixth-grade students. The data at the school level may be used to create goals, strategies, and action steps to overcome any issues identified.

Problem Statement

A great number of articles have been written concerning how teacher and student attitudes affect the academic performance of students. In this study, the researcher looks at whether there is any difference between teacher and student attitudes and academic performance in math by comparing the performance of students in three school districts with differing free and reduced lunch count status. There is increased pressure on teachers for students to perform well on a one-time high stake standardized test, especially considering teacher evaluations are connected to student academic performance. Further studies are required to ascertain if there is any relationship between teacher and student attitudes and academic performance. Thus far, there have been no studies based on the difference between free and reduced lunch count status and teacher and student attitudes with regard to academic performance.

There has been significant attention to analyze and transform K–12 education, especially related to math performance. Considerable research and intervention have aimed at helping improve instruction and determining where students continually struggle. In the state of Arizona, federal mandates force school districts to improve in academic proficiency, including math, through an annual high-stakes assessment. AzMerit is the statewide achievement test for Arizona public school students in grades three–eight and 10 (Arizona Department of Education, 2017), which determines the letter grade for school districts in Arizona. Additionally, the federal and state governments are constantly assessing how to increase expectations to achieve increased rigor and a closer alignment

of state standards to a common core concept.

The notion behind this concept of a common core is that all states should teach the same standards and provide the same rigor, thereby ensuring that students will not miss a step in their mastery of the standards should they move between states. Regarding math, it is essential that students master math concepts by building one skill upon another.

It is reasonable to conclude that teacher and student attitudes are as strongly related to students' math performance as students' natural ability or aptitude for mathematics. This research specifically focuses on four main concepts: The measurement of math performance, the up-to-date curriculum and best practices on teacher and student attitudes regarding how math needs to be taught, the negative outcomes standardized tests can have on a school, and the pressure on teachers to improve the data at all costs.

Research Questions

This research was guided by the following research questions:

1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?
3. What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?

5. What, if any, difference exists between fourth- and six-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?
6. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?
7. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?
8. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?

Hypothesis

H0 Teachers will not show statistically significant between-group differences regarding their students' growth in mathematics.

H1 Teachers will show statistically significant between-group differences regarding their students' growth in mathematics.

H0 Male fourth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Male fourth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female fourth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Female fourth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female sixth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female sixth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

H0 Male sixth grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Male sixth grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

H0 Attitudes of teachers and students from an 80% or more free and reduced lunch count school district will not show statistically significant between-group differences regarding math performance.

H1 Attitudes of teachers and students from an 80% or more free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

H0 Attitudes of teachers and students from a 65–80% free and reduced lunch count school district will not show statistically significant between-group differences regarding math performance.

H1 Attitudes of teachers and students from a 65–80% free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

H0 Attitudes of teachers and students from a 65% or less free and reduced lunch count school district will not show statistically significant between-group differences regarding math performance.

H1 Attitudes of teachers and students from a 65% or less free and reduced lunch count school district will show statistically significant between-group differences regarding math performance.

Research Methodology

A mixed-methods study was chosen as the most appropriate approach for this research. A mixed-method study focuses on sequential explanation, which means that the quantitative data were collected and analyzed first, after which follow-up interview questions were asked to gain a deeper understanding of how teachers feel and a full picture of any between-group differences in teacher and student attitudes as well as teacher and student confidence.

> Qualitative and quantitative approaches in a single study complement each other by providing results with greater breadth and depth. Combining what with a possible why adds power and richness to your explanation of the data. With quantitative methods, you can summarize large amounts of data and reach generalizations based on statistical projections. Qualitative research tells the story from the viewpoint of the participants that provides rich descriptive detail. (Roberts, 2010, p. 145)

Gay and Airasian (2003) offered three models of mixed-method research. In the first, qualitative data are collected and emphasized. The second method involves the collection of quantitative data first, followed by emphasis. In the third, qualitative and quantitative data are collected at the same time and are equally weighted (Roberts, 2010).

In the nineteenth and twentieth centuries, the majority of all studies, in all academic disciplines, used the quantitative method for collecting and analyzing data. These strategies of inquiry originated in psychology (Creswell, 2014). Quantitative methods involve the study of small or large samples of the population to examine trends, attitudes, and opinions. The framework for this study on teacher attitudes and student achievement was set through a survey and analysis of the collected data using a quantitative method.

Qualitative designs can be studied through a variety of lenses. A qualitative study could be conducted through narrative research, whereby the researcher studies one or more individuals to obtain stories from their lives. Another method of undertaking a qualitative study would be phenomenology, where the researcher describes the lived experiences of individuals regarding a phenomenon as described by the participants. Grounded theory is a way to examine information concerning the interaction of multiple participants. Ethnography, which is another form of qualitative study, involves the gathering of information on a person's culture and language in the participant's natural setting. Finally, there is the case study, which can be an in-depth program with deeper analysis and a great deal of information; a case study is more time specific (Creswell, 2014). The case study was determined as the best method for the qualitative part of this study on the impact of teacher and student attitudes regarding math performance.

Methodology

To understand how to use a mixed-methods research design, one must understand the two different tools used to measure research study results: Qualitative and quantitative data. Qualitative data are when words are used to define the results of a study, and quantitative data are when numbers are used to understand a study result.

The original idea behind mixed-methods research was the combination of qualitative data and quantitative data to explain the results of a single study more completely. However, the ideology behind applying a mixed-method research model has become more of a methodology in itself rather than a combination of standalone concepts. There are core beliefs behind using a mixed-method research model that includes using both qualitative and quantitative data to answer study questions, explain study results, organize a study, and frame a study within a particular ideology (Creswell & Clark, 2018).

Part of understanding the use of the mixed method as a research model is knowing why a researcher would apply this method rather than selecting either qualitative or quantitative data study. Generally, a mixed-method study would be preferable when research cannot be clearly defined or explained using one or the other. Using a combination of both allows for a more developed form of analytical questioning and follow-through than applying only one approach (Creswell and Clark, 2018). Another complication in terms of method selection is when a researcher finds that one tool or the other does not completely explain the data results in a way that is comprehensible or relatable to the audience of the study. A mixed-methods research model combines both elements, thereby ensuring the results can be more deeply understood and applicable.

As has been previously outlined, there are numerous advantages to applying a mixed-method research model. One tool may offset the weaknesses of the other, such as understanding the participants more deeply rather than only measuring their answers. However, personal interpretations of qualitative data can alter the overall understanding of the results, whereas quantitative data are more specific, involve less interpretation, and yield more "black-and-white" answers. Both tools contribute value to a study and can enlighten research results. Finally, the freedom in a mixed-methods research design allows for complete analysis in varied directions and eye-opening experiences in understanding the data results.

Another defined purpose of the mixed methods is to "build on the synergy and strength that exist between quantitative and qualitative research methods to understand the phenomenon more fully than is possible using either quantitative or qualitative methods alone" (Gay, 2014, p. 483). This further strengthens the argument that either quantitative or qualitative alone may not provide the most accurate picture of what is happening in a study. In order to enhance the qualitative data from interviews, quantitative information was derived from students' math performance using their pretest and post-test data from the Galileo benchmark tests. These data should explain whether the attitudes of students and teachers have any impact on math performance.

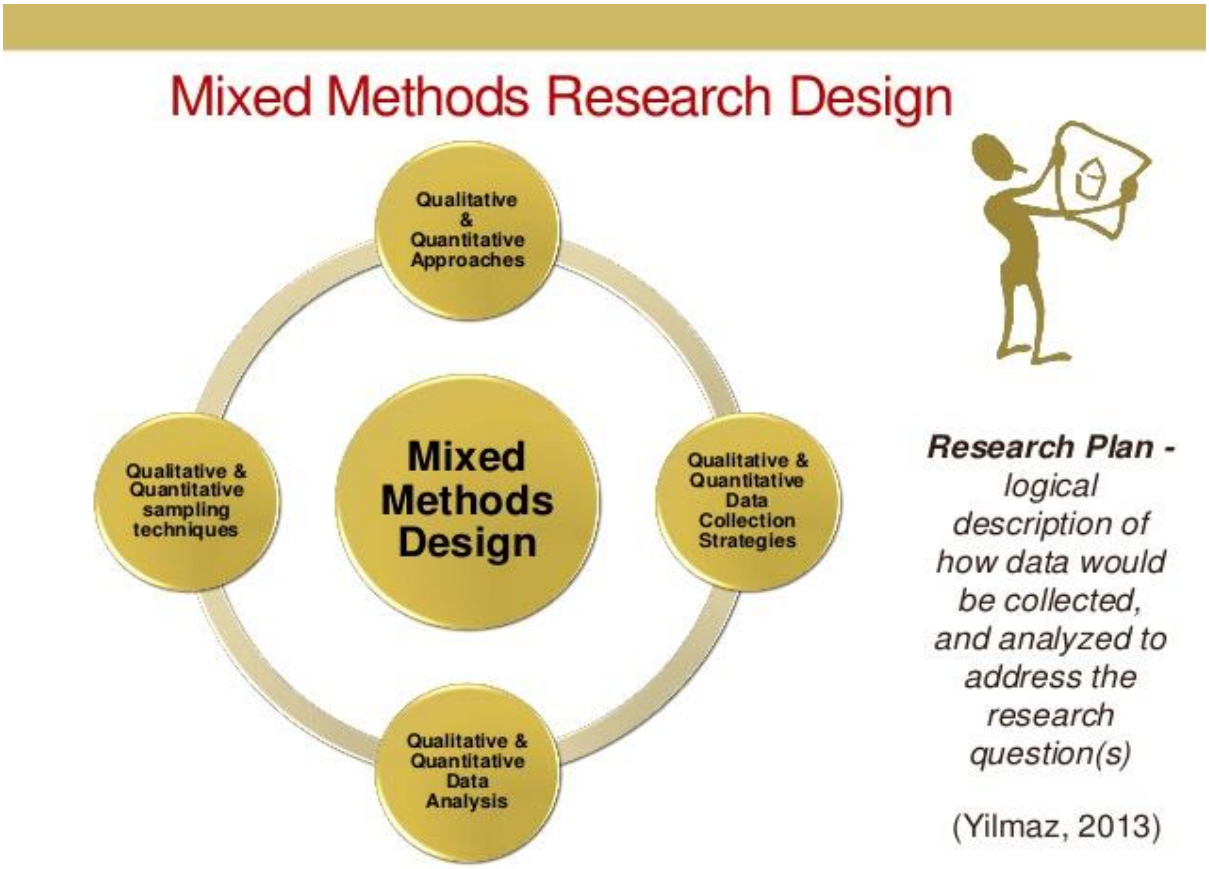
Converse to the numerous advantages of using a mixed-methods research design, one must understand there are disadvantages or challenges that face this design model. The most significant challenge a researcher may face when applying this design is the ability to combine the two tools successfully. One must understand how to use each tool separately before attempting to apply them together in one study; this depends on the skillset of the researcher (Creswell and Clark, 2018).

Another challenge that is often overlooked is the time and resources needed to complete the study. With this type of design method, considerably more work and thought must be input because of the use of two processes for collecting and analyzing data. More complex planning and preparing for the study may be necessary, and not thoroughly considering these elements could lead to disaster.

When designing a research study using the mixed-methods research approach, one must understand the theory the work is based on, such as the social science theory or the emancipation theory. In the social science theory, researchers examine their position on the purpose of the study at the beginning and throughout the study via defined questions and then through the analytical lens of the results. Some social sciences include a "leadership theory, an economic theory, a marketing theory, a theory of behavior" (Creswell and Clark, 2018, p. 44). On the other hand, with the emancipation theory, the researcher takes more of a "theoretical stance in favor of underrepresented or marginal groups such as a feminist theory, a racial theory, or ethic theory" (Creswell and Clark, 2018, p. 45).

Figure 1

Mixed Methods Research Design



This theoretical stance too would be examined at the beginning of the study and followed throughout the research; later, the same stance would be used as an analytical lens when reviewing the results of the study.

In conclusion, when researchers choose to use a mixed-methods research design for their study, they must understand their underlying theory or angle, have a strong grasp of the two processes involved and why it is beneficial to use a mixed-method research design in their particular study, and identify the time and resources required to successfully and accurately complete their study.

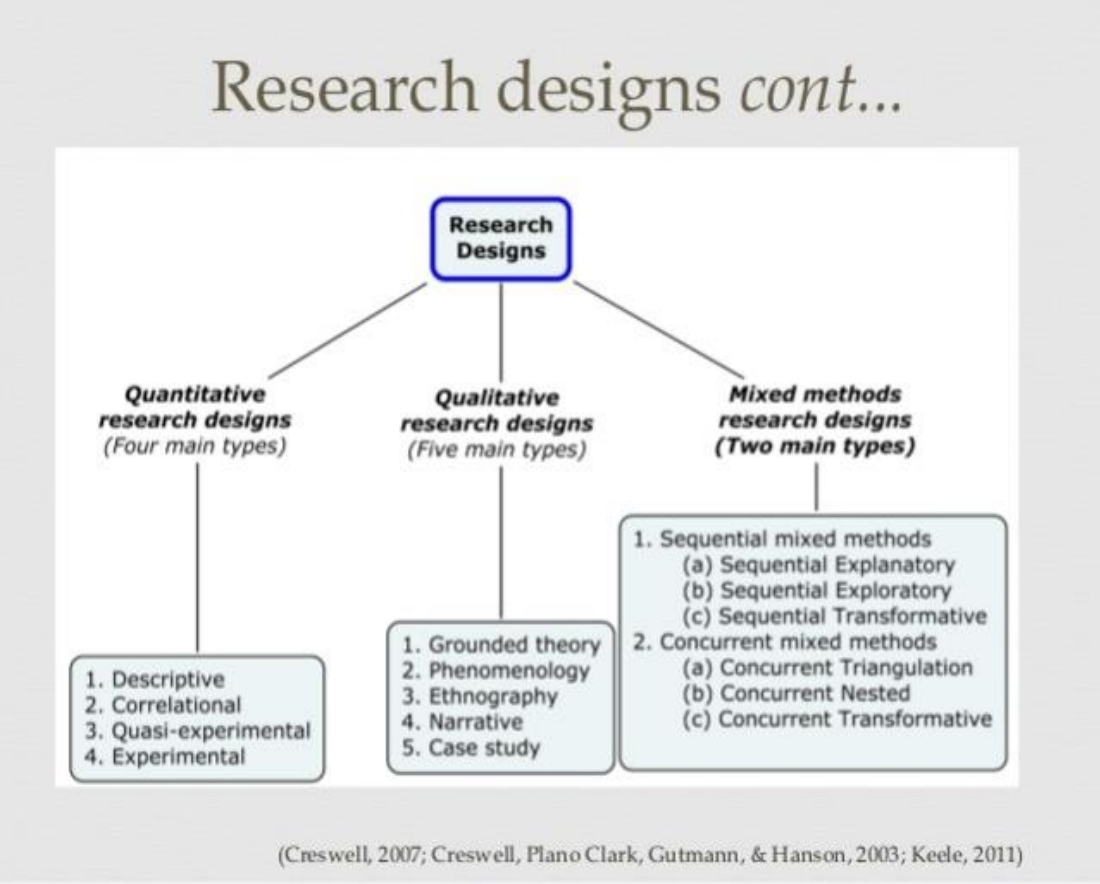
Research Design Rationale for Mixed Methods

This was a mixed-methods study that included surveys and interviews with teachers and surveys with students. A quantitative study alone was excluded due to the need to gain a deeper understanding of reasoning behind teachers' survey answers than a rating scale could provide, for example, how they feel about math. However, qualitative data alone do not allow for determining any correlations or differences in attitude as compared to math performance. The mixed methods allowed for the triangulation of data.

The quasi-experimental design does not include randomization. A cross-sectional design collects data at one point in time. The longitudinal design examines two or more points in time and should be over a long period, with the potential for the test results to change drastically over five or ten years. A fixed panel sample design would not work because it would be too expensive to keep track of every individual for years. Therefore, the research design selected was a causal comparative design. However, a deeper understanding of the quantitative results could be gained by completing a sequential explanatory mixed-method design, as this would help to triangulate the data.

Figure 2

Quantitative, Qualitative and Mixed Methods



This quantitative and qualitative research followed a causal-comparative design because the students were self-selected and not randomly assigned, and the independent variable was not continuous. Therefore, results could be somewhat generalized to other similar demographic populations in a comparable region of the United States at a similar time or season of the year.

The qualitative part of the research, in which teachers were interviewed, involved examination of broader emerging themes to provide the researcher a more in-depth picture than a survey could, in order to reach the root of the research problem.

Research Design

This mixed-methods research consisted of two steps. The first step was to determine if there is a difference between academic performance and attitudes. Additionally, the researcher collected data from three different school districts concerning student performance and impacting factors on free and reduced lunch count. Teachers and students were then asked to complete surveys and teachers were interviewed regarding their attitudes with mathematics and possible factors that impact these attitudes. Using this information gathered concerning attitudes and performance, a difference between student performance and attitudes could not be tested. The teacher interviews were analyzed to identify any trend data from the emerging themes.

The students' math performance was measured based on their Galileo data at the beginning and the end of the school year. The mean growth for the individual students was calculated from pretest to post-test (August–December). The teachers and students were categorized as students and teachers. The students were then analyzed by comparing each student's mean growth scores to the category of attitudes and beliefs obtained from the student and teachers' surveys, The categories of attitude and belief were the only categories surveyed. Next, the fourth and sixth grade males and females were compared to the category of attitudes and beliefs present in the student surveys to the fourth and six grade teachers' respectively (Frimer, 2017).

Next, 4^{th} and 6^{th} grade students were compared to the 4^{th} and 6^{th} grade teachers and to the category of attitudes and beliefs from their survey and then using their mean growth data from the Galileo tests, after being separated into the three separate school districts based on free and reduced lunch count. The tools used were from teacher surveys, student surveys, and teacher interviews.

Population and Sample

Population

The population of this study was all the students in fourth and sixth grade in three different schools representing the three free and reduced lunch categories. The total number of students was approximately N = 40 based on the known class sizes of fourth- and sixth-grade students at the three different schools. Six teachers completed the surveys, and six teachers undertook the interviews, with two from each school district participating.

Sampling Frame

The sample was obtained from all the fourth and sixth-grade students in the classes at the three schools selected. All six teachers completed the surveys, and six teachers undertook the interviews, with two from each school district participating.

Next, two teachers from each school — one from each of the grade levels — were chosen for interviews to gain a deeper understanding of the survey results. Once again, using a sequential explanatory mixed-methods design allowed for more insight into the quantitative results, further helping to triangulate the data.

Table 1

Instrumentation/Sources of Information

Research Questions	Survey/Interviews
1. What, if any difference exists between fourth-grade male students' performance	Expanded Math and Me student survey

in mathematics and the attitudes they hold toward mathematics?	
2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey
3. What, if any difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey
4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey
5. What, if any, difference exists between fourth grade and sixth grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?	Adapted MECS M-1
6. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?	Adapted MECS M-1/teacher interviews

7. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?	Adapted MECS M-1/teacher interviews
8. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?	Adapted MECS M-1/teacher interviews

The students' academic performance in math were measured based on the Galileo data at the beginning and the middle of the school year. The mean growth for the students was then calculated from pre- to post-test (August–December).

The teachers and students were grouped into fourth and sixth grade classes. The classes were then analyzed by comparing each student's mean growth scores to the 4th and 6th grade teachers' and the category of attitudes and beliefs obtained from the teacher surveys. Next, the fourth- and sixth-grade males and females were compared to the categories for attitudes and beliefs on the student surveys to their mean growth scores (Frimer, 2017). The last analysis stemmed from division of the 4th and 6th grade classes into percentage of free and reduced lunch count: 65% and less, 65–80% and 80% and above from three separate school districts meeting that criterion. Following this division into the three separate free and reduced lunch count categories, each fourth and sixth-grade student's mean growth data, based on the Galileo tests, were compared to the teacher and student categories

of attitudes and beliefs drawn from the student and teacher surveys (Frimer, 2017).

Informed Consent

This research was approved by the dissertation review board (see Appendix A). Copies of the IRB approval, Match of Research Questions, Mixed Methods and Convergence Table for Appendices A-C. Additionally, hard copies of the parent consent form, children assent form and the informed consent form are stored in my professor's locked file cabinet drawer. The information will be destroyed after seven years.

Data Collection Procedures

Qualitative and quantitative data were obtained from teacher interviews and a teacher survey. Each set of data were analyzed, and the results from the teacher interviews and surveys were compared to the math performance data from the Galileo benchmark tests, which were assessed as valid and reliable. Galileo Cronbach's alpha results are .80 to .85 for reliability. The Galileo tests were valid based on the average correlation coefficients between the Galileo benchmark test and the state exam, which was at .73 to .75 (ATI, 2019). The growth scores calculated based on the Galileo benchmark test (August–December 2020) data of each individual student were subsequently analyzed to identify any between-group differences.

Interviews

The interview questions were designed based on the research questions to ensure alignment with the purpose of the study.

Surveys

A teacher survey, called the MECS-M1 survey, was published in an article by Jong and

Hodges (2015) about teacher attitudes toward teaching mathematics (Frimer, 2017). The MECS-M1 survey stands for Mathematics Experiences and Conceptions Surveys. “When looking at validity and reliability, this survey yielded high alpha results of .852 to .896. Items were .97 and .87 for reliability” (Frimer, 2017, p.74). “The survey was modified by Dr. Frimer to add and remove test items for validity and reliability. This survey examines student attitudes and beliefs in mathematics. With minor modifications to the data the adapted Mathematics and Me survey tool in this study had high alpha results, from .781 to .972” (Frimer, 2017, p. 74).

Permission was given by Dr. Frimer to use her adapted MECS-M1 teacher survey. The items in this adapted form of the survey aligned more completely with the purpose of this study. Additionally, Dr. Frimer gave permission for the use of her Expanded Math and Me student survey and the Adapted MECS M-1 Survey, which also featured items in line with this study. When Dr. Frimer tested the new expanded survey, “the reliability did remain high; alpha levels of .845 to .922 were found in the various categories tested, indicating that the new expanded survey still maintained highly reproducible results” (Frimer, 2017, p. 75).

> Dr. Frimer feels the validity of the study is strong, given the clearly articulated definitions of student performance and the use of a thoroughly vetted survey tool to measure attitudes and beliefs. Use of survey tools whose validity has been well documented with the Mathematics Experiences and Conceptions Surveys (MECS) and the Mathematics and Me Survey helped in this process, as did the fact that the interview or essay questions were vetted with the district administrators before being used in the study. Initial tests for reliability were conducted on the collected

> survey data, which resulted in some items being adjusted or omitted prior to the full analysis to ensure reliability. The validity of this study was also strengthened by the careful design of the study conditions and analysis process, the use of well-documented methods of analysis for the qualitative data, and the selection of a district to study in which the impact of extraneous factors that may contribute to performance, such as the curriculum used and participant demographics, was minimized. The reliability of this study was also strengthened using clearly defined criteria in selecting a district to be studied and in using multiple clear definitions of student performance in mathematics. The reliability of the study was also strengthened using a district large enough to provide a broad sampling of each group surveyed, and by the selection and design of the well-vetted survey tools used to gather survey data. (Frimer, 2017, p. 78–79).

Some questions from beliefs for this research were removed from the expanded teacher survey. The categories of confidence, disposition and experiences were also removed from the teacher survey, but reliability and validity should not be affected.

Data Analysis Procedures

Quantitative Analysis

The survey results were examined through quantitative analysis. The teachers answered specific items related to how they feel about math and teaching math. All the data from the survey items were manually entered into an Excel spreadsheet (Check & Schutt, 2012). The information collected from the surveys and from the Galileo pre- and post-tests were displayed in tables.

The data were checked for type I errors due to the large sample from the different small schools.

Table 2

Variables, Conceptual Definition, and Questions for Measurement

Variable	Conceptual Definition	Question for Measurement	Level of Measurement	Stat Tool
(IV) Teachers	Attitudes regarding math as measured by survey	How do attitudes affect academic scores in math?	Continuous	SAS
(IV) Students	Attitudes regarding math as measured by a survey	How do attitudes affect academic scores in math?	Continuous	SAS
(IV) School I	65% or less free and reduced lunch counts	How does attendance at a 65% or less free and reduced lunch school affect academic scores in	Continuous	SAS

		math?		
(IV) School II	65% to 80% free and reduced lunch count	How does attendance at a 65% to 80% free and reduced lunch school affect academic scores in math?	Continuous	SAS
(IV) School III	80% or more free and reduced lunch count	How does attendance at a free and reduced lunch school affect academic scores in math?	Continuous	SAS
(1 DV) Academic performance	Having students take a pre- and post-test. All students who participate	Measured with a Galileo math test	Continuous	SAS

Math Test Performance Data

Performance data were analyzed by examining the 4th and 6th grade students to determine the growth or mean scores that each classroom obtained from their pre- and post-Galileo benchmark

tests (August–December). The student data were derived from the fourth- and sixth-grade classrooms at the three participating schools.

Analysis of Surveys

The survey analysis was completed through setup coding by using a simple alphabet code and then setup numbers for teachers and classrooms. The data were coded by the alphabet for the teacher (A1 for fourth grade and A2 for sixth grade, B1 for fourth grade and B2 for sixth grade, and finally C1 for fourth grade and C2 for sixth grade,) and a numeric code for the classroom (1 for fourth grade and 2 for sixth). The school code derived from the three schools was an alphabetic code of A, B or C. "This type of coding helped to secure the anonymity of the data and supported the decision to analyze the data only at the classroom level" (Frimer, 2017, p. 69). A Likert scale was applied in the surveys in order to measure student and teacher attitudes.

Analysis of Interviews

The six teacher interviews were analyzed by placing codes in the answers to help measure the data and identify trends that emerged to determine any similarities.

Performance Differences

Performance differences were undertaken to determine any difference between the teacher and student attitudes. The mean scores from the pre- and post-Galileo benchmark tests were compared the Likert scale scores from the surveys. The survey data had items in the categories of attitudes and beliefs; these answers were compared to both academic math performance of each student's grade level to the fourth- and sixth-grade teacher and attitudes measured by the Likert scale. The results were compared to identify any difference between the mean growth of the Galileo

benchmark test results and the categories of attitudes on the student and teacher surveys. Next, the mean growth of the Galileo benchmark tests of each of the fourth- and sixth-grade teachers was compared to the teacher survey data (Frimer, 2017).

The teachers and students were grouped into fourth- and sixth-grade classes. The individual scores were subsequently analyzed by comparing each of the fourth- and sixth-grade students with their mean growth scores to the teachers of the fourth and sixth grade classrooms and the categories of attitudes from the teacher surveys. Subsequently, the fourth- and sixth-grade classes were compared to the category of attitudes on the student surveys (Frimer, 2017). The final analysis was based on the fourth- and sixth-grade classes being divided into percentage of free and reduced lunch count: 65% and less, 65–80%, and 80% and above from the three separate school districts meeting that criterion. Then, each of the fourth- and sixth-grade students were compared with their mean growth data based on the Galileo benchmark, after being separated into the three separate free and reduced lunch count groups.

Qualitative Analysis

The qualitative analysis was based on the teacher interviews. The teacher interviews consisted of prescribed questions designed to ascertain emerging themes in the areas of teacher attitudes and teacher beliefs.

Codes to Help Interpret the Interviews:

Teacher Attitudes (TA)

Teacher Beliefs (TB)

Table 3

Interview Questions

Teacher Interview Questions	Category
Do you believe that all students can be equally successful in math if the teacher has an up-to-date curriculum and uses best practices in the classroom?	(TB)
Do you believe or have the attitude that a student from a low socioeconomic status school can be just as successful in math as someone from a high socioeconomic status school?	(TA)
Does a teacher need to be naturally good at math to teach math successfully?	(TB)

(Frimer, 2017).

Significance of the Study

Will teachers' and students' attitudes, whether negative or positive, determine academic performance? This topic was chosen due to the potential impact on teachers' data concerning their evaluations and students' data on high-stakes tests. Students feeling more confident and having a positive attitude combined with teachers who possess a positive attitude and confidence may together have a positive impact on academic performance. Is there a relationship between teachers' attitudes and students' attitudes and academic performance? Further, is there a difference in teacher and student attitudes between school districts with varying free and reduced lunch counts?

Answering this question may give insight into the importance of a positive attitude from both the teacher and student, with special consideration for socioeconomic status.

Limitations of the Study

This mixed-methods study gathered data on students' performance in mathematics. Both quantitative (surveys) and qualitative data (interviews) were collected, with a focus on student and teacher attitudes and beliefs that could have affected whether a teacher or a student had a negative or positive experience relating to mathematics. The researcher had limitations that included outside influences where teachers may not have felt supported by their administrator. Also, the researcher was an employee and educator in one of the districts.

Further, the researcher had the limitation of performing the study in the researcher's own school district. Additionally, there may not have been a math curriculum or pacing guide available for teachers to better prepare their students. Finally, a lack of parental support or increased parental support could have influenced the outcome of this study. Any of these limitations could have helped or hindered a student's academic performance in mathematics or affected the teacher's ability to do their best.

Another limitation of this research was the size of the schools. Each school was exceedingly small and there were not many teachers per grade level or a high number of students in the specific grade levels analyzed. Further insights could be gained from an increase in the number of grade levels examined and working with larger school districts that more closely represent all three free and reduced lunch count populations. Another limitation was due to COVID-19. The researcher was not able to interview and survey the teachers and students until the beginning of the following

school year due to a statewide school closure. Additionally, there were several families that moved from the school due to job loss in the community. Results may be generalized due to a small sample size. The last limitation would be teacher experience. A beginning teacher would also be a limitation.

Delimitations

The researcher conducted surveys and interviews from August 2020 to December 2020 in three rural districts in Arizona. The school districts were chosen based on their particular free and reduced lunch count. All students in the fourth and sixth grades in each school district were invited to participate in the survey. The teachers were chosen from those teaching fourth or sixth grade in the three school districts.

Definitions and Terms

Math pretest to post-test: When students are tested for knowledge at the start of the year (pretest) as compared to how well they do at the end of the year (post-test) after they have been taught.

Galileo benchmark: Each quarter, students are tested to see if they have mastered skills that have been taught in that quarter. Schools can opt to give students a quarterly benchmark only on the standards taught or a comprehensive quarterly benchmark that exposes the students to all the standards to be taught each quarter throughout the year.

Confidence/Self-efficacy: The ability of a teacher to reflect on their own teaching practices, which is driven by how they feel about their own ability to teach math.

Impacting factors on teacher attitudes and confidence about mathematics: How a teacher's

attitude can affect student academic achievement. Additionally, how the teacher's confidence may affect their ability to teach math effectively.

Free and reduced lunch count: Based on determining the free and reduced lunch count by multiplying the 2018 Federal Poverty Guidelines by 1.30 and 1.85, respectively, and by rounding the result upward to the next whole dollar amount (Lipps, 2018). Schools were taken from cms.azed.gov 2018 report (ADE, 2019).

AzMerit: Arizona Measurement of Educational Readiness which is statewide achievement test for students in grades three–eight and 10 in Arizona public schools (Arizona Department of Education, 2017).

Summary

The methodology for this research was a mixed-methods causal-comparative study. The next chapter reviews the findings of the study and tests them against the hypotheses and research questions.

CHAPTER 4: FINDINGS

Introduction

The researcher examined the impact of teacher and student attitudes on student math performance to determine if there is any correlation between attitudes and performance. This research was implemented by involving three different school districts in rural Arizona measured by students on the free and reduced lunch count, with one school each from the categories of 65% or less, 65–80%, and 80% and above. The next sections outline the background, statement of the problem, purpose of the study, research questions, significance, limitations, and delimitations of the study.

This research had limitations due to the smaller sample size resulting from being asked in the Prospectus hearing to only research K–8 schools. This was a condition after my prospectus that limited the sample size dramatically. Additionally, the sample size was impacted by COVID-19, as students left the schools due to job loss in the family the following year. Nevertheless, the surveys were distributed to all three K–8 schools with small class sizes. The surveys were returned by 21 out of 40 students that attended the schools in the 2019–2020 school year. All six teachers who had taught at the schools during 2019–2020 participated. The Galileo math data were taken from the August–December benchmark tests conducted in the 2019–2020 school year.

Background

There have been numerous and varied efforts to analyze and transform K–12 education, especially related to math performance. Considerable research and intervention have aimed at helping improve instruction and determining where students continually struggle. In the state of

Arizona, federal mandates force school districts to improve in academic proficiency, including math, through an annual high-stakes assessment. AzMerit is the statewide achievement test for Arizona public school students in grades three–eight and 10 (Arizona Department of Education, 2017), which also determines the letter grade for school districts in Arizona. Additionally, the federal and state governments constantly aim to assess how to increase expectations so that there is improved rigor and state standards are more closely aligned to a common core concept.

The notion behind this concept of a common core is that all states should teach the same standards and provide the same rigor, thereby ensuring that students will not miss a step in the mastery of the standards when they move between states. Regarding math, it is essential that students master math concepts by building one skill upon another.

It is reasonable to conclude that teacher and student attitudes have as much or more to do with the students' math performance as the students' natural ability or aptitude for mathematics. This research specifically focuses on four main concepts: The measurement of math performance, the effect of up-to-date curriculum and best practices on teacher and student attitudes concerning how math needs to be taught, the negative outcomes standardized tests can have on a school, and the pressure on teachers to improve data at all costs.

This chapter presents the findings and results of this study and attempts to answer the following research questions:

1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
2. What, if any, difference exists between fourth-grade female students'

performance in mathematics and the attitudes they hold toward mathematics?

3. What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?
4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?
5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?
6. What, if any, difference exists between the teacher and fourth- and sixth-grade students' performance and attitudes at a school with a 65% or less free and reduced lunch count?
7. What, if any, difference exists between the teacher and fourth- and sixth-grade students' performance and attitudes at a school with a 65–80% free and reduced lunch count?
8. What, if any, difference exists between the teacher and fourth- and sixth-grade students' performance and attitudes at a school with an 80% or more free and reduced lunch count?

To answer these questions related to student performance, the following data were collected from quantitative and qualitative information related to student and teacher attitudes, experiences, and beliefs surrounding mathematics. After the data were collected, any correlation that may have occurred was noted. In the following section, student and teacher information are presented to

address the research questions.

Analysis of Student Data and Surveys

The level of student performance in mathematics was based on the Galileo benchmark assessment between the first quarter and second quarter (August to December 2020). The benchmark data were collected in six classrooms from three schools of different socioeconomic backgrounds, the latter of which was measured based on free and reduced lunch count. The students' benchmark data was compared to their completed surveys to examine whether their attitudes and beliefs regarding mathematics showed any correlation to their benchmark data. The participation rate across all the classes at the three schools was around 53%.

Analysis of Teacher Surveys and Interviews

The teacher surveys were analyzed to determine if the classrooms where the teacher's taught math showed any correlation to their attitudes, experiences, and beliefs compared to their student math performance on the benchmark data between the first and second quarter (August to December). The teachers had a 100% participation rate. Later, interview questions were developed from the survey items answered by the teachers to gain deeper understanding from the surveys. The next section addresses the findings and results of each research question.

Findings and Results

1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?

H0 Male fourth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Male fourth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

Table 4

Fourth Grade Male Students

Fourth-Grade Male Students	All Schools
School Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all fourth-grade male students recorded an 8.24% improvement
Fourth-Grade Male Students Math and Me Responses	All schools
Responses Measured on a Likert Scale: 1 — Strongly Disagree to 5 — Strongly Agree	Mean Likert scale response for attitudes towards math: 3.06

The fourth-grade male students showed growth of 8.24% from the first benchmark to the second. The fourth-grade male students' attitude average Likert scale score was 3.06, where some specific items proved the most enlightening. The item *My family talks a lot about math* had one of the lower scores related to attitude, with a Likert score of 1.4. Although this average response does not necessarily affect the student's attitude or confidence towards math, the item *I understand math* had an average answer of 4.0 on the Likert scale. Another item on which fourth-grade male students had a low Likert scale score was *I can tell if my answers in math make sense*, which had an average answer of 2.8. This seems low compared to the 4.0 on the item *I understand math.*

The fourth-grade male students recorded an overall growth of 8.24% on the Galileo benchmark

tests. However, their scores on the benchmark exams were lower to in the first quarter, which should be taken into consideration because it is usually easier to improve from a lower score than when the student starts with a high score. Overall, these Likert scores were in the high 2s or low 3s.

H0 Male fourth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Male fourth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding between-group differences in fourth-grade male and female students.

2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?

HO Female fourth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Female fourth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

Table 5

Fourth Grade Female Students

Fourth-Grade Female Students	All Schools
School Mean Growth from Benchmark One to Benchmark One (Aug–Dec)	Mean growth for all fourth-grade female students had a 6.89% improvement rate

Fourth-Grade Female Students Adapted Math and Me Responses	All schools
Responses Measured on a Likert Scale: 1 — Strongly Disagree to 5 — Strongly Agree	Mean Likert scale response for attitudes towards math: 3.17

The fourth-grade females had a 6.89% improvement from benchmark one to benchmark two and an average Likert scale response of 3.17. The fourth-grade females generally had a positive attitude towards mathematics. There were certain items that ranked lower than others, for instance, the item *My family talks about math* was scored at an average of 1.4, but that did not seem to affect the students' overall attitude towards mathematics. Another item that scored low was *I enjoy studying math*, which was scored at a 2.5. This item had a low score in fourth-grade males as well as females. Some of the high-score items worth noting include *my math teachers have always been nice.* This score was a 4.5, which shows a positive attitude on the part of these students towards their teacher. Overall, the scores for this group were in the 3s and above.

HO Female fourth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Female fourth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding between-group differences for fourth-grade male and female students.

3. What, if any, difference exists between sixth-grade male students'

performance in mathematics and the attitudes they hold toward mathematics?

Table 6

Sixth Grade Male Students

Sixth-Grade Male Students	All Schools
School Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all sixth-grade male students had an 8.63% improvement
Sixth-Grade Male Students Math and Me Responses Measured on a Likert Scale: 1 — Strongly Disagree to 5 — Strongly Agree	All schools Mean Likert scale response for attitudes towards math: 3.10

The sixth-grade males had a mean growth of 8.63%, while the mean score for the sixth-grade males' Likert scale response was 3.10. The Likert scale response was a little higher than the females of the same grade, even though their mean growth performance for their benchmark exam was lower than the females. One of the items that recorded a higher Likert score was *My math teachers have always said that there can be more than one way to solve a problem correctly.* This item stood out as one of the higher mean averages in the sixth-grade male survey. Another item that was telling was *I understand math*. This item showed that this group of students have a confident attitude towards mathematics. The lower Likert scores in the sixth-grade male survey were on the items *I do math problems on my own "just for fun"* and *My family talks a lot about math*. However, the low Likert mean average for these two items did not seem to have a negative impact on the group's overall attitude toward math.

H0 Male sixth-grade students will not show statistically significant between-group

differences regarding their individual growth in mathematics.

H1 Male sixth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding between-group differences for sixth-grade male and female students.

4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?

HO Female sixth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

HO Female sixth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

Table 7

Sixth Grade Female Students

Sixth-Grade Female Students	All Schools
School Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all sixth-grade females was 11.13% improvement
Sixth-grade Females Students Adapted Math and Me responses	All schools

Responses Measured on a Likert Scale:	Mean Likert scale response for attitudes
1 — Strongly Disagree to 5 — Strongly Agree	toward math: 3.02

The sixth-grade females had a mean growth score of 11.13% on their math assessment. The sixth-grade females had a Likert average of 3.02 and their attitude toward math was found to be less positive than the sixth-grade males, although the females had greater benchmark improvement. One of the items on the sixth-grade females' attitude survey worthy of note was the item *My family talks a lot about math*, which had an average item score of 1.8, but did not affect their overall attitude about mathematics. Another item that scored low on the Likert average was *I enjoy studying math*. This item also did not seem to discourage the sixth-grade females regarding their overall attitude toward math or their improvement in their benchmark scores. An item that rated high on the Likert score, at 4.4, was *My math teachers have always been nice*. This concept, specifically as related to the students' improved benchmark scores, may be something to consider and observe, as the students' connection to their teacher may affect their attitude toward and success in math. Another item that scored high for this group, at 3.7, was *My math teachers have always said that there can be more than one way to solve a problem correctly*. This item may provide insight into how sixth-grade females continue to work hard to solve the problem despite possible struggles.

HO Female sixth-grade students will not show statistically significant between-group differences regarding their individual growth in mathematics.

H1 Female sixth-grade students will show statistically significant between-group differences regarding their individual growth in mathematics.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding between-group differences for sixth-grade male and female students.

5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?

Table 8

Fourth and Sixth Grade Teachers

Fourth-Grade Teachers	All Schools
Schools' Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all fourth-grade students had a 7.52% improvement
Fourth-Grade Teachers Adapted MECS-M1 Mean Likert Score (1–6)	All schools Mean Likert score for all fourth-grade teachers: 4.28
Sixth-Grade Teachers	**All Schools**
Schools' Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all sixth-grade students had a 9.79% improvement
Sixth-Grade Teachers Adapted MECS-M1 Mean Likert Score (1–6)	All schools Mean Likert scores for sixth-grade teachers: 4.57

The fourth-grade teachers had an average Likert score of 4.28, which was the lowest between the fourth- and sixth-grade teachers. The students' improvement from benchmark one to

benchmark two was 7.52%. Further, the fourth-grade students had the lowest growth in their student performance data. Some of the items that were especially enlightening regarding fourth-grade teachers were *I like mathematics*, which had an average Likert score of 4.70. That is an extremely high Likert score, and it is a simple but informative item regarding a teacher's attitude toward mathematics. Another item that scored high for fourth-grade teachers were *I enjoy solving mathematics problems*. This item was also simple but can accurately reflect a teacher's attitude towards mathematics. For the fourth-grade teachers, the highest Likert averages were on simple yet informative items. The lower Likert score averages on particularly informative items concerning fourth-grade math teachers were *whether students succeed in mathematics depends primarily on how hard they work* — an item essentially stating that hard work equals success in math. This item had a lower score compared to others, at 5.15. Therefore, some of the teachers working with fourth grade did not necessarily show a positive attitude or belief toward this statement.

The sixth-grade teachers had the highest Likert average, at 4.57, between the two teacher groups. The sixth-grade students recorded a mean growth of 9.79% on their benchmark tests, which was the greatest improvement between the two grades examined. One of the items that determined a positive attitude on the part of the sixth-grade teachers was *I like mathematics*, which had a mean Likert score of 5.0. Therefore, the sixth-grade teachers all had a positive attitude toward math. Another item that had a high Likert average across the sixth-grade teachers was *Math is one of my favorite subjects*; all teachers gave this a 5 out of 5. There was not a low score related to a more negative attitude from all teachers.

Although there were only two teachers from each school for fourth and sixth grade, all

participated in this research. Keeping the design focused on only K–8 schools that were small and rural affected the sample size and there was an insufficient sample size to test the related hypothesis statistically for significance regarding the correlations between students' performance and teacher attitudes. A larger sample size in K–8 rural schools may warrant further exploration on this subject.

6. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?

H0 Attitudes of teachers and students in a 65% or less free and reduced lunch count school district will show no between-group differences in math performance.

H1 Attitudes of teachers and students in a 65% or less free and reduced lunch count school district will show between-group differences in math performance.

Table 9

65% or Less Free and Reduced Lunch Count

Fourth- and Sixth-Grade Teachers and Students	65% or Less Free and Reduced Lunch Count School
Schools Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all fourth- and sixth-grade had a 9.7% improvement
Fourth- and Sixth-Grade Teachers' Adapted MECS-M1	65% or less free and reduced lunch count school:
Mean Likert Score (1–6)	Average teacher Likert score: 4.39

Math and Me (1–5)	Average student Likert score: 3.08

As indicated in Table 9, the teachers at a 65% or less free and reduced lunch count school had a mean Likert score of 4.39 and their students recorded a 9.7% growth from the benchmark one to benchmark two test. The item about *I like mathematics* recorded a score of 6.0 and *I enjoy solving math problems* was also a 6.0. There were no low mean Likert scores for any item. The average student Likert score was 3.08.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding the differences between students' performance and teacher attitudes. Achieving a larger sample size in K–8 rural schools may warrant further exploration.

7. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?

H0 Attitudes of teachers and students in a 65–80% free and reduced lunch count school district will show no between-group differences in classroom math performance.

H1 Attitudes of teachers and students in a 65–80% free and reduced lunch count school district will show between-group differences in classroom math performance.

Table 10

65% - 80% Free and Reduced Lunch Count

Fourth- and Sixth-Grade Students	Teachers and 65-80% Free and Reduced Lunch Count School

Schools Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all fourth- and sixth-grade had a 1.4% improvement
Fourth- and Sixth-Grade Teachers Adapted MECS-M1 Mean Likert Score (1–6) Math and Me (1–5)	65-80% free and reduced lunch count school: Average teacher Likert score: 4.57 Average student Likert score: 3.10

The teachers in the 65-80% free and reduced lunch category had two items that were extremely high on the mean Likert score. These items were *I like mathematics* and *Math is one of my favorite subjects*, which both had a 6.0 mean Likert score. Similar to the 65% or less group, there was no low score recorded. This 65-80% group of teachers had an overall average Likert score of 4.57, but rated exceptionally low on the benchmark improvement, at just 1.4%. The average student Likert score was 3.10.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding the correlations between students' performance and teacher attitudes. Achieving a larger sample size in K–8 rural schools may warrant further exploration.

8. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?

H0 Attitudes of teachers and students at an 80% or more free and reduced lunch count school district will show no between-group differences in classroom math performance.

H1 Attitudes of teachers and students at an 80% or more free and reduced lunch count

school district will show between-group differences in classroom math performance.

Table 11

80% or More Free and Reduced Lunch Count

Fourth- and Sixth-Grade Teachers and Students	80% or More Free and Reduced Lunch Count School
Schools Mean Growth from Benchmark One to Benchmark Two (Aug–Dec)	Mean growth for all fourth- and sixth-grade had a 11.76% improvement
Fourth- and Sixth-Grade Teachers Adapted MECS-M1	80% or more free and reduced lunch count school:
Mean Likert Score (1–6)	Average teacher Likert score: 4.32
Math and Me (1–5)	Average student Likert score: 3.11

The teachers at schools in the 80% or more free and reduced lunch count category had a 5.0 mean Likert score for the item *I look forward to teaching mathematics*. Another item that scored high in this free and reduced lunch category was *It is important to use student cultural knowledge when teaching mathematics*, which is an interesting item to record a mean Likert score as high as 5.3. This group of teachers had an overall average teacher Likert score of 4.32 and recorded the highest improvement of all three schools from benchmark one to benchmark two, at 11.76%. The average student Likert Score was 3.11.

There was an insufficient sample size to test the related hypothesis statistically for significance regarding the correlations between students' performance and teacher attitudes. Achieving a larger sample size in K–8 rural schools may warrant further exploration.

Table 12

Teacher Responses to Survey Items

Teacher Statement	A1	A2	B1	B2	C1	C2
I like mathematics.	6	6	5	6	6	6
Mathematics is one of my favorite subjects.	6	6	3	6	6	6
I think mathematics is boring.	1	1	3	1	1	1
I enjoy solving mathematics problems.	6	6	5	5	6	6
I am anxious about teaching mathematics.	2	2	4	1	2	1
I look forward to teaching mathematics.	6	5	4	6	5	6
Every student can be successful at learning mathematics.	6	6	5	5	5	6
Mathematics can help students critically analyze the world.	5	6	4	6	5	6
All students should be held to high expectations in mathematics.	6	6	5	5	5	6
Mathematics is a culturally neutral subject.	6	6	5	6	4	3
It is reasonable to have lower expectations in mathematics for students with special needs.	1	1	2	5	1	4
It is important to use student cultural knowledge when teaching mathematics.	6	6	5	5	6	4

Whether students succeed in mathematics depends primarily on how hard they work.	6	6	5	4	4	5
Mathematics instruction does not need to be differentiated for ELL students because mathematics is a universal language.	1	1	2	3	3	4

In Table 12, the teachers' Likert scale was 1 — Strongly Disagree, 2 — Disagree, 3 — Somewhat Disagree, 4 — Somewhat Agree, 5 — Agree, 6 — Strongly Agree. (Frimer, 2017).

Table 13

Student Survey Questions

Math and Me Student Survey Items

- I have always done well in math.
- My math classes have always used a lot of worksheets.
- My math classes have always had a lot of homework.
- My math classes have used calculators and computers a lot.
- My math classes have always had a lot of projects.
- My math classes have always had a lot of group work.
- My math teachers have always talked a lot at the board.
- My math teachers have always been nice.
- My math teachers have always been helpful.
- My math teachers have always made me feel like I can succeed in math.

- My math teachers have always said that there can be more than one way to solve a problem correctly.
- My parents use a lot of math.
- My family talks a lot about math.
- My parents like math.
- My friends like math.
- My teachers like math.
- I know a lot of people that use math in their jobs.
- I am really good at math.
- I love math.
- I understand math.
- Math is boring.
- I can solve difficult math problems.
- I enjoy doing math puzzles.
- Math is very hard for me.
- I do math problems on my own “just for fun.”
- Math is confusing to me.
- I look forward to learning new math.
- Math comes easily to me.
- I hate math.

- I enjoy playing math games.
- I can tell if my answers in math make sense.
- I enjoy studying math.
- Doing math is easy for me.
- Solving math problems is fun.

Table 13 shows the items on the survey that the students answered (Frimer, 2017).

Table 14

Student Response to Survey and Growth Score

Likert Score	Score-Pre	Score-Post	Growth
3.41	23.3%	36.6%	+13.3%
2.88	53.3%	46.3%	-7%
3.02	82.9%	73.3%	-9.6%
3.45	35.3%	51%	+15.7%
3.47	47.1%	52.9	+5.8%
2.75	12.8%	31.9%	+19.1
2.53	10.1%	28.5%	+18.4%

3.14	36.2%	51.1%	+14.9%
2.55	36.2	48.8%	+10.6%
3.30	19.1%	34.0%	+14.9%
3.27	17.0%	27.5%	+10.5
2.63	32.1%	27.5	-4.6%
3.02	17.0%	33.3%	+16.3%
3.26	30.2%	35.3%	+5.1%
3.45	26.4%	31.4%	+5%
2.81	34.0%	54.9%	+20.9%
2.73	26.4%	45.1%	+18.7%
3.12	34.0%	41.2%	+7.2%
3.26	32.1%	43.1%	+11%
2.79	30%	46.8%	+16.8%
2.97	28%	36.2%	+8.2%

In Table 14, the students' Likert scale was from 1 — Strongly Disagree to 5 — Strongly

Agree. The Pre and Post scores are from benchmark one to benchmark two. The Growth is the difference between their two scores.

Teacher Interview Summary Data

To triangulate the results of this research, teacher interviews were added to obtain more in-depth information concerning how teachers feel about mathematics and students learning mathematics. The qualitative analysis was based on the teacher interviews. The teacher interviews consisted of prescribed questions designed to identify emerging themes in the areas of teacher attitudes and teacher beliefs.

Codes to Help Interpret the Interviews:

Teacher Attitudes (TA)

Teacher Beliefs (TB)

Table 15

Interview Questions

Teacher Interview Questions	Category
Do you believe that all students can be equally successful in math if the teacher has an up-to-date curriculum and uses best practices in the classroom?	(TB)
Do you believe or have the attitude that a student from a low socioeconomic status school can be just as successful in math as someone from a high	(TA)

socioeconomic status school?

Does a teacher need to be naturally good at math to teach math successfully (Frimer, 2017)? (TB)

The researcher personally conducted each interview with every teacher to guarantee that the interview protocols were followed. The teachers participated in their interviews at times of the day that were convenient, and appointment based in order to ensure all questions were addressed; time was allotted between each question. The interviews were conducted for approximately 5 to 10 minutes. The interviews were recorded and then transcribed. The next step was the analysis to determine any emerging trends. The teachers were coded (A1, A2, B1, B2, C1, and C2) to represent the two teachers from each of the three schools.

Teacher A1. Teacher A1 described her beliefs related to question one: They were *thankful for having an updated curriculum and having something to follow. I am having some students that can be equally successful. I'm not sure there because I do think some children are stronger and richer and have a different way of thinking while others are very analytical, and they just seem to grasp the rules of math.* This answer seemed a little incoherent. Teacher A1 said that all students can be successful in math — they simply have a different way of grasping the information from the teacher. Another question teacher A1 answered that provided more in-depth information pertaining to her attitude was whether a student from a low socioeconomic status school can be just as successful in math as someone from a high socioeconomic status school. Teacher A1 explained that *I am sorry, but I've seen a number of teachers that have the attitude that students that come from a low socioeconomic status cannot be successful. I did not agree that they thought that as well.* Some

of the teachers interviewed may have thought about this concept but none felt this way overall or wanted to be recorded saying they did. For the last question — does a teacher need to be naturally good at math to teach math successfully? —teacher A1 explained that *even though the student was strong in math, teachers that are not good at math can be successful in math.*

Overall, Teacher A1 focused on discussing how she felt students from lower socioeconomic backgrounds can be successful in math and what best practices the teacher could have in the classroom to be successful with the students. For example, she was a big believer in hands on manipulatives and that the more a teacher uses this approach in the classroom, the more success the teacher will have engaging the students and improving their scores. Teacher A1 seemed to feel that other teachers not having a positive attitude and failing to make their classroom engaging would lead to less than positive effects on the students.

Teacher A2. Teacher A2 discussed how, with the curriculum being updated, she will now be able to ensure all students succeed in math. Her statement about the curriculum places excessive emphasis on curriculum and not enough on teacher best practices, although feeling that all students can be successful shows a positive attitude. The following question concerning if students can be just as successful whether from a low socioeconomic background or a high socioeconomic background resulted in an insightful answer: She felt that it is not as much about socioeconomic circumstance, but that students need a natural talent and passion for math in order for a teacher to be able to guide them to success in math. In the last question concerning teachers needing to be naturally good at math in order to teach math, Teacher A2 expressed that teachers *did not have to be good and that sometimes the struggle in math can make a teacher better at teaching math.*

Statement along these lines were a recurring theme among the teachers, who seemed to generally feel they do not necessarily have to be good at math to instruct the subject well.

Overall, teacher A2 felt an updated curriculum was especially important to help students succeed in math. Further, she felt that there are teachers who do not have a positive attitude about students of a low socioeconomic status but still being able to have success in math. She felt that students needed to have a natural passion and talent and if they did, they could be successful in math no matter what their socioeconomic status might be.

Teacher B1. Teacher B1 described her attitude related to question one by succinctly explaining that *Yes, I believe all students can be successful with an up-to date curriculum and best practices are happening in the classroom.* This response was not very in-depth but to the point. The second question — whether students can be just as successful if from a low socioeconomic background as a high socioeconomic background — had an insightful answer from teacher B1. She outlined how *a student from a low socioeconomic background can be just as successful in a high socioeconomic background. If the teacher is using best practices and as we mentioned the curriculum is updated, I really think any student can be successful no matter what the socioeconomic background.*

The last question, regarding teachers needing to be naturally good at math in order to teach math successfully had the answer: *I kind of take this to heart personally because I feel like I don't excel in math naturally on my own. I feel like I must work hard to be a good teacher in math.* Teacher B1's position was that if she practices teaching math and has the up-to-date resources, she does not have to be naturally good at math to teach math successfully.

Overall, teacher B1 was more definitive with her answers, more personal than general about all students being successful with best practices and combined her responses to question one and two somewhat. Teacher B1 answered the last question, concerning teachers needing to be naturally good at math in order to teach math successfully, with a more personal response, outlining that she struggles with math but through teaching practice and experience she has become more successful teaching math.

Teacher B2. Teacher B2 answered the first question about whether an updated curriculum and best practices are what is needed for students to be successful in math with a response of *Yes well equally as the key word probably there for me. I think students can all be successful. I think some kids working in math have a natural talent to retain information more quickly*. This response seemed to be a recurring theme — that student with ability and talent can have success in math.

The question regarding whether a student from a low socioeconomic background can achieve the same success as one from a high socioeconomic background had a positive response. Teacher B2 said that she has worked in numerous schools with students of low socioeconomic backgrounds, and many of her students have gone on to excellent colleges and have been remarkably successful in math and in their careers. The last question, about teachers needing to be naturally good at math in order to teach math successfully, fit the recurring theme of teachers needing to have a passion for math and dedication in order to be successful at teaching math. She felt that she is naturally good at math but did not think that all teachers need to be good at teaching math to be successful.

Overall, teacher B2 thought students need natural talent and ability that will help drive their

success in math. She felt that all students, regardless of socioeconomic background, can be successful in math and that definitely applies to students from low socioeconomic backgrounds, as she has witnessed some of her students' acceptance into excellent colleges. This was a recurring theme among different teachers. Teacher B2's answer to the last question was a little off track but ultimately came back to teachers needing to have a passion for math, but not necessarily natural ability, to teach math successfully.

Teacher C1. In her answer to the first question, Teacher C1 discussed that students can all be equally successful in math, but their level of math success could be dependent on their ability. This is the first answer that was different from that of the first two teachers that were A1 and B1. Students can find success in math but may be limited in exactly how much, depending on their ability. For the next question, focused on low socioeconomic or high socioeconomic background as an impactful factor, the teacher found the chance for success in mathematics to be the same. Teacher C1 implied that she has seen more success in math from low socioeconomic students than high socioeconomic. This answer was also different than that of the previous two teachers. The last question focused on whether the teacher needs to be naturally good at math to teach math successfully. Teacher C1 stated that y*ou must have some skills, but I am not sure that you must be an expert*. She did not feel that a teacher needs to be naturally good at math, but that practicing math is necessary to acquire the skills to teach the subject successfully. Teacher C1 provided more in-depth answers and gave a detailed blueprint on how to be successful teaching math without being naturally good at it.

Overall, teacher C1 gave different answers than the first two teachers A1 and B1. Her

answers were more insightful, with direct examples regarding of not only how a teacher can be successful instructing students from different socioeconomic backgrounds but explaining that students need to have ability and ability does not necessarily stem from a high socioeconomic background; indeed, she has seen more ability and success in students from a lower socioeconomic background. These answers and explanations from all three questions showed some new emergent themes.

Teacher C2. In her first response, teacher C2 explained that all students can be successful but outlined three different necessary steps for that to occur. First, there need to be best practices in the classroom, with an updated curriculum. The second step is students having a desire to learn, and the last step is the teachers being dedicated to teaching. All three of these ingredients, together, can lead to students being successful in math. This response outlined more of a formula for success rather than simply explaining that every student can have success in math because the teacher has observed that occurrence. For the next question, teacher C2 stated that socioeconomic status can put students at a disadvantage in math, but they can still be successful regardless. The last question, about teachers needing to be naturally good at math, saw the recurring theme in her response, as she answered that a teacher who finds math challenging may be a better teacher because they may connect with a struggling student better to help that student be successful.

Overall, teacher C2 had a very formulaic response to the first question and that differed from all the other answers. The response to the second question was matter of fact, as she outlined that even when a student may be at a disadvantage, they can be successful anyway. The last answer aligned with a recurring theme among the responses, as she stated that teachers not only do not have

to be naturally good at math to teach math but can even struggle in math themselves and then possibly connect better with challenged students.

Table 16

Summary of Teacher Demographic Data Provided on the Surveys

Teacher Question	**A1**	**A2**	**B1**	**B2**	**C1**	**C2**
Gender	Female	Female	Female	Female	Female	Female
Age	41–50	51+	41–50	51+	51+	51+
Years Teaching	11–20	0–5	11–20	20+	11–20	20+
Highest Degree	Undergraduate degree	Undergraduate degree	Undergraduate degree	Undergraduate degree	Undergraduate degree	Undergraduate degree
Major	Elementary Education	Environmental Science/ Biology	Special Education: Learning Disabilities	Elementary Education and Dance Education	Science Elementary Education	Elementary Education

Math Courses Taken	Trigonometry, Pre-calculus,	College Algebra, Statistics	Pre-Calculus, Mathematics for Elementary Teachers (undergraduate), College Algebra	Mathematics for Elementary Teachers, College Algebra	Trigonometry, Precalculus, Sets and Logic, Calculus 1, Mathematics for Elementary Teachers (undergraduate), College Algebra, Financial Mathematics, Statistics, (Graduate)-Bilingual Math

Schools Interested in Teaching	Public	Public	Public	Rural, public, religious	Public	Rural, public
Grades Preferred to Teach	4th, 5th, 6th	7th, 8th, 9th	K–12 special education students with disabilities	5th, 6th, college	4th, 5th, 6th	7th, 8th, 9th
Interest in Becoming a Math Specialist	Somewhat interested	Somewhat interested	Neutral	Somewhat interested	Very interested	Neutral
Interest in Being a Reading Specialist or Reading Coach	Somewhat interested	Not interested	Somewhat interested	Somewhat interested	Very interested	Not interested at all

Interest in Becoming a School Administrator	Not interested	Not interested	Not very interested at all	Not interested	Not very interested	Neutral
Ethnicity	Caucasian	Caucasian	Caucasian	Caucasian	Caucasian	Caucasian
Mother's Highest Degree	Some college	Some high school	Some college	Some college	Some high school	Bachelor's degree
Father's Highest Degree	Some high school	Some high school	Master's Degree	Some K–8	Some college	Some college
Places Lived in Addition to Arizona	None	None	California, Virginia, North Carolina, South Carolina, Tennessee	Illinois	Zimbabwe, South Africa	None

(Frimer, 2017).

Breakdown of Demographic Information

The teacher demographics presented in Table 16 show numerous similarities and highlight some interesting information. For example, all of the teachers were female and over 40. Every teacher had an undergraduate degree, and the majority of their parent's education level was "some college." The teachers all had over 10 years of teaching experience, except for one who had less than five. Not one teacher was interested in becoming an administrator. The last commonality of note was that every teacher was interested in teaching at a public school.

Table 17

Mixed Methods Convergence Table

Question (sub problem, hypothesis)	Quantitative Results	Qualitative Results	Convergence
1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for

fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	significance regarding differences between students' performance and teacher attitude. They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between

			students' performance and teacher attitude.
3. What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher

			attitude.
4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' and teacher attitudes.	No qualitative results due to interviews not being conducted on students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitude.

5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	Teacher common themes: Teachers do not have to be naturally good at math to teach math. Students can be successful in any socioeconomic environment.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitude.

6. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitude.

7. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding differences between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitude.

8. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitude.

Summary

This chapter has outlined the findings and analyses and has tested the research questions and hypothesis for this research, which followed the format of a mixed-methods causal-comparative study. The next chapter presents the summary, conclusions, and recommendations and implications of the research.

CHAPTER 5: DISCUSSION

Introduction and Overview of the Study

This research examined the impact of teacher and student attitudes on math performance.

In Chapter 5, the researcher reviews the summary of findings, conclusions, overall themes, recommendations for practical applications, and future implications.

Summary of Findings and Conclusions

The target population of this research needed to be gathered through time and patience. Rural Arizona has a small sample size when comparing kindergarten through eighth grade schools in Arizona. The majority of kindergarten through eighth-grade schools in rural Arizona may only have three or four students per grade level in any given school year. Further, within these schools there is a transient population every school year, which can render any short-term research or long-term research difficult. However, teachers usually remain at their particular school. One negative element of gaining any insight from teachers through quantitative or qualitative data is there is usually just one teacher per grade level for an individual school.

This research focused on findings derived through application of the mixed-methods research. Qualitative research provided more information than the quantitative did based on conducting teacher interviews. The teacher interviews gave insight into some trends by way of certain themes that emerged. Additionally, the teacher and students' surveys provided insight into trends and themes. However, the researcher was not able to apply any inferential tests of significance of mean differences concerning student and teacher attitudes and math performance due to an insufficient sample size to test the related hypotheses statistically. The summary of findings

presents more in-depth information regarding the identified themes.

Discussion

The researcher discovered several common and positive themes that emerged in the teacher and students' surveys. Additionally, the researcher identified some common and varied themes between fourth-grade male and female students and sixth-grade male and female students. Finally, the researcher identified some common themes among teachers that could influence how administrators can focus and train teachers concerning the importance of attitude and confidence in themselves and their students.

RQ 1 Summary. RQ1 addressed the question: What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics? Among fourth-grade male students, there were several themes identified that showed both positive and negative attitudes toward math. The fourth-grade males responded that, overall, they *understand math.* The researcher's analysis of this question, which had one of the highest Likert averages in the student surveys, is that fourth-grade males have a built-in confidence toward math. Built-in confidence can be an advantage but also a disadvantage, as students may not want to continue to work as hard or may want to quit when the study content becomes more complex.

One item that had a low Likert score was *I can tell if my answers in math make sense*. The reason for the low Likert average here with the fourth-grade males could be because these students may not want to show their work to the teacher and just get to the answer. This was something the researcher experienced as a teacher: The male students would not want to explain their answer but just write the response without showing how they came to that conclusion.

One surprising theme that arose from the survey was the fourth-grade males having one of the highest Likert score averages on the item *I look forward to learning new math*. In the researcher's previous experience, that has not always been the case, hence it was a pleasant surprise to the researcher to see such a positive attitude toward this item.

RQ2 Summary. RQ2 addressed the question: What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics? Several themes that showed both positive and negative attitudes toward math were identified from the fourth-grade females' surveys. The fourth-grade females overall had a higher Likert average than fourth-grade males, which means that they generally have a more positive attitude toward math than fourth-grade male students. However, the fourth-grade males had more of an increase in score on their benchmark tests than the fourth-grade female students.

The fourth-grade females had the most positive response to the item *My math teachers have always been nice*. This could be due to the fourth-grade females placing importance on having a relationship with their teacher. In the researcher's experience, relationships are more of a priority in females than male students. One of the items with a lower Likert score among fourth-grade females was *My family talks about math.* This could have seen a low Likert score among the fourth-grade females due to these students being relationship focused, therefore, math being perceived as unimportant to their family may bother them. The score for this item was not as low in fourth-grade males.

One of the surprising findings related to the fourth-grade females was the exceptionally low score on the item *I can solve difficult math problems.* The researcher was surprised with this finding

due to female students' tendency to work hard and persevere even when a math problem is difficult. This low Likert score may be due to a confidence issue.

RQ 3 Summary. RQ3 addressed the question: What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics? The sixth-grade males overall had their highest Likert score on the survey item *My math teachers have always said that there can be more than one way to solve a problem correctly.* This could be due to the sixth-grade males having a focus on the process instead of their relationship with their teacher. In the researcher's experience, male students tend to focus less on the relationship with their teacher and more on wanting to know how to solve the problem. However, as a math problem becomes more difficult, these students will sometimes want to give up if the possible solutions to the problem do not come easy.

Another survey item that scored high was *I am really good at math.* This high score may also be due to the built-in confidence that males tend to have, although, in this case, the sixth-grade males did not improve as far as the sixth-grade females on their benchmark test. There may be some over-confidence to consider. There were no significant surprise findings from the sixth-grade males' surveys.

RQ 4 Summary. RQ4 addressed the question: What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics? The sixth-grade female students had the highest Likert average overall on the survey item *My math teachers have always been nice*. In the researcher's experience, as stated previously, this can be due to relationships being the focal point for female students.

The lowest Likert average on the sixth-grade females' surveys was the item *My family talks about math a lot*. This same survey item had one of the lowest average scores on the fourth-grade females' surveys. This could be due to relationships being important to females and they may feel bothered that their family does not talk about their academic study.

One surprising finding from the sixth-grade females' surveys was that the item *I love math* recorded one of the lowest Likert averages, even though the survey item *My math teachers have always been nice* had the highest Likert score for the sixth-grade females. This should not be a surprise finding, given the importance of the relationship the researcher discussed previously. The sixth-grade female students may not like math or have a positive attitude towards math, but their teacher seems to make the difference as the sixth-grade females showed greater improvement on their benchmark tests compared to the sixth-grade males. The overall finding was surprising to the researcher.

RQ 5 Summary. RQ5 addressed the question: What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics? One of the items that was most informative among the fourth-grade teachers was *I like mathematics*, which had an average Likert score of 4.70 in this group. That is an extremely high Likert score, and it is a simple but telling item about the teachers' attitudes toward mathematics. Another item that scored high for fourth-grade teachers was *I enjoy solving mathematics problems*. This item is also simple but can clearly show a teacher's attitude toward mathematics. In my experience as a researcher, elementary teachers have very positive attitudes towards math even if they may not find themselves to be good at math.

The fourth-grade teachers had the lowest Likert scores on the survey item whether students succeed in mathematics depends primarily on how hard they work. The fourth-grade teachers may feel that their students can work hard but still not be successful in math. This concept was further explored in the teacher interviews and was a common theme that arose among some of the teachers. This finding regarding teachers viewing success as mainly dependent on level of effort was one of the surprise findings that the researcher would not have thought to be true prior to the study.

The fourth-grade teachers had some common themes in their interviews. One of these common themes was that teachers do not necessarily have to be good at math to teach math. Based on the researcher's experience, this is a common opinion among more than only fourth- and sixth-grade teachers. However, a larger sample size would be needed to judge that statement a fact.

The sixth-grade teachers had an extremely high Likert average on the teacher survey item *All students should be held to high expectations in mathematics*. The teachers who participated in the survey all seemed to feel that high expectations are important to establish in the classroom. Based on their interview responses, the sixth-grade teachers had the common theme of *Teachers do not have to have natural ability to teach math*. The researcher was a little surprised by this finding. Teachers are hard workers and do not seem to let many obstacles stand in their way.

RQ 6 Summary. RQ 6 addressed the question: What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count? The teachers' attitudes at the 65% or less free and reduced lunch school did not result in any surprising findings. The item *I like mathematics* scored at a 6.0 and *I enjoy solving math problems* was also a 6.0. There were no low mean Likert scores for any

one item and the average teacher Likert score in this group was 4.39. The average student Likert score was 3.08. Compared to the other two schools, the students' Likert score was the lowest, which related to their attitude as the least positive. The teachers' Likert score was in the middle of the two other schools. The researcher was surprised that the students had the least positive attitude toward math despite their attendance at the 65% free and reduced lunch school.

RQ7 Summary. RQ 7 addressed the question: What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count? Unexpectedly, the teachers in this school had the highest Likert average for teacher attitude out of all the schools, although they are not employed at the lowest free and reduced lunch count school. The other surprising finding was that, even though the students' Likert score was really no different than the other schools, the teachers had the highest Likert average concerning their attitude toward math and their students. The students had the least amount of improvement from benchmark one to benchmark two. The researcher suggests, based on prior experience in education, that strong attitudes and confidence do not always mean that students will improve their scores.

RQ8 Summary. RQ8 addressed the question: What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count? The students at the 80% or more free and reduced lunch count schools had a similar Likert average to the other schools. The teachers had the lowest Likert average out of all schools. However, the surprising finding in this group was that the 80% free and reduced lunch count or greater school had the most improvement from benchmark one to benchmark

two. This data, combined with the researcher's personal experience, suggests that just because students and teachers may not have the best attitude and confidence toward math does not mean that the student cannot improve their math data.

The prior research had the same results related to certain themes as this current research. The themes that students were positive about were nearly the same. The teachers' themes were inconclusive regarding confirmation or disproving of prior research and may be a topic for future study. A higher number of teachers should be sampled to ascertain if there is any significance to some teachers feeling that some students may not be successful despite hard work. It was not possible to determine statistical significance due to an insufficient sample size to test related hypotheses regarding correlations between students' performance and teacher attitude.

Recommendations for Practical Application

The data collected from this research could help a superintendent or principal gain insight into the impact of teacher and student attitudes regarding math performance.

- Create professional development opportunities for school leaders to provide insight into the importance of teacher attitude and confidence in themselves and their students.
- Provide opportunities to school and district leaders to conduct training on the potential impact of teachers' attitudes toward students, which may affect a student's attitude toward math.
- Examine multiple ways to coach teachers regarding the importance of the teacher attitude and confidence toward the students, as well as how teachers

can have the most positive impact on a student.

- Include the importance of teachers establishing the relationship with students in teacher preparation programs held by school districts at the beginning of the school year.
- Create a minimum amount of required professional development and ranges of required professional development concerning how teachers can implement strategies in the classroom to focus on their relationships with students.

Recommendations for Future Related Research

After reflecting on the findings from Chapter 4 and the summary in Chapter 5, there are several identified further opportunities related to teacher and student attitudes and math performance that can guide future research, such as:

- Conduct additional quantitative research on teachers' attitudes related to math performance at a minimum of 10 to 15 K–8 schools, to obtain a greater sample size.
- Conduct additional quantitative research on student attitudes related to math performance at a minimum of 10 to 15 K–8 schools in order to obtain a better sample size.
- Conduct additional qualitative research on teacher attitudes related to math performance.
- Conduct additional qualitative research on student attitudes related to math

performance.

- Conduct an investigation or survey teachers regarding their attitudes toward math at the school and district level.
- Conduct an investigation or survey teachers regarding their attitudes towards students acquiring math skills.
- Create a committee of principals and teachers to ascertain if there is any data that can be used to improve math performance.
- Conduct additional qualitative research where the interview questions require follow up probes such as “Can you give me an example of how/why you feel that way”.
- Conduct additional quantitative research with teacher intervals of years of teaching experience included.
- Conduct and investigation to relative impact of “skill set” vs. “mind set” and their comparative impacts on attitude and performance.
- Conduct a phenomenology to explore more in-depth into lived experience of both teachers and students regarding attitudes and performance.

Implications

In revisiting the significance of the study and with consideration for realistic goals, the research may benefit and contribute to current and future education in the following ways:

1. Future administrators can gain insight into the importance of a teacher’s attitude and confidence in their personal math abilities as well as the

connections they make with their students.

2. Future teachers can gain insight into students' motivations regarding what drives them to acquire math skills and have a positive attitude toward the subject.
3. Academic research can gain insight into attitudes related to math performance.

Summary

This researcher enjoyed working with the three different elementary schools in rural Arizona. The teachers felt that they gained insight into how they observe their students and were pleased to participate in this research and add to the understanding of teacher attitudes toward math. The impact that teacher and student attitudes have on math performance should be further researched.

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APPENDIX A: NAU IRB APPROVAL

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NORTHERN ARIZONA UNIVERSITY
Office of Research Compliance

Institutional Review Board for the
Human Research Protection Program

To: Chad Greer, Masters

From: NAU IRB Office

Approval Date: August 13, 2020

Project: The Impact of Teacher and Student Attitudes on Math Performance ofFourth- and Sixth-Grade Students in Rural Arizona

Project Number: 1535965-4

Submission: Amendment/Modification

Action: APPROVED

Project Risk Level: MINIMAL RISK

Approval Expiration Date: March 13, 2025 **Next Report Date:**

Review Category/ies: The project is **not federally funded or supported** and has been deemed to be **no more than minimal risk.**

This project has been reviewed and approved by an IRB Chair or designee.

- Northern Arizona University maintains a Federalwide Assurance with the Office for HumanResearch Protections (FWA #00000357).
- All research procedures should be conducted in full accordance with all applicable sections of theguidance.

The Principal Investigator should notify the IRB immediately of any proposed changes that affect the protocol and report any unanticipated problems involving risks to participants or others. Please refer to Guidance Investigators Responsibility after IRB Approval, Reporting Local Information andMinimal Risk or Exempt Research.All documents referenced in this submission have been reviewed and approved. Documents are filed with the HRPP Office within IRBNet. If subjects will be consented, the approved consent(s) areavailable

Important

The principal investigator for this study is responsible for obtaining all necessary approvals before commencing research. Please be sure that you have satisfied applicable external and University requirements, for example (but not limited to) data repositories, listserv permission, records request, datause agreement, conducting University surveys, data security, international, conflicts of interest, biologicalsafety, radiation safety, HIPAA, FERPA, FDA,

- within IRBNet upon approval notification from the HRPP Office.

APPENDIX B

Match of Research Questions [sub problem, hypothesis]

to Corresponding Sources of Information

and Data Analysis/Reporting Procedures

Research Questions	**Corresponding Sources of Information**	**Corresponding Data Analysis/Reporting Procedures**
1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey	Summary narrative
2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey	Summary narrative
3. What, if any, difference exists between sixth-grade male	Expanded Math and Me student survey	Summary narrative

students' performance in mathematics and the attitudes they hold toward mathematics?		
4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	Expanded Math and Me student survey	Summary narrative
5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?	Adapted MECS M-1	Summary narrative
6. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?	Adapted MECS M-1/teacher interviews	Summary narrative

7. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?	Adapted MECS M-1/teacher interviews	Summary narrative
8. What, if any, difference exists between the teacher attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?	Adapted MECS M-1/teacher interviews	Summary narrative

APPENDIX C: MIXED METHODS CONVERGENCE TABLE

Question (sub problem, hypothesis)	Quantitative Results	Qualitative Results	Convergence
1. What, if any, difference exists between fourth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitude.
2. What, if any, difference exists between fourth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically

			for significance regarding correlations between students' performance and teacher attitude.
3. What, if any, difference exists between sixth-grade male students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitude.

4. What, if any, difference exists between sixth-grade female students' performance in mathematics and the attitudes they hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitude.
5. What, if any, difference exists between fourth- and sixth-grade students' performance in mathematics and the attitudes their teachers hold toward mathematics?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	Teacher common themes: Teachers do not have to be naturally good at math to teach math. Students can be successful in any	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students'

		socioeconomic environment.	performance and teachers' attitude.
6. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65% or less free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teachers' attitude.

7. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 65–80% free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teachers' attitude.
8. What, if any, difference exists between the teacher and student attitudes and fourth- and sixth-grade students' performance at a school with 80% or more free and reduced lunch count?	There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students' performance and teacher attitudes.	No qualitative results due to interviews not being conducted with students.	They failed to converge. There was an insufficient sample size to test the related hypothesis statistically for significance regarding correlations between students'

performance and

teachers' attitude.