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Math Teachers' Experiences Learning and Teaching Math

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COLLEGE OF EDUCATION

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Abstract

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Doctoral Study Submitted in Partial Fulfillment

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Abstract

In a charter school in the Southwest United States, elementary students were struggling to attain proficiency in math and have been failing to meet the standards in math on the Arizona Instrument to Measure Standards test. As a result, these students may not have been prepared for more advanced math courses as they continued their schooling, and this failure to attain proficiency in math may continue to impact the school's ability to make adequate yearly progress. The purpose of this explanatory case study was to explore the perspectives of elementary math teachers toward teaching math, their preparation to teach math, and the possible influences they may have on their students' math skills development. The theoretical framework was self-efficacy theory. Data were gathered through questionnaires completed by 5 participants teaching kindergarten through 5th grade and through the investigation of archival data of their students' achievement test scores. Emerging themes were coded to record and organize relevant information. The participants indicated that they did not feel prepared to teach elementary math when entering the classroom after their teacher preparation programs and that they want to gain more content knowledge and learn more strategies to teach math. Social change may occur as the elementary math teachers are given a voice concerning the teaching of math, and this voice could be used in producing staff development and improving instruction.

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Dedication

This work is dedicated to my husband, Tom, who always believed in me. It is also dedicated to all of the elementary teachers who strive every day to make math come to life for their students.

Acknowledgments

Many people helped with this endeavor, and I greatly appreciate their advice and support. Staff at the charter school helped more than they know by sharing their experiences and ideas throughout this journey. They helped me to see beyond their struggles to learn math, but to see how preparation for future teachers could be improved. I also have great respect and appreciation for my chair, Dr. Szlizewski, and my second chair, Dr. Tappler, for their words of encouragement and support when they were needed.

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Introduction

In a charter school in the Southwest United States, elementary students have been struggling to attain proficiency in math as shown by their failure to meet the standards on Arizona's mandated yearly test (AIMS) in math and the Stanford 9 and 10 Achievement Tests. Because of this trend, these students may not have been prepared for more advanced math courses as they continued their schooling. As a consequence, the students' lack of proficiency has impacted the school's ability to make adequate yearly progress (AYP) for each second through fifth grade class.

There has been limited information available on the perspectives of the charter school elementary math teachers toward math and how their perspectives may affect their ability to improve the math achievement of their students. Much of the information about improving student math achievement, such as teaching students according to their learning styles (Gardner, 1993), that had been gathered previously came from experts or researchers in the field of education, but not from the teachers themselves. Understanding how the events of elementary teachers' schooling and preparation for teaching influences teachers' perspectives could have several benefits. Staff development programs could be developed to give appropriate academic and behavioral supports to teachers who are already in the classroom. Questionnaires or surveys could be prepared and administered to prospective teachers, and the results could be used to guide their program of instruction so they may be better prepared to teach with a high level of competence and satisfaction. By creating programs that meet the needs of each teacher and prospective

teacher, students may have a better opportunity to learn because teachers may be prepared for classroom teaching responsibilities.

The research design for this project study was an explanatory case study design. This design was the most appropriate to study teachers' perspectives about math and how those perspectives may influence their effectiveness in improving student academic achievement in math. The sample included six elementary math teachers from a small, urban charter elementary school whose teachers have varied schooling and teacher preparation backgrounds. These teachers were selected because it was expected that they would be able to provide rich, thick, descriptive data about the perspectives of elementary teachers about teaching math. Data were gathered through questionnaires that were completed by the participants. The data were themed and coded to record and organize relevant information related to the teachers' perspectives. Class averaged test scores from the AIMS tests for Grades 3 through 5 and the Stanford 10 test for Grade 2, available to the public, were used to help determine whether or not individual teacher's students were progressing academically.

Questions were asked to be sure that the data collected would be useful in understanding teachers' perspectives. I created questions that were meant to draw out the participants' experiences, which allowed the teachers to express their views as they recalled their past experiences and helped them discuss relevant information for the study. The information obtained about these teachers' perspectives may add to previous knowledge about elementary teachers' perspectives about math and may lead to the development of better materials with which to prepare elementary teachers to teach math.

Statement of the Problem

At a charter school in the Southwest United States, at least one-third of the elementary students were failing to meet the standard in math set by the Arizona's Department of Education (AZ Learns, 2011). Arizona State law requires that all students in Grades 3 through 5 take the AIMS each year in April (Arizona Department of Education, 2010). The test scores are divided into four levels labeled 1=*falls far below the standard (FFB)*, 2=*approaching the standard (Appr)*, 3= *meets the standard (Meets)*, and 4=*exceeds the standard (Exceeds)* with 1 and 2 indicating student scores that are below an acceptable level of learning. These scores have been cut at different levels at different years at the discretion of the Arizona State Department of Education (Arizona Department of Education, 2011).

Second grade students are required by the state to take the Stanford 10 Test, which has a different scoring system of percentile ranking. On the Stanford 10, students should score at the 50th percentile to be considered to be at grade level. The state publicly releases the scores by grade and school the following school year.

The state's legislature determined that the acceptable level of performance at Grades 3 through 8 was called Meets, with Exceeds the standard being exemplary. Some years, the class averages showed an improvement, but each year many students in Grades 3 through 5 were below the standard (Arizona School Report Cards, 2012).The Arizona Department of Education (2011) analyzes the language, math, and reading results for all schools each year and provides each school and the public with the scores. The lowest scores, consistently, across the state have been in math (Arizona Department of Education, 2011). Table 1 includes a comparison of the charter school's student scores

compared to the state in which the school is located indicating the students consistently performed below state levels at Grade 3 through Grade 5.

Table 1

Charter and State Three Year Math Score Comparison

	Falls Far Below		Approaches		Meets/Exceeds	
Grade	Charter	State	Charter	State	Charter	State
3	15%	10%	34%	21%	51%	69%
4	15%	8%	37%	37%	48%	55%
5	24%	19%	32%	22%	44%	59%

Second grade Stanford 10 scores showed that about 32% of students completed this grade with below grade level math scores. Stanford 10 test scores should show students at or above the 50th percentile, which means that the student scored equal to or better than 50% of the students who took the test (Test Interpretation Guide Stanford 10, 2011). The lower students' scores at the charter school showed some students as low as the 13th percentile (State School Report Card, 2011). Math scores at the charter school are significantly lower than the state's scores. The low scores indicate a need for improvement in student math achievement at the charter school to show that the school meets state expectations of meeting the standard.

Description of Focus School

The focus school is a charter elementary school in the southwest United States with grades kindergarten through eighth grade. There is one classroom at each grade level. Each elementary classroom is limited to no more than 20 students. Many students

have attended the school since kindergarten, and some of their parents attended the school as children.

The school does not have the typical public school design of large buildings with large classrooms, but consists of two small block buildings and one modular building with kindergarten through second grade in one block building, third through fifth in the other block building, and sixth through eighth grade in the modular building. The classrooms are of unequal sizes, and teachers use the space they have to create a classroom environment. The elementary school shares the property with a high school that is associated with the elementary school, and sometimes a family will have children in both elementary and high school.

The charter school operates on a calendar from mid-August through the end of May with traditional holidays off. Students attend classes from 8:00 a.m. to 2:30 p.m., Monday through Friday. This calendar is typical for elementary schools in the area. Teachers work from 7:45 a.m. to 2:45 p.m. except on days when meetings are scheduled after school.

This problem of low math achievement scores impacts the charter school's stakeholders in various ways. Students and parents at the charter school are impacted because the low math achievement of the students makes it difficult for the students to keep up with the advancing math curriculum (Badejo, 2011) each year causing parents to worry about their child's future progress (DuFour, DuFour, Eaker, & Karhanek, 2010). The school's middle school and high school teachers are also impacted by the low achievement of students coming in to their classes and the extra tutoring that must be done to help students pass the AIMS (Libeskind, 2011; School Tutoring Program, 2010).

The school must also account for its students' achievement to the state and to the community, and these low math scores are contributing to the school's failure to make AYP.

The math teachers at the charter school are qualified to teach elementary math as a part of the general curriculum taught each day (Arizona Teacher Certification Requirements, 2013). Though the teachers have completed all state requirements to teach, and the school's curriculum has been used successfully for students in the United States (Pearson Education, 2012), many of the charter school's students are not meeting the standards set for achievement by Arizona. This gap in practice, which has led to the underperformance of the students, has not been resolved.

Problem at National Level

The problem of low math proficiency continues to be found at the national level. As a whole, the United States continues to score below most other industrialized nations in mathematics. According to the Program for International Student Assessment (PISA, 2012), the Trends in International Mathematics and Science Study (TIMSS, 2007), and the Office for Economic Cooperation (OECD, 2012), the United States ranked 27th out of 34 in math, which is behind most other industrialized nations, and there continues to be concerns that the nation is in an educational and economic decline and will not be able to maintain its standing in the world economy or in scientific progress (Hanushek, Jamison, Jamison, & Woessmann, 2008; Sahlberg, 2010). It is vital that math scores improve so that the United States will be able to remain an economic and scientific world leader, but the experts in education (Blank & delas Alas, 2009; Bloom, 1956; DuFour,

DuFour, Eaker, 2010; Gardner, 1993; Hess, 2008) have not been able to implement a plan that has resolved the problem of low academic achievement.

Rationale for Choosing the Problem

Math student achievement in Grades 2 through 5 has been low at the local charter school being studied, and this school follows a national trend (PISA, 2008; TIMSS, 2009). This low achievement in the early grades has affected students' ability to meet state standards in math, made it more difficult for them to succeed in higher level math courses in upper grades (Arizona Superintendent's Message, 2009; U. S. Department of Education, 2009), and may be affecting the United States' ability to maintain its standing in the global economy and in leadership in scientific progress (OECD, 2009). Scholars in education, such as Gardner (1993) and Hadley and Dorward (2011), have documented why they believe students continue to struggle to attain proficiency in school, but there has been limited information available about how the perspectives of elementary math teachers about their math development and their teaching preparation may have affected their effectiveness in raising student math achievement (Hill, 2009; Kahle, 2008; Parajes, 2007; Woolfolk & Hoy, 2003). To understand teachers' perspectives, more information is needed. This study has added to the existing knowledge about teachers' perspectives about learning and teaching math so programs can be developed to address teachers' views that may lead to increased student achievement in elementary math (Abrams, 2011; Brown, 2010; Starnes & Saderholm, 2010).

Parents, teachers, and students at the focus school have been concerned about the lack of achievement because it has made it difficult for the students to be prepared for math at the next grade level (J. Tellez & R. Corbin, personal communication, November,

2012). Though parents have required their children to do their homework and complete assignments, some parents have not felt that their children were progressing as well as they should (Parent School Satisfaction Survey, 2010). When parents were asked if they felt their children were proficient in math, 42% reported that they did not feel their children were proficient (Parent Satisfaction Survey) and students have been concerned that if this trend continues the students would not be able to pass AIMS at the high school level and, therefore, would not be able to graduate because students are required to pass AIMS before they are awarded a high school diploma.

Definition of Terms

Academic achievement: A level of skill attained by a student in a subject as shown by test scores and other means of assessing skill levels (Arizona Department of Education, 2011).

Approaching or Approaches: A level of achievement assigned by the state of Arizona on the AIMS test based on a formula applied to the student's scaled score. This is the second lowest level and indicates that the student is below the acceptable achievement level, but is closer to meeting the standard than the falls far below level (Arizona Department of Education, 2011).

Arizona Instrument to Measure Standards (AIMS): Arizona's state-mandated test taken each year by students in Grades 3-8 and in 10th grade 10 as a graduation requirement (Arizona Department of Education, 2011).

Charter school: A public school that is meant to give parents a choice for the education of their children (Arizona Department of Education, 2011).

Exceeds: A level of achievement assigned by the state of Arizona on the AIMS test based on a formula applied to the student's scaled score. This indicates the highest level of achievement on the scale and indicates that the student's achievement is above average and has exceeded the state's requirement for a passing score (Arizona Department of Education, 2011).

Falls far below: A level of achievement assigned by the state of Arizona on the AIMS test based on a formula applied to the student's scaled score. This is the lowest level of achievement on the scale and indicates that the student is below the acceptable achievement level and is in the lowest of the four categories (Arizona Department of Education, 2011),

Inservice: Professional development received after becoming a classroom teacher and usually offered by the school where an educator is teaching (Caprano, 2010; Cave, 2010).

Math standards: A set of items determined by the state of Arizona to be learned by all students at each grade level (Arizona Department of Education, 2011).

Preservice: The time spent by prospective teachers as they complete college and university coursework, practicums, and student teaching/internships before becoming a classroom teacher (Ottawa University Registration, 2006).

Meets: A level of achievement assigned by the state of Arizona on the AIMS test based on a formula applied to a student's scaled score. This is the lowest level of achievement that is acceptable and indicates that the student's achievement level has reached the states' requirement for a passing score (Arizona Department of Education, 2011).

Program for International Student Assessment (PISA): An international compilation of data about the achievement of students from 34 member countries and 41 partner countries/economies (PISA, 2009)

Percentile: A ranking stating the percentage of people who scored above or below another person (1% through 99%). On a Stanford 9 and Stanford 10, a 50th percentile score is considered grade level. Scores below 50% show a progressively less proficient score as the score is lower. The reverse is also true, and the student is more proficient as the score reaches a higher number (Pearson Education, 2012).

Stanford Achievement Test: A standardized achievement test used to determine students' understanding of various school subjects (Pearson Education, 2012).

Trends in International Mathematics and Science Study (TIMSS): TIMSS researches and reports on international issues in mathematics and science (TIMSS, 2011)

Significance of the Problem

Through the use of an explanatory case study, I attempted to explore the problem of low student achievement in elementary mathematics at the charter school as it impacted the students, parents, teachers, and community. Finding a solution would have benefits beyond academics as each stakeholder may have a unique interest in the results of this explanatory case study. Parents, students, teachers, the school, and the community would all benefit as student math achievement improves.

Students could receive the most benefit from this explanatory case study because exploring the perspectives of elementary math teachers and how these perspectives affect student achievement is a significant factor in how the teaching and learning of math is accomplished. Students who have been successful in school, including in math, often

have higher self-esteem, and according to Bandura (1997), Cox (2010), and Darling-Hammond (2010), are more likely to continue to progress and succeed as they continue in school. Students may want to progress each year so that they are able to meet the challenges of the next grade level. Students may want to be promoted to the next grade level and ultimately graduate from high school with the skills necessary to be successful in college and in the workplace. Self-esteem is an important factor in motivation; individuals with a high self-esteem may feel that, with effort, even difficult tasks can be accomplished. Exploring teachers' perspectives will provide insight into how and why teachers teach the way they do, and this can have an impact on the success of students.

Parents may also benefit from their child's academic achievement by knowing that their child has been prepared for the challenges of college and the work place. Parents have a much greater chance of raising a child who is confident in his or her abilities and able to make appropriate choices that will help their child to be happy and successful in whatever career path he or she chooses (Bandura, 1997).

The school could benefit from proficient student academic achievement and build a beneficial reputation as being an institution that promotes higher learning and produces students who have been prepared for the next grade level and, ultimately, college. Parents and students may want to enroll in the school to take part in the academic successes of the school. Teachers would feel the satisfaction of doing a good job, and this feeling of self-efficacy would promote further teacher and student success (Bandura, 1997; Protheroe, 2008; Swars, Daane, & Giesen, 2006). Teachers may want to work at a successful school, so this could help with teacher retention and academic consistency for students. The community also has a stake in exploring the teachers' perspectives about

their students' math achievement. Students who achieve proficiency in math are better prepared for higher learning and the workplace (Aikens, 1970). These students will have the education necessary to help the community meet its needs of a skilled workforce that can fill jobs requiring more mathematics such as those with a basis in science, technology, and research.

Research Question

In this explanatory case study, I attempted to answer the question: What are the teachers' perspectives concerning their personal experiences in learning math and in their teacher preparation programs. Gaining a better understanding of the teachers' perspectives could lead to a better understanding of influences that could affect their students' math achievement.

Review of the Literature

The literature review was created by collecting and analyzing research from peer-reviewed journals and articles, books, school data, and personal communications. Saturation of data was obtained by an exhaustive search through the use of the Walden library database and search engines including Google, Google Scholar, and Yahoo. Some keywords that were used to search for information included *learning and teaching elementary math, self-efficacy, professional development, teacher preparation, experts in education, math achievement, teacher's perspectives and student math achievement*, and *math proficiency in the United States*. After the data were gathered, they were organized into the sections required for the study.

Student math achievement in the United States in elementary grades has been poor for decades (A Nation at Risk, 1983), but changes in the classroom have been slow

and those that have been done have had little effect on student math achievement in elementary grades (Gainsberg, 2003). Bloom (1956), Gardner (1983), and Darling-Hammond (2010) have made suggestions to bring about improved student growth, but not all educators or international testing results show improvement in math achievement after following these suggestions (Gainsberg, 2003; PISA, 2012). More must be learned about how teachers can help their students learn math.

Studies have been done to find out why U.S. elementary students are not achieving academic success in math as well as students in some other developed countries (Caprano, Caprano, & Helfeldt, 2010; Hoy, Tarter, & Hoy, 2006), but study results have been conflicting (Ingersoll & Maynard, 2007). Some researchers blame teacher preparation colleges and claim that teachers are not being prepared to teach elementary math (Abrams, 2011; Boyd, Grossman, Lankford, Loeb, & Wycoff, 2006; Greenburg & Walsh, 2008). Others suggest that many students are not motivated to learn math (Kaplan & Dorsey-Sanders, n.d.), or parents are to blame for not expecting their children to learn math. Others believe that it is a combination of these factors that lead to a lack of student math achievement in elementary school (Beswick & Goos, 2012; Coleman & McNeese, 2009; Greenburg & Walsh, 2008). Though some students have benefitted from the changes in teacher preparation and classroom strategies used to teach math, many students are still struggling to learn math. It is important to understand more about why students are not progressing in math as they should, and until then, it will be difficult to solve the problem.

At a charter school in the Southwest United States, some of the second through fifth grade students have been failing to meet the standard for mathematics performance

set by the State Department of Education (Arizona Department of Education, 2011). The students have varied schooling backgrounds, and the teachers have varied teacher preparation backgrounds and number of years of experience in the classroom. Though the teachers have used various strategies for teaching math, students have continued to fail to make sufficient academic progress in math**.**

Self-Efficacy Theory

Self-efficacy is an important factor in teaching as well as student academic achievement. Self-efficacy of both student and teacher plays a role in student achievement (Margolis & McCabe, 2006; Badejo, 2011; Guskey, 1988; Woolfolk & Hoy 1990). Teachers who are self-efficacious tend to promote those feelings in their students. An individual who lacks confidence in his or her ability to be successful may have difficulty instilling confidence in those they teach. Students may experience a circular effect of low aspirations related to previous disappointment in academic performance, which can cause lack of effort and then a lack of confidence in ability (Ball, Hill, & Bass, 2005; Briley, 2012; Evans, 2011; Margolis & McCabe, 2006). Woolfolk and Hoy (2003) stated that students tend to be motivated more easily by teachers who have a high level of self-efficacy. According to Woolfolk and Hoy, these teachers are willing to try new ideas and experiment with varied teaching strategies which may be a part of the reason for their students' success. The theoretical framework of this study was self-efficacy theory, which helped me to explore the teachers' perspectives about teaching elementary math (Cave & Brown, 2010; Hill, Rowan, & Ball, 2005).

How Teachers' Attitudes Affect Student Achievement

Teachers have many different attitudes about teaching elementary math, and one teacher can have different attitudes about different aspects of teaching math. Teachers' beliefs about teaching math affect how they teach in the classroom (Donaldson, 2006; Guskey, 1988; Martin & Dawson, 2009; Weinstein, 1998). Chavez and Widmer (2002) reported that most elementary teachers felt that they were successful math students in elementary school, but did less well in high school. Teachers also explained that they should be able to teach elementary math because they were good at it in elementary school (Hadley & Dorward, 2011). When asked why they did less well in high school, some teachers stated that they had a teacher who made them feel bad about themselves or a teacher who was impatient or could not explain how to do the math (Briley, 2012). Many teachers also complain of receiving low grades and no help from teachers or parents to do better (Chavez & Widmer, 1982; Hashmi & Shaikh, 2011; Lampert, 2007). Teachers play an important role in helping students learn, and one comment can affect a student's self-confidence and enthusiasm to learn. Teachers should do all they can to support their students' learning of math content as well as positively influence their students' confidence in their ability to learn math.

Teachers who believe that they understand a math concept and can calculate a correct answer should be able to teach it effectively, but they may not be as effective as they think they are (Chavez & Widmer, 1982; Patton, Fry, & Klages, 2008). However, many elementary math teachers only see themselves as someone who helps students learn how to calculate the correct answer to a math problem (Briley, 2012; Wolters & Daughtery, 2007). They must also master the metacognitive processes that a student must

go through to develop a thorough understanding of a math concept (Patton et al., 2008). Elementary teachers must develop an attitude toward math that will help them learn not only how to correctly calculate an answer, but also understand the concepts behind why the calculations work to be able to explain to their students in an in-depth way why the answer is correct. This will help students learn to think through math problems and be able to solve more complex problems using prior understanding of the concepts they have learned (Evans, 2011; Kalsi, n.d.; Slavin & Lake, 2008).

Some elementary math teachers claim that they do not know how to choose the most appropriate method for solving a math problem because all they learned to do was follow the directions for the assignment that they were given to complete for homework (Patton et al., 2008; Sundipp, 2010). More teachers have less confidence in their ability to teach math and science than any other elementary subject (Fennell, 2007; Hadley & Dorward, 2011; Ray, 2010). Teachers who do not believe they are good teachers are less likely to be highly effective teachers in the classroom. Teachers who are not confident in their math or teaching skills are more likely to feel anxiety teaching math

Math Anxiety

Another issue plaguing many elementary math teachers is math anxiety (Bursal & Paznokas, 2006; Erskine, 2010; Stodolsky, 1985). These teachers feel that they are not proficient at math and fear not being able to do the problems required of their students and, therefore, cannot teach their students how to do the problems correctly (Bursal & Paznokas, 2006). Greesham (2007) believed that math anxiety causes preservice teachers and teachers to avoid teaching concepts in the depth that needs to be reached for their students to be able to succeed in higher-level math courses. Math anxiety may be caused

by negative experiences in school such as teasing by teachers and students for making mistakes in math, sarcastic or inattentive math teachers (Swars, Daane, & Giesen, 2006), or low grades due to a lack of understanding of math concepts (Isikal, Cuvran, Kocyusuf, & Aslevn, 2009). Many students have been affected by their teachers' math anxiety. Developing a better of understanding of math concepts may help eliminate math anxiety in teachers and allow them to be better able to teach their students.

In the Math Anxiety Rating Scale (MARS), Bursal and Paznokas (2006) showed that preservice teachers majoring in elementary education scored the highest on the MARS than any of the other groups except those who were enrolled in a math anxiety workshop at the time. But Chavez and Widmer (2002) found that only 17% of women and 8% of men actually claim to have math anxiety. Swars, Kart, Smith, Smith, & Tolar (2007) suggested that what some people feel is math anxiety is a lack of knowledge of math concepts and applications and the fear that they will not perform well because they have not learned the material.

Math anxiety can be passed along by anxious teachers. According to Seffens, Jelenc, and Noack (2010), female teachers who are math anxious tend to produce female students who are also math anxious. Elementary school teachers who are afraid to do math may not be aware that young girls are noticing this fear and may begin to feel the same way because of their experiences with the teacher (Cox, 2010; Hadley & Dorward, 2011). The more math anxious the teacher is, the more likely the girls are to pick up on it and follow the teacher's lead (Beckman, 2003). This math anxious self-concept can begin as early as the third grade. Even at this young age, when asked, many girls say that math is more for boys than girls (Chavez & Widmer, 2002), and Cox (2010) claimed that boys

score higher in math than girls. It is important for girls as well as boys to feel that math ability is not limited by gender because many career options are thought about while children are in early elementary grades (Steffens et al., 2010). Girls need to be taught that by the time they reach postsecondary education, women perform as well as men, but fewer women choose math-oriented careers than men.

Self-efficacy and its Role in Teacher Quality

Self-efficacy has an important role in teacher quality. Bandura (1977) stated that self-efficacy is a person's belief in his or her ability to do what is required to complete a task at an acceptable level of accomplishment. Bandura also stated that self-efficacy is related to a person's behavior. A teacher's self-efficacy has been shown to be a predictor of effectiveness as a math teacher (Hashmi & Shaikh, 2011; Swackhammer, Koellner, Basile, & Kimborough, 2009). Past experiences have an impact on whether teachers develop self-efficacy regarding teaching elementary math.

Teachers generally believe that they have the skills to teach elementary math, and the teachers who believe that they have the skills and abilities needed to be effective elementary math teachers are able to teach their students more effectively, even if the students have life factors that tend to decrease their learning potential (Swars, 2005). Patton et al. (2008) suggested that teachers who feel good about their abilities in math have the confidence to continue to learn about math and to teach those new concepts to their students, which helps the teacher's self-efficacy. Because high levels of self-efficacy in teachers have been shown to be of benefit to students, Swackhammer et al. (2009) stated that efforts should be made to increase preservice teachers' feelings of self-efficacy by teaching more content knowledge in teacher preparation programs so that

they will feel better prepared to teach elementary math when they reach the classroom. Teachers with higher self-efficacy are more patient with students who struggle to understand math concepts because they can discuss and correct student errors more effectively and are willing to teach new concepts to students than teachers with lower levels of self-efficacy (Gibson & Dembo, 1984). Teachers began learning math in elementary school and each math teacher they had throughout their educational years influenced their beliefs about their ability to learn math and how much math content they received each year. Teachers should understand how what they do in class affects their students in the future, so they can prepare all students for any career choice.

International Comparison of Student Math Achievement

Studies are conducted at periodic intervals comparing the scores of 15 year-old students from various countries who choose to participate in the international testing program. PISA (2009) showed that U.S. students scored 25th out of 34 countries, which is far behind countries such as South Korea, Finland, Hong Kong, Singapore, and Canada which were at the top. This mediocre score has prompted the U.S. Department of Education secretary, Arne Duncan, to show increased concern about the state of education in the United States (USA Today, 2011) and look for differences in the education systems of the higher ranked countries compared to the United States including preparation of teachers, length of school day and school year for students, as well as expectations of students (Wagner, 2008). Understanding the effects of these differences may help the United States create better programs to improve student math achievement.

Teacher Preparation Requirements

Teacher preparation requirements vary in many areas including: time required in subject-knowledge coursework, the total number of years required to complete all requirements to teach at a particular grade level, and what skills a preservice teacher must have to be accepted into a teacher college program. According to Stewart (2011), there are many differences in teacher preparation, and they begin as early as elementary and high school coursework requirements. For example, in most states in the United States, teachers are required to complete high school and obtain a 4-year degree at a university where the prospective teachers complete coursework about the subject(s) they will be teaching and more coursework and practice in teaching (Office for Economic Development [OECD], 2009). Charter school teachers have varied requirement by state mandates (Arizona Department of Education Charter School Teacher Requirements, 2011; Vergari, 2007). Teachers in China must have the equivalent of a high school diploma and only 2 years of "normal school" (teachers' college) before becoming an elementary math teacher, but students in China tend to score near the top on international tests (Ingersoll & Maynard, 2007; PISA, 2009). There is no set of teacher preparation requirements that consistently produces effective math teachers.

Not all top performing countries allow teachers to spend so few years in school before becoming an elementary classroom teacher. Singapore and Thailand, whose students have higher student achievement scores than the United States, require 5 years of post-high school education to teach elementary school (PISA, 2009). Teachers in Japan have approximately the same preparation requirements as the United States, but their teachers are better prepared to discuss math problems at a deeper level (Vernille, 2007).

Teachers in Finland are required to have a master's degree to be a classroom teacher (Sahlberg, 2010). The top performing countries also require teachers to complete professional development coursework throughout their teaching careers (Stewart, 2011). Top performing countries have some requirements for teachers in common and completion of these requirements to be a teacher may have a positive influence on student math achievement. Teacher preparation programs in the United States are determined by each state and are not consistent throughout the United States. This lack of consistency may have had an impact on teacher math content knowledge and classroom teaching skills.

Critical thinking skills are important for understanding math concepts. Schleicher (2010) stated that the critical thinking skills that are tested on PISA are an accurate indicator of future success in school and in the workforce. Schleicher stated that because teachers in the top performing countries are trained to teach by discussion and have a deeper understanding of math themselves, they are better prepared to teach their students to be critical thinkers. To help students become critical thinkers, teachers must be able to discuss students' ideas about math and correct misconceptions through discussing student errors and then helping the students understand how to complete problems correctly. U.S. teacher preparation programs are not developing the deep conceptual understanding that is needed (Ma, 1999; Sahlberg, 2010). Developing this understanding in teachers could make a difference in student achievement (Ball & Bass, 2000; Stigler & Hiebert, 1999). Teachers should have an understanding of concepts before taking any methods courses (Ferdinand & Wagner, 1999).

School student discipline and expectations for student achievement may be another factor influencing student achievement across the world. PISA (2009, 2012) also discussed teacher training toward student discipline and stated that, in the top performing countries, students are required by the teachers to maintain focus on their studies, are expected to work hard and long, and have parent support in the discipline of the students. In top performing countries, all students are expected to achieve proficiency in math, and the socioeconomic status of a student is not an acceptable reason for low math achievement (Ma, 1999; PISA, 2012). More emphasis on student learning expectations for U. S. students may have a positive influence on student math achievement.

Teacher Professional Development

Though student math achievement in the United States is not at the level of many other nations (PISA, 2012), there is disagreement about what should be done to improve student learning (Bakula, 2010; Booker, Booker, & Goldhaber, 2009; Brown, 2010; Yeh, 2009). Prospective teachers are expected to be effective in helping all students become proficient in all the subjects that they teach upon graduation from their teaching program (Briley, 2012; Lampert, 2007). However, not all teachers in the classroom are proficient at teaching math (Kalsi, n.d.; Starnes & Saderholm, 2010). Approximately 40% of elementary classroom teachers feel inadequate to teach math when they enter the classroom (Stiff, 2001), and this percentage does not get much better with time in the classroom. These teachers feel that they need help in becoming better math teachers. It is the responsibility of educational leaders in the schools to offer teachers instruction that will improve teachers' skills and improve student achievement (Blank & delas Alas, 2009; DuFour, Dufour, Eaker, & Many, 2006; Evans, 2011).

Much of the professional development offered to teachers consists of programs that give teachers ideas about teaching strategies and activities meant to motivate students to learn (Erskine, 2010; Hess, 2008; Richardson & Darling-Hammond, 2009). Some people believe improving student motivation to learn will not be effective in improving student math achievement. Hill (2009) and Libeskind (2011) suggested that more attention should be given to helping teachers develop math content knowledge. As they acquire more math content knowledge, teachers will know how to teach the subject. Others suggest that teachers need to learn to enjoy math, and this enjoyment will make them better teachers as they see math's usefulness in the world (Smith-Jones, 2005). Booker et al. (2009) and Abrams (2011) stated that the only way to raise student achievement sufficiently is to completely reform U.S. schools including how teachers are trained and how teachers are expected to teach their students. Many scholars believe that professional development should be changed from the short, 1- to 3-day programs to programs that are more individualized and allow the teachers to practice their skills over time with a math coach to help them successfully integrate their new skills into their teaching (Desimone, 2011; Dunst & Raab, 2010; Nagel, 2013; Walker, 2013). Professional development programs for teachers would be more effective if the programs continued over a longer period of time than the typical sessions that last only a few days. More time in professional development work would allow teachers more time to learn and practice the new skills they had been taught.

To be effective, teachers must understand how students learn, have a variety of teaching strategies, and understand the concepts they are expected to teach their students. Zeichner (2010) stated that until education leaders are willing to change how teachers are

prepared in teacher colleges, few teachers will be prepared to teach their students adequately. Zeichner and Hill (2009), and Hess (2008) agreed that teachers must learn better ways to teach all students so that every student can understand complex concepts such as those that are taught in math. What should be done until a new generation of teachers can be prepared is a dilemma. According to Booker et al. (2009), Blank & delas Alas (2009), Cave & Brown (2010), and Dunst & Raab (2013), professional development will have minimal impact on ineffective teachers already in classrooms, but for now, professional development should be used to teach math content to teachers and in a more effective program of instruction. To be an effective teacher requires many hours of preparation and teachers should be given more time to practice new skills learned in professional development programs. Teachers will then be better prepared to help students prepare for learning in the classroom.

Student Preparation

There are important differences in various countries' requirements for students. For example, U.S. students spend an average of 6 hours in school each day (PISA, 2009) and receive about 180 days of instruction per year. Chinese students spend a month more in school than their U.S. counterparts according to Stewart (2003). Chinese students score much higher on international math tests than U.S. students. The longer school year may have helped Chinese students learn more math content each year which would give these students an advantage when comparing student math achievement with countries, such as the United States, which require fewer hour of instruction each year.

The No Child Left Behind Act (2002) has had an effect on elementary student achievement in the United States, including student math achievement. According to

Cronin, Kingsbury, McCall and Bowe (2005), more teachers are teaching to a set of standards prescribed by each state. These standards may or may not be rigorous or comparable to what is expected of students in another state or internationally. In each country where students performed better than U.S. students there are national standards with a strong core curriculum (Stewart, 2003).

Another main difference between top performers and mediocre performers is the amount of study time done outside of school (PISA, 2009). Students attend more school hours in the top performing countries except for Finland (www.asiasociety.org, 2011). These differences may be affecting how well the students from each country perform on achievement tests.

Teacher Preparation and Teacher Requirements by Country

Results of the research about why some schools perform better than others across international lines is contradictory (Ingersoll & Maynard, 2007). Chinese teachers spend less time preparing to become teachers than in other top nations and much less than the U.S. teachers, but Chinese students outperform U.S. students. Vernille (2007) stated that Japan and France, who are ranked much higher in mathematics than the U.S., teach by discussion more than by teacher-led lessons, but the math students in South Korea, who also perform higher than U.S. students are more teacher-led. Most teachers in the United States believe that practice and drill is needed before students will learn math according to Chavez and Widmer (1982) and has not changed in the last several decades (Briley, 2012). Rather than concentration on practice and drill, teachers in Japan spend a great deal of time during teacher preparation learning to thoroughly discuss math problems and much less time learning about how students learn (Vernille, 2007). Finland's schools,

ranked at or near the top in international testing, according to Sahlberg (2010), require teachers to have a master's degree in education before beginning their teaching career. Finland requires preservice teachers to receive in-depth instruction in pedagogy and content for the subject areas they will teach. Though teacher preparation is accomplished differently throughout the world, it is what teachers do in the classroom that makes the greatest difference in student achievement.

According to Johnson (2011), teachers are not the problem as much as how they teach the students. Johnson believes the United States should be incorporating more situational and experience learning in the classroom. Johnson stressed students learn more through studying real-world examples and by following how others have worked through these types of problems. Students will learn more as they solve real problems, not by just computing answers through memorizing math facts and formulas. Students need to be exposed to complex concepts and then practice solving many types of problems.

Curriculum

The topics teachers must cover at each grade level are an important factor in student achievement (PISA, 2009). Though most top performing countries have national common standards that teachers must teach, the U.S.'s development of the No Child Left Behind Act, which requires states to teach a curriculum based on state developed standards, has not led to increased math academic achievement (Cronin, et al., 2005; Dufour et al., 2010). Recently, the United States has announced implementation of Common Core Standards, but states are not required to adopt them (Arizona Department of Education, 2011).

There is also a difference in what students are taught and when they are expected to master the material in different countries (Hook, Bishop, & Hook, 2007; PISA, 2009 PISA, 2012). Some educators stated that the United States requires too many topics be taught each year and that many of them are introduced too early and this makes it impossible for students to learn enough about any one topic to be able to fully understand the topic (Sahlberg, 2010; Wagner, 2008). Other top performing countries study much fewer topics, but study them in depth to develop a thorough understanding of each topic (Hook, et al., 2007). Common Core standards may require students to study more topics, but students may not be able to gain a deep understanding of so many concepts.

Student Effort

Though U.S. students' 2005 NAEP results were higher than they had been since 1973, U.S. students performed lower than many other countries on these international tests, and they are also not progressing well on national tests (National Center for Education Statistics, 2011). Some educators believe that students know more than they are demonstrating on tests, but may be unmotivated to put forth the effort needed to show what they really know (Martin &~~and~~ Dawson, 2009). O'Neil, Sugrue and Baker (1996) reported a plan in which a monetary reward of $1.00 was promised to students for each math question students answered correctly on the 1996 NAEP (National Assessment of Educational Progress.) Other students had instructions that said they would receive a great feeling for doing well, and others were offered a certificate for doing well. A significantly greater number of students answered more questions correctly on the NAEP when they were promised a monetary reward. Nichols, Blass, and Berliner (2006) concluded that since there are usually no consequences for not doing well on tests, many

students choose not to try very hard. Though this technique of offering a monetary reward worked for this study, students cannot always be given a monetary reward that will motivate them to do their best. Other incentives do not work for all students. This study also showed that increased pressure to do well had no effect on student math test scores on the NAEP in the 4th or 8th grade.

Other Factors Affecting Student Achievement in the U.S.

Other factors may prove to be more important in student achievement than incentives. NAEP (2009) scores showed significantly higher 8th grade math scores for students whose teachers had a teaching certificate in math or a major or minor in college in mathematics. Much evidence has been collected that suggests that the main factor impacting student learning is teacher quality (Palardy & Rumberger, 2008). Teacher quality also had an impact on 2008 student learning for at risk or low socioeconomic students (Cave, 2010; Pianta, Belsky, Houts, & Morrison, 2008). Teacher quality is a product of many components of teaching skill and knowledge, and there is little agreement as to reasons behind the low quality of teaching in U.S. schools (Amato, 2004; Evans, 2011; Leonard & Evans, 2009). Poor teacher quality is a difficult problem to solve according to Ingersoll & Maynard (2007). Many factors influence teacher quality.

Educational leaders suggest that teacher content knowledge, attitude about teaching math, previous personal experiences learning math, math anxiety and many other factors influence a teacher's ability to be an effective elementary math teacher (Ingersoll & Maynard, 2007). According to Castro (2006) and Brown (2010), teacher preparation programs should spend much more time instructing preservice teachers in how to use various curricula. Teachers need to be able to evaluate the materials they are

expected to use in the classroom and decide how to best teach the material to their students. Castro also stated that teachers must be able to choose the best materials for their particular students to be sure all students receive adequate instruction and practice. By strengthening teacher content knowledge and understanding of the use of curriculum materials, teachers will be able to deliver instruction in ways that will reach more students (Beckman, 2003; Erskine, 2010; Wolters & Daughtery, 2007). Teachers who have more content knowledge have more information to teach their students.

Implications

Though many changes have been suggested for the improvement of student achievement in the elementary classroom in the last few decades (Bloom,1984; Caprano, Caprano, & Helfeldt, 2010; Dufour et al., 2006; Gardner, 1992; Hersh, 1986), no one has yet developed a method of instruction that has improved elementary math student achievement for all students. Because classroom teachers have the most direct contact with students and provide the most instruction in the classroom, it was important to understand their perspectives about mathematics and how their own experiences have affected their ability to increase student math achievement for their students. This explanatory case study may have provided more information to add to the base of knowledge about teachers' perceptions about math and how those perceptions may have influenced their students' achievement. This information has been useful to better understand how teachers' perspectives of math have influenced their development of math skills and to develop curricula for elementary and high school students to influence their success in learning math. Colleges and universities may use the information from this study as they develop teacher training coursework that will help preservice teachers

overcome any experiences that may have negatively influenced their perceptions about teaching math. The project deliverable of a professional development program to help teachers gain more content knowledge and learn new strategies for teaching elementary math, may help the teachers at the focus school be better prepared to teach math to their students and therefore help the students improve their math achievement (Brown, 2010; Cave, 2010).

Summary

This explanatory case study explored a charter school in the Southwest United States where elementary students have been struggling to meet the standard in elementary mathematics as set by the state requirements. Though some leaders in education have offered suggestions as to how raise academic achievement for all students, no method has been shown to be affective for all students. This explanatory case study provided more information to add to the base of knowledge already in existence about how to help raise student achievement by understanding teachers' perspectives about teaching math.

The study sample was six elementary teachers from Kindergarten through fifth grade from a charter school in the Southwest United States. Though Kindergarten and first grade student test scores are not included in the data, these teachers were invited to participate in the study because student academic achievement could not be limited to the teachers in the second through fifth grades. Students had already attended Kindergarten and first grade previously, and those teachers could have influenced the second through fifth grade students' learning. The participants had varied backgrounds in elementary and high school and in teacher preparation programs. The diverse backgrounds of the participants helped provide rich, thick data giving a range of experiences and

perspectives. Data were gathered through questionnaires completed by the participants. The data were transcribed and member checked (Creswell, 2008) to increase trustworthiness. The data were coded and organized into themes and analysis explored the teachers' experiences to gain a better understanding of the teachers' perspectives about learning and teaching math.

After analysis of the data, suggestions were made for the development of an inservice program to help classroom teachers understand how their perspectives about teaching math affect their students' math achievement and how to be more effective teachers. The research design and approach allowed for an effective methodology in which to study the teachers' perspectives.

Section 2: The Methodology

Research Design and Approach

In a charter school in the Southwest United States, elementary students have not become proficient in mathematics at their grade levels (Arizona Department of Education, 2011; GreatSchools.net, 2011) though all of the teachers are considered highly qualified to teach elementary math as a part of the curriculum for the grade level they teach. All of the teachers have been trained in various teaching methods designed to help struggling students (Arizona Department of Education, 2010). The teachers need to become more effective in helping to improve their students' math achievement. It is important to understand what teachers need to learn to become more effective in helping their students learn math

The research design chosen for this study was a qualitative explanatory case study. This design was the most appropriate to study teachers' perspectives about math and how those perspectives may affect the teachers' effectiveness in raising student academic achievement in math. The sample included six elementary math teachers from a small, urban charter elementary school whose teachers had varied schooling and teacher preparation backgrounds. These teachers were able to provide rich, thick, descriptive data about the perspectives of elementary teachers about teaching math. Data were gathered through a review of the literature on the topic, and questionnaires were completed by the participants. The data were themed and coded to draw out and organize relevant information. Class averaged test scores from the state-mandated, yearly Arizona Instrument to Measure Standards tests for Grades 3-5 and the Stanford 10 test for Grade

2, which are available to the public, were used to help determine whether or not individual teacher's students had been progressing academically.

Questionnaires given to the participants through an online survey host were worded exactly the same, which avoided possible conflicts in responses that could have elicited answers based on changed meanings of questions. The open-ended question approach allowed for the broadest responses from the participants which brought rich, thick data for analysis (Turner & Creswell, 2010). Results will be used to develop a Project in collaboration with my committee (See Appendix A).

I created open-ended questions to draw out the teachers' perspectives about learning math and teaching math as they recalled their past experiences and discussed relevant information for the study (See Appendix B). In the questions, I asked participants to remember their experiences and their perceptions about their preparation to teach math from elementary school through college coursework. The teachers had the opportunity to think about the questions and write and edit their responses as often as they chose before submitting their responses. The teachers were given 2 weeks to think through past experiences and remember events and activities that they wanted to discuss in their responses. The questionnaire was accessed by the participants through an online survey host.

Careful consideration should be given to choosing the most appropriate research design for a study. Creswell (2008) stated that a qualitative research design should be used when the variables are not known but would be found through exploring the data. This design was chosen also because it was the most appropriate for "discovering meaning and…to gain insight and in-depth understanding of small groups in a specific

setting (Lodico, Spaulding, & Voegtle, 2010). Case studies are also bounded by a limited number of participants (Merriam, 1998). The small group in the study was the elementary teachers at the local charter school. These teachers had varied backgrounds in teaching preparation at the university level and varied backgrounds in their own elementary and high school learning, which provided rich and varied information about math and how a teacher's perspective about math may affect student achievement.

A quantitative research design was considered, but was rejected because I sought to investigate the perspectives of the participants (Lodico et al., 2010). It would not be useful to quantify the data, but to understand the participants' experiences and perspectives about teaching math. A qualitative grounded theory approach was also considered, but rejected. Though grounded theory researchers use qualitative data gathering methods (Lodico et al., 2010), the data for this study were not used to develop a theory. A phenomenological study was rejected because the participants would not share their individual perspectives of an experience,which is the purpose behind a phenomenological study; instead, the participants shared their own perspectives about teaching elementary math. The participants in this study had varied experiences, which helped them develop their perspectives, so a case study best fit the design needed to gather the appropriate data to understand the teachers' perspectives.

Participants

Understanding teachers' perspectives about their education and teacher preparation would require the participants to remember events in their lives that may evoke varied emotions. These memories could be about their learning experiences, childhood activities, or other events in their personal backgrounds that could cause stress

or discomfort. These memories must be discussed by the teachers for me to understand their varied learning backgrounds and individual differences. Because a researcher does not know how a participant may react during a study, safety protocols must be followed in all research involving human participants to be sure that no participant will be harmed in any way as the study progresses. As the researcher, it was my responsibility to work within the university guidelines to protect my participants.

Protection of Participants

Before beginning the study, it was necessary to plan for the protection of the participants. Walden's International Review Board (IRB approval number 07-24-13-01593d4, expiration date 7-23-14) approval was necessary because of my student status at the university and the use of human subjects (Creswell, 2008; Walden University, 2011). The IRB reviewed the documents to determine if the study conformed to the guidelines under Title 45 CFR Section 46. After IRB approval, other permissions were necessary. Written permission was needed and obtained from the school director. The participants' invitation to participate stated that if they completed and returned the survey, they gave implied consent.

Study data were obtained anonymously from the participants who answered the questionnaire through an online survey host. Because of my roles in the school as a founder and board member, it was important to be sure that the teachers did not feel coerced to participate in the study. Care was taken to be sure that all data were collected anonymously. No questions asked the participants' identity or allowed me to know who had responded to the questions. E-mail was used to invite the kindergarten through fifth grade teachers in the sample to participate; each potential participant received an e-mail

that a study was being conducted about the perspectives of elementary math teachers, about their teacher preparation, and about their perspectives about math. I also explained the study and how they could participate. The e-mail contained all of the information necessary for the teacher to participate in the study. Consent was implied if the participant responded to the questionnaire. The invitation e-mail included an explanation of the study and what would be done with the results, the name and contact information of who could be contacted for more information, that they could refuse to participate or withdraw at any time, and that there would be no consequences for refusing to participate or for withdrawing their permission (Office of Health and Human Services, 2011). The e-mail contained a link to the survey and instructions about how to complete it.

School Permission and Access to Participants

The charter school did not have a superintendent or district personnel to ask permission to conduct the study at the school before asking the director of the school. The director of the charter school was asked in writing for permission to conduct the study using an informed consent form. The director was also assured verbally that the teachers would not lose work time for the study and that the names of the school, staff, and all other information would be kept confidential. Identifiable information was changed to protect the school, staff, and participants.

It is necessary to protect participants in a research study for many reasons. Participants feel more comfortable sharing their personal thoughts if they know that their identity will not be disclosed to others. Because of my acquaintance with possible participants, there was no direct contact with them about the study. Correspondence was only through e-mail to the participants and through the survey host back to me. The e-

mail included information about the possible benefits and possible harm that could result from participating, such as taking time away from other activities and embarrassment because personal information may inadvertently be disclosed as they respond to questions. Though I had no contact with the teachers or students about the study, their publicly released test data were discussed in the study, which may identify a particular teacher with his or her students' grade level. This does not indicate that any specific teacher participated in the study. No personally identifiable information was gathered or was placed on any documents or study notes. All notes and documents not in use were stored in a locked file cabinet in my home.

Participants Profiles

This study's purpose was to examine the effects of teachers' perspectives about math on student achievement in a small charter school. All six elementary teachers in grades kindergarten through fifth grade were purposely chosen and were invited to participate by the school secretary during a teacher's meeting. This sample was selected because they taught students who were failing to make adequate progress; were teaching at the school for a number of years; and were anticipated to have rich, descriptive data for the study (Creswell, 2008).

Participant Demographics

Though there were many differences in the teachers at the charter school, there was at least one similarity. The teachers were all female. According to the U.S. Department of Education (2010), almost 80% of elementary teachers in the United States are female. This does not create a problem because the purpose of the study was to understand the teachers' perspectives at this particular school. Due to the anonymity of

the responses to the questionnaire, it was not possible to match participant demographics to their responses.

The teachers had varied backgrounds in their elementary and high school education. Two teachers went to rural elementary and high schools, one in Arizona and the other in Hawaii, while the other four teachers attended elementary and high school at large urban schools in Arizona or near the east coast.

The teachers also attended various universities to prepare for teaching. Two teachers attended state universities, one in Arizona and one in New York. Two teachers attended private universities; one obtained her degree through an online university, and one teacher completed her degree through a combination of community college and online coursework. All but one teacher completed student teaching in a regular education classroom. The other teacher had teaching experience before completing her degree and did not complete the typical student teaching. The years of teaching experience also varied considerably. The teacher with the least classroom experience had been teaching for 5 years, and the most experienced teacher had been in the classroom for 18 years. This variation in educational backgrounds, professional preparation, and multi-grade teaching experience allowed me to gather in-depth data.

All of the teachers in the study taught within one grade level of the grade they were teaching at the time of the study. After receiving their teaching degree for their state, none of the teachers took extended time off or left the profession for more than a few days during any year.

Table 2

Participants' Education

Participants' Educational Background Data	Number of Participants
Attended rural/urban elementary school	2/4
Attended rural high school	2/4
Attended state universities	2
Attended private college/universities	2
Degree by combination of online/ com. college/ university	4
Completed degree by online university only	1
Participated in student teaching	5
Had teaching experience before degree	1
Teaching experience at time of study	5-18 years

Methods for Establishing Researcher/Participant Relationship

All data were collected anonymously, so this made it difficult to build a researcher/participant relationship. I worked at the high school associated with the elementary school, so I had a working relationship with the participants. In the past, some of them shared their difficulty in helping their students meet the state requirements in math, and a few of the elementary teachers had asked questions about how to best teach specific concepts in their curriculum. It is possible that I discussed my doctoral program with some of them, but, because I had to collect my data anonymously, I was careful not to discuss the project with them.

Data Collection

Qualitative case studies often use several data collection methods (Lodico et al., 2010) including a review of the literature and questionnaires. In this study, I examined the effects of elementary teachers' perspectives about math on student math achievement in their classrooms by gaining an understanding of this small group's perspectives (Lodico et al., 2010).

Instrumentation

Each participant was e-mailed an invitation to participate in the study and a link to the survey with the questions that I created about their experiences in elementary and high school mathematics and how they felt about their math ability to guide their reflections (Appendix B). It was anticipated that the questionnaire would take approximately 1 hour to complete. Questions were included about their college and teacher preparation math courses and whether they felt the courses prepared them for teaching elementary math. The participants were instructed to complete and submit their questionnaire within 2 weeks. This time frame allowed them adequate time to remember events related to the topic and to respond to the questionnaire. The questionnaire was able to be opened and responses changed as often as the participants wished until they submitted it.

Participants were informed that they could discuss the survey questions with others if they chose to do so, but to be sure that the responses were their own perspectives. This allowed me to gather and record richer data for later analysis. The teachers' perspectives were important because they had prepared for teaching by completing their state's requirements and taught using a curriculum that is commonly

used throughout the United States (Charter School Information Packet, 2010). The teachers thought about their own skills and their experiences in elementary and high school and how they were affected by their own successes and failures in math. They thought about whether their preservice teacher preparation adequately prepared them for teaching elementary math.

Through the questionnaire, the teachers were asked questions to help them remember their experiences about their experiences in learning math and their preparation to teach elementary math. My questions focused on six main areas which were selected to help me understand teachers' perspectives about the overarching research question:

- His or her perception of success learning math while in elementary and high school and what experiences made him or her feel that way
- His or her experiences in college math courses that have affected his or her feelings about teaching math
- His or her perception about having an appropriate level of content knowledge to prepare their students for future math courses (i.e., their certificate says "K-8," do they feel they have the math knowledge to change to a higher-grade level and still be an effective math teacher?)
- His or her perception of preparedness to teach math when entering the classroom (ie., If they feel they needed more preparation, what could have been done differently to help them be better prepared?)
- How does he or she feel about teaching math in the classroom
- Adequacy of textbooks and resources for math classes

These questions were appropriate because the purpose of this qualitative study was to explore the teachers' perspectives about teaching math, and knowing about their experiences was important in the exploration and data gathering processes. Varied opinions were needed so the data collected would be accurate (Creswell, 2010; Glesne, 2011) and reflective of teachers' perspectives about teaching math and why they have these perspectives.

Analysis and Presentation of Data

The purpose of this study was to explore the perceptions of the elementary teachers at a charter school in the Southwest United States about their experiences in learning math and how their perceptions may have affected their students' achievement. The study participants were selected from this charter school. Because I knew each of the teachers who were invited to participate, Walden University felt it was appropriate only to collect data through an online questionnaire, which allowed the teachers to remain anonymous. Using only an online questionnaire limited the data that were collected, but according to Creswell (2008), using a questionnaire (survey) allows the researcher to get answers from the participants without biasing their responses. Participants also did not get the opportunity to hear other participants' responses as they would have had if there had been a group interview. I was not able to clarify any responses made by participants, nor did I ask any follow-up or probing questions because I did not know who had made a particular statement, and I was not able to meet with any of the participants. I stopped reviewing here due to time constraints. Please go through the rest of your section and look for the patterns I pointed out to you. I will now look at Section 3.

Most responses were not as fully developed as I would have liked, but I believe I was still able to understand what was meant by the participants (Merriam, 2009). Through an organized study of the data (Hatch, 2002), I was able find themes and plan professional development to help these teachers become more confident in their math skills and teaching strategies that should then improve their students' achievement (Briley, 2008).

To collect data, I created a questionnaire asking teachers about their experiences with math in elementary, high school and college, and other questions related to teaching elementary math and posted it on an online survey host (Appendix B). Participants, Kindergarten through 5th grade teachers at the charter school, received an invitation to participate and the URL for the questionnaire through email. Participants were given 15 days to respond to the questions and submit them to the survey host. To minimize the possibility that I would know which participant was responding to a question, instructions were given for the participants not to include any identifying information in the answers. They were told in the invitation that they could skip any questions they did not wish to answer. Each participant answered every question.

The survey host did not provide any information that could be used to identify a participant. The survey host gave each participant a number based on the order in which they submitted the questionnaire. The participants did not know who had already submitted their questionnaires when they submitted theirs, so the participants did not know what their submitter number was. One teacher did not submit a questionnaire because only five questionnaires were received by the survey host. Knowing that it was

not possible to know for sure who had not responded to the questionnaire added another layer of anonymity.

The questions were open-ended and written to encourage participants to think back to their experiences in math courses in elementary and high school and during their college preparation for teaching, and then give details about their perceptions of their experiences. The six questions were written open-ended to allow each participant to answer each question in depth which gives more rich data than multiple choice or other closed type questions (Creswell, 2008). Each question had a text box underneath for typing the response. Participants could make changes to their responses until they submitted the questionnaire. There is no spell check in the program, and while analyzing and presenting the data I did not correct spelling, grammar, or punctuation. When quoting from the participant, I used the exact spelling as submitted by the participant.

Data Analysis

The data analysis presentation discusses participant responses to each question and then provides a summary of the theme(s) discovered in the responses. Analysis was also done based on each participant's responses to all of the questions. Analyzing using this technique allowed me to understand the perspective of each participant which helped me develop a teacher development program to help each participant gain content knowledge and develop additional teaching strategies.

Credibility and Trustworthiness

Merriam (2009) proposes that "no one can ever capture reality" (p. 214), so it should be the goal of the researcher to obtain results that are credible. The results of a study must also be trustworthy to be useful (Creswell, 2008). According to Merriam,

since qualitative researchers cannot find all of the truth about a topic, they must use several different ways to show that their study is credible, which is the same as the reliability and validity of quantitative research. Creswell also states because there are different types of qualitative research designs, there are different ways to address credibility and trustworthiness. Because traditional member checking would not allow participants to remain anonymous, participants were asked to re-read their responses to the questions to be sure their answers conveyed the intended meaning. Questions were worded so that participants had a clear understanding of what was being asked so their responses were valid.

Another method to determine if a study is credible and trustworthy is through seeking to understand the results in relation to what is already known about the topic (Glesne, 2011). Information from the literature review was used to develop the questions for the participants. This helped me develop an understanding of the participants' comments.

Triangulation is another process that can be used to determine if the data is credible (Creswell, 2007; Lodico, et al., 2010; Merriam, 2009). Triangulation involves the process of using varied data collection methods, such as a review of the literature and questionnaires. Using these data collection methods helps ensure that differing viewpoints and perspectives would be included in the analysis of the data (Merriam). Triangulation also includes cross-checking the data collected from each collection method to look for deviations outside of what is expected. This method of data analysis was used to help ensure that the data gathered was valid by cross-checking participants' responses with data collected through the literature review.

Credibility is also based on the integrity and credibility of the researcher (Creswell, 2007; Merriam, 2009). I took steps to ensure that the participants did not feel coerced to participate or answer questions in a particular way which would have diminished the credibility of the study. Because I know each of the teachers who were invited to participate, Walden University felt it appropriate only to collect data through an online questionnaire which allowed the teachers to remain anonymous. That helped ensure there was no undue stress for the teachers to participate out of any perceived obligation as a friend and coworker or fear of any repercussions toward their employment.

I reflected on possible personal biases and expectations about the topic and took steps to guard against these threats to reliability and validity by not only collecting data anonymously, but also by not talking to the participants about the study or questions. Questions were phrased without biases and care was taken to ask open-ended questions that did not influence participants' responses. Participants were informed of any known biases and were asked to state any concerns they had about the questions or interpretation of it. The participants expressed no concerns. Using these methods helped ensure that the study was credible.

Systems for Keeping Track of Data and Emerging Understandings

Data must be organized to be useful. I created methods for keeping track of data as I followed an inductive analysis approach. This approach required reading and finding themes and patterns. I wrote each possible theme or pattern as it came to my mind, and I labeled each paragraph so that common themes and patterns could be compared to be

sure I understood any slight differences in what the participants wrote in response to each question.

Some themes or patterns changed as I read the responses over again. The themes or patterns developed more fully as I read other participants' responses about the same question. Each of the original responses and the themes I developed from each of them were placed together into a notebook with tabs labeled with the question number and theme. I followed this process over again for each question and all of the responses before I continued to the next question. After moving to the next question, I sometimes developed a better understanding of a teacher's perspective that allowed me to gain a greater understanding of the teacher's perspectives about their experiences they discussed in a previous question.

Analysis of Online Survey

The data from this exploratory case study was analyzed using an inductive analysis approach. According to Hatch (2002), analysis means to organize data and ask questions in ways that allow researchers to find patterns, identify themes, discover relationships, and develop explanations and theories. This approach allowed me to find themes in the responses to each question by re-reading each participant's response looking for themes. I then created hypothetical themes and tested them against the data repetitiously to be sure each theme was truly derived from the data (Hatch).

It was important to choose an analysis method that could be used with a small number of participants. The inductive analysis approach can be used when there are few participants (Hatch, 2002). It requires a thorough investigation of each response to draw out all possible themes for further study, and by systematically searching the data and

asking the right questions, (Hatch) the researcher should gain an understanding of what the participant is saying. Understanding how the participants perceived their math education was necessary for me to create a project for this study. Though a traditional code book was not used, each response was analyzed, and comments with similar meanings were grouped and used to draw conclusions about the teachers' perspectives, and those with no similar meanings were acknowledged and used to develop a better understanding of the teachers' perspectives.

As each of the charter school elementary teachers submitted their answers online, the survey host organized the data by giving the participant a number associated with the order in which the survey was submitted. This allowed me to analyze the data using an inductive analysis approach (Hatch, 2002) from each of the participant's responses to one question and also based on each participant's response to all of the questions. I wrote the responses from the online survey exactly as written by the participants on individual sheets of paper which allowed me to work with each response to a questions side-by-side. This helped me to more easily find the similarities and differences in the responses.

To ensure accuracy of the data, I read a question and then a response (Hatch, 2002). I took notes and made comments about ideas that were developed from the responses. Following an inductive analysis approach, I re-read the question and response as necessary to be sure I understood the response in the context of the question. I continued this process for each participant and question, reading the question again and then re-reading the response. I found that this helped keep the question clearly in my mind. I eliminated parts of responses that did not answer the question or did not offer further explanation of the response to the question. The data that did not fit the question

was transcribed onto a separate document labeled with the question and the participant's submitter number. This data was held for rereading and further analysis.

Each response was re-read several times as I developed themes from the data. There was at least one major theme discovered for each question which helped me understand the teachers' perspectives about teaching elementary math. On a separate sheet of paper for each question, I made a chart listing each theme and then labeled which participants' responses included the theme (Appendix C).

After labeling the themes, I re-read the responses to be sure each statement from each participant that fit the theme was placed in the correct place on the chart. Finally, I paraphrased some of the responses that supported the theme and labeled them with bullets under the questions. Each question and participant responses were discussed based on themes before I continued to the next question. Then a summary of the participants' responses was discussed briefly. (See Appendix C for a transcript of participants' responses.)

Question #1:

How did you feel about your success while in elementary and high school math, and what experiences made you feel that way?

Theme Q1. Negative perception of math in elementary and/or high school

- teachers did not explain "why," just gave a process or comment about not understanding math
- teachers made me feel stupid or ignored me
- middle school or high school was somewhat better for my learning than elementary

- Most teachers (4 out of 5) expressed having a negative perception about math while in elementary and/or high school ranging from despising or hating math to a milder negative perception of it being a challenge or that they did not understand the concepts (Aiken, 1970; Boaler, 2008). Some participants did not state whether they were talking about elementary or high school math. Participant 1 said she "despised math" in high school, because she did not understand algebra. She felt like they were speaking a "foreign language," and she felt "lost and stupid." She did not mention elementary math in her response to this question. All four teachers who had a negative perception of math in elementary and/or high school (Participants 1, 3, 4, and 5) said they did not understand it and that teachers did not help break down the concepts, which they felt would have helped them understand the math better. According to (Slavin & Lake, 2008), concepts are more easily learned when concepts are broken down into small pieces and concepts are taught in a logical order. The teachers felt that this did not happen in their elementary and/or high school years (Amato, 2004; Smith-Jones, 2005).
- Participants 2 and 3 reported that their teachers did not care if they understood why a procedure worked to get the right answer, they felt the teacher only cared that the students memorized the procedures and could use them. Participant 3 went so far as to state that "the arrival of the right answer was never allowed to be challenged or explored." Participants 1,

3, 4, and 5 all suggested that not understanding math concepts led to their negative feelings about math (Beckman, 2003).

- Participant 4 struggled with understanding math and remembers hearing teachers using the word “retarded” before she was given what she considered to be “busy work” for her to do in the back of the room when other students were being taught math. From then on she avoided math “at all costs.” She said she hated math from “my very earliest recollection.”

Not all of the participants felt such strong negative perceptions about their experiences in math, but they were only slightly better. Participant 5 did not “develop the nesesary [sic] concepts for elementary math” and found it “non-interesting.” She felt that middle school and high school helped shape her interest to be better toward math but it was still difficult to learn.

Participant 3 did not learn much from the teacher working a problem on the board, because no one was allowed to ask questions about it and the teacher never presented other ways to work a problem (Boaler, 2008). In high school, she said that they were given textbooks, but few problems were modeled, and then homework was given. The tutoring that was offered did not help. Older brothers and sisters helped her get through the necessary classes for graduation. Participant 2 had a similar experience, but felt that she could follow the procedure being taught to solve a problem, and she could memorize the procedure though she did not understand why. She stated she just “did what she was told.” She too felt that the teachers did not explain anything about the problems, and only gave procedures for doing them.

Summary of Question #1

Four out of five participants expressed strong negative feelings about their experiences in elementary and/or high school math classes. These seem to have centered around lack of understanding of the concepts, because they felt the teachers did not explain why certain procedures should be used to solve the problems. No participants mentioned difficulty learning basic math skills such as memorization of math facts or inability to solve division problems. Their difficulties were in understanding how to solve "problems." All five of the participants discussed struggling in elementary and/or high school. Though each of the teachers attended different schools and most attended school in different states in the United States, the four participants who said they struggled with math all have a common theme: their teachers did not teach them the necessary skills to solve math problems using a method that could help them understand "why" a problem was solved with a certain procedure.

Question #2

What were your experiences in college math courses that have affected your perceptions/feelings about teaching math?

Theme Q2. Math in college was frustrating, but one could gain a better understanding of math from an instructor who could break down the concepts to understandable parts (Ball, Hill, & Bass, 2005). Responses included:

- college as frustrating as elementary and high school
- courses went to fast/the instructor thought you already knew how to do math
- one teacher broke it down so I could understand it

Some participants expressed similar frustration with college math courses as they had with elementary and high school math courses. Participant 2 continued to struggle throughout college math courses, because no one gave information as to "why certain concepts followed particular rules."

Participants 1, 2, and 4 discussed how not understanding concepts during earlier years continued to make it extremely difficult to understand college math courses, Participant 5 said that she learned to teach elementary math through her math methods course and did not give any further details. According to Participant 1, she remained frustrated until she had an instructor who also taught high school. According to Fennel (2007), it is important for teachers to break down instruction into understandable concepts, and this participant felt that her instructor knew how to break down the concepts into steps and could "communicate in a way I could understand. She explained the 'why' part of every operation."

Participant 4 said that her college professors expected students to know how to do math from previous courses and did not take the time to explain to students who were struggling. She also felt that college courses moved too fast and did not give her time to learn how to work a problem before more problems were assigned. During one of her methods courses about teaching math in the elementary classroom, she was told that since you already know how to do it, just tell the students what you do. To her this was obviously no help at all. She wanted someone to help "unravel the unknown," and she was not getting that help.

Participant 1 eventually had an instructor who helped her understand the math by breaking it down into small steps. Participant 3 also had a college instructor who took the

time to explain why and how the concepts were used to solve problems and this helped. Participant 3 was introduced to Marilyn Burns. Participant 3 stated she "loved Marilyn Burns' teaching style, and her assortment of ways of developing the students' learning and thinking of math." Participant 3 explained that understanding the concepts and being shown several ways to teach them made her feel "free to teach" through "more than just the pre-printed pages of a book". She felt that the textbooks made no connections for teachers and students and that concepts needed to be explained and not just given through a book's examples. She felt that Marilyn Burns understood that "all students come into the classroom with different levels of understanding," and it was the instructor's responsibility to go to where each student was and build on their knowledge. Participant 3 decided then that she wanted to be that kind of teacher.

Summary of Question #2

Three out of five participants continued to have at least some difficulty with math in college. Two of the three participants, though, had instructors who knew how to break down the concepts to understandable pieces. One instructor took the time to find out what skills their students needed to learn to be successful in math and taught them. One instructor even had "an assortment" of ways to teach a concept which allowed Participant 3 to feel free to teach math. According to (Briley, 2012; Evans, 2011) teacher self-efficacy is an important part of being a successful teacher.

Question #3

Do you feel you know enough about math to easily teach your students and even move up a grade level or two and still easily teach your students? (Ex: Your certificate

says K-8, do you feel you have the math knowledge to change to a higher-grade level and still be an effective math teacher?)

Theme Q3. All but one of the participants said they felt they could move up a grade level or two and still feel comfortable teaching math. Main themes are:

- at this point do feel comfortable because of "on the job training"
- I do not feel comfortable two years above my grade level
- I can see myself teach several grades above and be comfortable

Only one participant, #4, responded that she did not feel comfortable moving up to a class two years above the grade level she teaches. She believes she could do it, if necessary, but she would not feel comfortable at first because the standards continue to change and she would need to do some studying and learn new skills to be able to move up and be effective.

Though Participants 1, 3, 4, and 5, stated varying degrees of frustration with math in elementary, high school, and college, they all stated that they felt comfortable moving up a grade level or two and still felt comfortable. An examination of their reasons for the change showed that they all had experiences after college that helped them learn math better (Ball, Hill, & Bass, 2005). Only Participant 1 elaborated on the question. She said that because she had “on the job training,” over the last several years, she felt confident in her math skills enough to move up. She stated that her school’s administration had spent time during teacher development classes helping the elementary teachers be better as math teachers and that she had also studied on her own (Hashmi & Shaikh, 2011) All the other participants simply stated that they felt that they could move up and still be

comfortable, but none of them stated their perceptions/feelings about how effective they would be.

Summary of Question #3

The participants all stated they would be comfortable moving up a grade level or two and teaching math. Participant 1's response explained that it was her work after she was a teacher that she believed made her capable of doing this. The other participants just stated they would be comfortable moving up. None of the participants addressed their perception of their level of effectiveness at a higher grade level.

Question #4

Do you feel you were well prepared to teach math, or do you feel that you were not adequately prepared when you entered the classroom as an elementary teacher? (Ex: If you feel you needed more preparation, what could have been done differently to help you be better prepared?)

Theme Q4. One out of five participants said they felt prepared to teach elementary math when they entered the classroom, (Patton, Fry, & Klages, 2008), but the one who felt prepared still felt she needed to know more about teaching math in the elementary classroom when she began teaching. Reasons given for needing more preparation were:

- college didn't prepare me
- still the same thing, no one could explain math
- finally had a teacher who broke down the concepts

Four out of five of the participants expressed that they did not feel that they were prepared to teach math in elementary when they began teaching (Sundipp, 2010). Participants 1, 2, 4, and 5 stated that they felt that their college coursework did not

prepare them to teach elementary math. Participants 1 and 4 said that they only had to take one class on teaching elementary math while in their college teacher preparation program and that it was not enough. Participants 1and 5 believed that their college courses about teaching math should have shown them more step-by-step methods of solving problems so they could teach their students better (Hill, 2009).

Some participants explained that their own experiences outside of their own coursework helped them be better at teaching math than their college coursework did. Participant 1 stated that she attended a private university and was only required to take one math class in her teaching program. This course did not give her any strategies to use to be able to teach. She explained that the course did not give her any "step-by-step" information to help her get "caught up" in math. She believes that she would have been better prepared if she had taken math classes at the community college that were "specifically for teaching math."

Participant 2 felt she was also not prepared, but one course was helpful. This course "focused on math teaching math fundamentals," (Hill, 2009). Participant 4 explained that she was not prepared at all by her course work as she only had to take one course. She stated that, "My personal experiences extended above the level of the class." to learn how to teach math.

Though Participant 3 said she felt "quite prepared to teach math in the elementary level," she did not feel comfortable with "all the learning levels of understanding and development that enters the classroom." She was concerned about how she would find out what each child knew and where to start. She expressed that how to do that should have been taught in teacher preparation courses that she took. Participant 5 did not

directly answer the question, but said she was taught to teach students using “physical objects and experiences and then to explain them to students on paper.” It was harder to teach when the students needed to “work in their minds” to solve a problem.

Summary of Question 4

All of the participants expressed some apprehension about being prepared to teach after completing their teacher preparation coursework and entering the classroom. Most participants did not feel that they had been required to take enough courses about teaching math to their students. Two participants expressed that they only had to take one course about teaching math and that it was not enough. Participant 3 felt prepared to teach, but was not comfortable with all the different levels of the students who were in her class and did not know how what to do about it.

Question #5

What are your perceptions/feelings about teaching math in the classroom?

Theme 5. Enjoy or do not like

- now I enjoy teaching it/ it is easier now.
- still do not like teaching math…boring/abstract ideas are difficult to teach
- math seems to be an easier subject because it is not subjective
- I have grown to enjoy teaching math, but it's because of my on the job training
- so much stress on reading puts math on the back burner

This question prompted the most diverse responses from the participants. Participant 1 said, “I have grown to enjoy teaching math,” but it was because of her “on the job training with it.” Participant 2 said she felt that it was easier because “it is not

subjective" and "there are [sic] more than one way to solve the problems, but the answer is either right or wrong."

Participants 3, 4, and 5 were not as positive about teaching math. Participant 3 did not address the question directly, but explained math's position in the elementary classroom as "math becomes a back burner and is not given its full due" because of "stress that is place upon students learning to read." Participant 4 expressed a preference to teach language arts because it is more creative and easier to bring to life, and she also stated that she thinks math is boring. She does feel that she is "ok with teaching math in my classroom, and just ok." Participant 5 is still concerned with the abstract, the "working in the mind" that was brought out in previous questions (Briley, 2012; Cave, 2010).

Summary of Question #5

Participants 1 and 2 expressed that they have actually grown to like teaching math, though Participant 1 believes that it is because of learning after her teacher preparation program that helped her. Participants 4 and 5 discussed their inability to make math meaningful for the students or help them with the abstract part of math.

Question #6

What are your perceptions/feelings about your textbooks and resources for the math classes you teach?

Theme Q6. Some participants like the new curriculum, but those who do not, do not like it for the same reasons they did not understand math themselves, it goes too fast and not enough repetition. Main themes were:

- it's better than the other one...more explanations

- it's harder, you have to use all of the resoures to reach every one
- it has more resources
- not enough practice problems, goes too fast

The charter school recently changed the textbook series for the elementary math classes K-8. New books were needed because the old books did not cover the common core standards that the state has adopted. The three-five grade teachers were given several of the textbooks to preview in August 2012. The other teachers received their books June of 2013. All elementary teachers began to use the new books for the 2013 school year.

Participants 1and 3 responded that they liked the new series. Participant 1 said that the new "curriculum does an excellent job of breaking things down" and explains the "why part" of math (Hook, Bishop, & Hook, 2007; Libeskind, 2011)). There are also many strategies for teaching students, for instance, she can help those who have different learning styles. Participant 3 likes how the textbook "introduces higher levels of exploring and thinking for the students and teachers." The students seem to understand the ideas, and the teacher finds herself exploring more as well. Participant 3 feels the units are more interesting. Websites are given in the students' and teacher's book that allow the students to find out more about the topic of the problem and how to solve it. Both Participants 1 and 3 like the resources that go along with the book. Both participants would like to have more computers in their classrooms so they can more easily take advantage of the internet resources suggested in the books.

Others are not as impressed with the new series, My Math, published by McGraw- Hill. Participant 2 feels the textbook should only be used as a basis for teaching, but is concerned that unless the teacher uses all the resources, some students

will be “left out.” Each resource offers a different way of presenting the material, so she has to go to every different resource to teach the lesson. In disagreement, Participant 4 does not “really care for the new math curriculum.” She does not feel that there is enough practice work. But she said that she understands why the school had to change. The old series did not cover all of the new standards. Participant 5 would like to see more repetitive and hands-on activities. She felt the “chapters go too fast,” and there is “not enough time for them to learn.”

Summary of Question #6

Participants who said they now enjoyed teaching math or liked math, had a more positive position about the new curriculum than those who felt that they still struggle with math. Two participants gave reasons for not liking the curriculum which were similar to reasons they previously gave for struggling with learning math themselves, wanting more practice problems and having the problems broken down into understandable steps.

Interpretation and Discussion

Analysis of the data revealed two themes that could be used to develop the project for this study. Teachers reported that they did not feel prepared to teach elementary math by their pre-service math experiences and that affected how they felt about math, and they want more content knowledge and strategies for teaching math.

Self-efficacy

Through analysis of the data, themes emerged that helped me understand some of the problems faced by the participants as they prepared to become teachers. Most of the participants expressed strong negative feelings about their experiences learning math in elementary and/or high school and reported that they felt they did not learn math well

during those years. Most also reported that teacher preparation coursework did little to prepare them for teaching elementary math in the classroom. According to Beswick and Goos (2012) and Briley (2012), teachers' feelings about learning math can have a strong influence on their confidence in teaching math and school leaders should provide effective professional development to help teachers overcome those feelings. Teachers who are confident in their content knowledge and strategies are more effective teachers (Briley, 2012; Slavin & Lake, 2008; Sundipp, 2010).

Content Knowledge and Strategies

Participants reported that they wanted to gain more content knowledge and they wanted to know more strategies to help them teach their math students. Some of the teachers pursued their own study of math outside of the regular education program offered by their teacher preparation programs and expressed a desire to learn more. A professional development program designed to meet he specific needs of teachers who feel that they need further preparation could be offered to help these teachers and others who are pursuing an elementary teaching degree be more effective teachers (Cave & Brown, 2010; Lanni, Webb, Cheval, Arbaugh, Hicks, Taylor & Bruton, 2013; Swackhammer, Koeliner, Basile & Kimborough, 2009).

Conclusion

The purpose of this study was to explore teachers' perceptions about teaching elementary math at a charter school in the southwest. Their students have not been progressing academically as much as they should according to test scores released by the state (AZ Learns, 2011). I wanted to know what the teachers thought about teaching math, their own math learning experiences, and how these may influence low student

achievement, and felt it was important to ask the teachers about their own perceptions about math, as this may have an effect on their students' achievement.

Four out of five participants stated that they struggled to learn math in school and did not feel that their college teacher preparation was adequate. Two participants said that they were required to only take one course in how to teach elementary math. Two participants eventually had instructors in college that helped them understand math by breaking the concepts and procedures down into smaller steps.

The problem of elementary math teachers struggling to teach math to their students has been shown to be nationwide (OECD, 2009). Understanding the reasons why the teachers at this charter school feel unprepared to teach math can lead to teacher development specifically designed to ameliorate these problems (Darling-Hammond, 2010; Fennel, 2007; Protheroe, 2008).

Section 3: The Project

Introduction

According to the data analysis, teachers felt that they needed more content knowledge to feel confident to teach elementary math more effectively, and they wanted to know more strategies for teaching their students. The project, a professional development program with three components, was designed to help teachers gain more content knowledge about elementary level math through taking math content courses and to give them more strategies for teaching their students math by working with a math specialist who is known to be an effective math teacher with excellent strategies for teaching her students (Appendix A). Erskine (2010) stated that sufficient content knowledge is important for teachers to be effective in improving student achievement. All kindergarten through fifth grade elementary teachers at the charter school will be expected to participate in the professional development. Section 3 includes the description and goals of the project and a review of the literature discussing professional development as a method of promoting learning of new content knowledge and strategies for teaching math.

Description and Goals

There are several components of the professional development program. These components will help the instructor learn what the teachers need to know about the new curriculum that was selected by the school and provide the teachers with content knowledge and new strategies for teaching math in the classroom.

The first component of the teacher development will be for the teachers to take the final exam from each of the textbooks at all the grade levels kindergarten through

fifth grade. The exams will be graded, and the exams and grades will be kept for an end-of-program comparison. The instructor (math coach) for the teacher development, a high school level teacher at the charter's high school, will then begin to teach the elementary teachers how to do the math from their new curriculum that any of the teachers do not know how to do as shown by their tests and by the teacher's requests. This part of the program will be 3 full days of instruction totaling approximately 6 hours per day. Tutoring sessions will also be scheduled for the teachers throughout the school year at least once per month. These sessions will support the teachers as they include their new math content knowledge and teaching strategies in the classroom.

The second component of the teacher development will be for the teachers to complete three modules of Singapore math training given online through a nearby community college. This will give teachers new strategies for teaching elementary math for all grades kindergarten through eighth grade level. Each module is 6 weeks long.

The third component will be a 2-day, follow-up teacher development workshop in which the math coach will meet back with the teachers to answer any questions they have about the teacher development, including the Singapore math modules, and then readministering the final exams from the textbooks. The exams will be graded and compared with the scores from the first administration as a part of the outcome-based evaluation of the project. The teachers will be given their scores and any additional help requested.

Rationale for the Project

Most of the study participants from the charter school expressed that they needed more content knowledge and teaching strategies to be more effective teachers and to

improve their students' math achievement. This project incorporates the three components and teacher testing to determine any gaps in content knowledge and methods to improve teachers' skills in each of these areas. It is important for the teachers to know content above their teaching grade level to help them understand where their students need to be able to work when promoted to the next grade level. Teachers at the charter school also need to understand and be able to teach the new common core standards that are required to be taught currently.

Teachers also expressed a need to know more teaching strategies to help them break down concepts to reach all students and help them learn. The school recently sent a middle school and a high school math teacher to Singapore math classes, and this is the model that the school would like the teachers to become more familiar with so that they can use the strategies from this program in their classrooms. Training for all elementary teachers in this method will help make it easier for students to transition from one teacher to the next as the teachers will use a comprehensive set of the same strategies in the classroom (Castro, 2006; Swackhammer, Koellner, Basile, & Kimborough, 2009).

Review of the Literature

The purpose of this study was to explore teachers' perceptions about their preparation for teaching math from elementary school through their college preparation courses, and their perceptions about teaching math in the classroom. The teachers indicated that they felt that gaining more content knowledge and learning new strategies would help them be better prepared to teacher elementary math. Understanding their perceptions helped me to develop a professional development plan to help the teachers gain more content knowledge and strategies for teaching math. According to Hine (2015)

and Zweip and Benken (2013), teachers need more content knowledge to be more effective teachers, and although education scholars have tried to create programs to improve math education in the United States (Thanheiser, Browning, Moss, Watanabe, & Garza-Kling, 2010; Walker, 2007), many teachers feel unprepared to teach elementary math, including teachers at this charter school. New professional development may be what is needed to help the teachers at the charter school to improve their students' achievement (Beswick & Goos, 2012; Killion, 2015; Mancelli, 2011).

According to data collected in this study, most of the teachers felt that they needed more content knowledge. Each teacher has state and common core standards to teach that have changed over the years (Arizona Department of Education, 2012; Faulkner, 2013). The addition of math content and new standards has made it difficult for elementary math teachers to help their students learn the new material (The Conference Board of Mathematical Sciences [CBMS], 2012; Nagel, 2013). Most of the teachers felt that their preparation to teach math was not sufficient, and more content knowledge and teaching strategies could help them to improve their teaching (Killion, 2015; Polly, 2015). But the teacher development must address the individual teacher's needs (Cowen, Barrett, Toma, & Troske, 2015; Swars, 2005; Yeh, 2009). Too often, teacher development addresses a particular curriculum or theory (Toh, Daur, & Koay, 2013; Walker, 2007) rather than mathematics content that is taught throughout elementary school (Beswick, 2014). This additional content knowledge will help the teachers be more effective in preparing students for their future math classes because they will know how to structure lessons toward this goal (Lannin et al., 2013). The typical professional development programs offered to teachers, though, may not be effective in helping

teachers to gain new content knowledge and teaching strategies (Pyle, Wade-Woolley, & Hutchinson, 2011).

Professional development must be created to meet the needs of the teachers who will attend and be formatted so teachers will have the most effective learning outcome. According to Walker (2013), teacher professional development should no longer be the usual 1- to 3-day series that most schools still offer. Walker stated that professional development should be grounded in the individual teacher's needs which are discovered through a process of testing or surveys, and teachers must then be coached by someone the teacher knows, like a colleague, to help them develop the new skills. This math coach should be knowledgeable and available to help the teacher through the long process of changing his or her teaching style to what is required in the new program (Guamhussein, 2013). This type of professional development is important because the new common core standards are to be taught by teachers who have not had to do so in the past and were not trained in the new standards before becoming a teacher (Mizell, Hord, Killion, & Hirsh, 2011; Nagel, 2013; Rentner & Kober, 2014).

Teachers may have a lack of understanding of mathematical topics (Newton, Leonard, Evans, & Eastburn, 2012), and this lack of understanding can affect their students' learning. It is important to create professional development that not only supports the participants learning of content, but encourages them to ask questions and have any misconceptions clarified (Vergara et al., 2014). Though it may be difficult for districts, individualized professional development is important (Brown, 2010; Zeichner, 2010), and it should be considered a better alternative to group professional development that may not meet the needs of all of the participants. Desimone (2011), and Jones and

Dexter (2014), stated that professional development that is focused on enhancing content knowledge is linked to improved student achievement. A teacher who has a deep understanding of the content that he or she is teaching can pass along to his or her students a deeper understanding of the content (Schachter; 2015). The students' deeper understanding improves student achievement and prepares the student to move forward more easily as they are introduced to new concepts (Dunst & Raab, 2010; Hine, 2015; Walker, 2007).

Most teacher development programs provide little time for learning, and most teachers do not continue or even begin to change their classroom instruction based on what they were taught during a professional development course (Drago-Severson, 2011; Jones & Dexter, 2014). Taton (2015) claimed that inadequate time for learning in professional developmental has left teachers feeling that professional development is forced upon them so that districts feel that teachers are receiving training, no matter how ineffective it is. The professional development should allow the teachers the needed time to process the material mentally and begin to incorporate their new learning into their classrooms (Beswick, 2014; Mancabelli, 2011). The typical, short professional development programs can even be counterproductive (Christ & Wang, 2013). To be effective, professional development should be what teachers want and in a format that is useful (ongoing, coached) to motivate teachers to learn (Vaughn & McLaughlin, 2011).

The professional development that is the most beneficial for teachers is developed to meet individual teacher's needs (Dunst & Raab, 2012). A coach should be available for an extended period of time so that teachers have time to change their teaching style and become proficient and comfortable teaching using their new skills (Woolley, Rose, &

Mercado, 2013). Walden guidelines require a project study using professional development as the deliverable to include a minimum 3-day professional development program. A 3-day program will be included in this study, but additional professional development will be written and will be included in this study and presented to the administration of the focus school for their consideration. The administration will then have the option of two types of professional development or to use the 3-day and year-long professional development to implement for their teachers.

Potential Barriers

The teachers at the charter school have various skill levels for math. The kindergarten teacher may not need or use the same skill set as the fifth grade teacher because of the skills they teach students in their classrooms, though the teachers' certificates are all K-8. This could be a barrier in the project. Some teachers may not want to practice skills so far above their teaching level. It is expected that all teachers should be able to understand the math concepts and teach at least 2 years above their grade level as stated by the teachers in response to Question 3 in the study. Teachers will be expected, though, to do their best answering the questions from each test.

Other barriers could include individual teacher's desire to build his or her skills. One of the teachers may be about 5 years from retirement age, and this could make it more difficult to get buy-in and full participation in the project. Other teachers may not want to take the extra time it would take to participate in the teacher development. Another barrier could be natural math ability of each teacher. Learning new math strategies or learning strategies at different levels could be more difficult for a teacher with less natural math ability.

Project Evaluation

Evaluation of the project will be based on three separate components: (a) the increase in content knowledge of teachers based on the readministration of curriculum-based exams, (b) their responses to a survey about their perceptions/feelings about their improvement in content knowledge and teachers' new knowledge of teaching strategies, and (c) a comparison of the teachers' students' academic achievement from before the teacher development and after the teacher development.

Project Implications

Student math achievement in the United States is well below that of most other industrialized countries (PISA, 2012). The project's goal is to improve teacher preparation for teaching elementary math by creating an opportunity for teachers to assess their content knowledge of what their students must learn and by providing instruction for the teachers in areas of need and in new strategies for teaching elementary math. The teachers in this study felt that they did not gain enough content knowledge or teaching strategies while in school to be as effective as they would like to be in the classroom. The project's components of instruction are designed to help with this perception of lack of content knowledge.

Summary of Section

This explanatory case study's purpose was to answer the following question: What are the teachers' perspectives concerning their personal experiences in math and teacher preparation? The project was derived from the participant responses, which showed that the teachers felt they needed more content knowledge and strategies to teach math to their students.

The results from this study may be used to improve student achievement through understanding teachers' perspectives about their own learning of math and then providing teacher development to support the teachers in gaining more content knowledge and new teaching strategies to teach elementary math. This project study's components of small group teacher development consisting of an assessment of current content knowledge and then individualized instruction by a math specialist to remediate any areas of need, coursework in math teaching strategies, and follow up to allow teachers to have any further support requested with a final exam and survey to determine the effectiveness of the project study should help teachers to improve their own skills, which may help their students' math achievement (Bursal & Paznokas, 2006).

Gaining a better understanding of the teachers' perceptions in this study, helped me develop a professional development program to provide instruction in content knowledge and teaching strategies to help the teachers be more effective classroom teachers. Though there are limitations to the study and the depth of data that could be gathered, the data collected indicates that appropriate professional development may provide the participants with the content knowledge and teaching strategies to become more effective teachers.

Section 4: Reflections and Conclusions

Introduction

Section 4 includes a discussion of the project's strengths and weaknesses and limitations that may affect the study outcomes. This section will also include my personal reflections about the study and the process. I will then discuss what I have learned about my growth as a practitioner, scholar, and project developer. I will also discuss potential social change that could occur as a result of this project study including implications and suggestions for further research and applications.

Project Strengths

The project study was chosen based on the responses of the teachers who are involved in the day-to-day teaching of their students. The questionnaire given to them to collect data about their perceptions was designed to help the teachers remember their experiences and perceptions about their teacher preparation to reveal the strengths and weaknesses in their preparation. The teachers could openly answer the questions without fear of embarrassment or worry about their employment because the questionnaire was administered anonymously online. The information gathered was useful in the development of the project, which is designed to help teachers more effectively teach their students, especially those who are struggling to make sufficient math progress.

Project Limitations

One of the limitations of this project study is the limited data that could be gathered using only an anonymous questionnaire online. This type of data gathering was deemed the only appropriate method of data collection due to my work association with the teachers in the study. This anonymity did not allow for any follow-up questions or

clarification of my questions for the participants. I could also not ask questions to clarify participant responses. Though the data were limited in this way, the study provided information to guide the creation of a teacher development program to help teachers gain content knowledge and new teaching strategies for teaching elementary math.

A related limitation could have been that the participants did not feel comfortable sharing some of their experiences knowing that I was the researcher and that I may have been able to guess who was "anonymously" answering a particular question. Another limitation in the project was that there were only five participants. This limited the data that could be collected. It is possible that not all of the perceptions teachers had about their preparation for teaching math were included in the limited number of questions posed and responses that were received.

Recommendations for Remediation of Limitations

Limitations may affect the usefulness of a research study (Cresswell, 2008; Glesne, 2011). The limitation of this study that may have had the most effect on its usefulness is the limited data available because the only data collected were through an anonymous online questionnaire because of the working relationship I had with the study participants, the teachers. The responses were anonymous, so there was no opportunity for follow-up questions or any discussions with the participants to clarify answers or to ask probing questions. A future study could be done at a site where the researcher does not know any of the participants. This would allow the researcher to gather data through the use of individual and group interviews and through asking follow-up questions to develop a better understanding of the participants' perceptions. The additional data could

also be used to help determine if the results can be generalized to a larger population (Glesne, 2011).

Another limitation was the small number of participants in the study. The number of participants in the study was limited because the study's participants were elementary teachers, and the school only had six elementary teachers. Only five participants out of the six who were invited responded to the questionnaire. Though this study's purpose was to understand the perspectives of the elementary teachers at this particular school, a future study with more participants would provide useful information from teachers with more varied backgrounds and provide richer, thicker data (Creswell, 2008).

It is important to have as much data as possible and have as many perspectives as possible be included in the analysis so that a deep understanding of the topic can be achieved. Though this study had a small number of participants, the data collected and analyzed were important and helped me to understand the perspectives of the teachers.

Alternative Solutions

The elementary teachers in the study discussed their perceptions of having limited content knowledge and few strategies to teach their elementary math students. The project was created to meet the needs of the teachers by providing the opportunity for them to develop their content knowledge and strategies for teaching elementary math quickly, because they were already teaching and needed to be able to improve their students' academic achievement as soon as possible. An alternative solution could have been to require the teachers to take more college courses, but because the teachers expressed concerns about their previous college coursework and because most colleges do not offer many, if any, courses in how to teach elementary math or improve

elementary math content knowledge, this option was rejected. Any possible solutions must provide content knowledge quickly, meet the needs of each teacher at his or her level of knowledge, and provide new strategies that the teacher can implement quickly so that the students in the teachers' classes can benefit from the teacher development as soon as possible. Testing teachers on the content they were expected to teach at elementary grade levels will allow the teachers and their instructor to target that content immediately. The online Singapore Math courses will provide a program of strategies that all of the teachers will be able to discuss and support each other in learning.

Analysis of New Learning

The purpose of this explanatory case study was to understand teachers' perceptions about their teacher preparation and how it affects their students' achievement. As a teacher, I understand the need for teachers to have deep content knowledge and then be able to use many different strategies to reach all of their students. I did not, however, understand the level of frustration that this was causing the teachers at the charter's elementary school. Through the study, I learned that the teachers knew they needed more content knowledge and strategies to teach elementary math and were willing to take their personal time to improve their skills, but they did not know how or where to begin. They did not know what classes to take and what strategies they should learn to be the most effective.

I learned that, as a teacher and a principal of a high school, I need to share my concerns and information with others. I learned that by asking the right questions anonymously, people are willing to share their concerns so that solutions can be found. I believe that discussion is the first step in solving a problem.

I also learned that choosing a research design based on the type of data needed is essential to gathering useful data. Following a case study design allowed me to gather enough data, even though the collection process was limited to an anonymous online survey. Through the data gathered, I was able to complete the study and gather the information I needed to be able to create a project that should help the teachers improve their content knowledge and skills.

Analysis of Self as Scholar

Scholarship requires perseverance, creativity, and abstract thinking. I have learned that a scholar seeks information through in-depth research of the ideas of others and then uses what is learned to promote positive social change. As I struggled to complete this research study, I learned the importance of organization, that a quality study could take years, and the detail that must be attended to while completing the study is critical. I also learned about my resolve in completing a project that I feel passionate about and that I can do it.

Learning through discovering new meaning and applying it is important for a scholar. I learned that there is much to learn from others in my field and that I need to be open to the experiences of others as I try to find solutions to help my colleagues and their students. Keeping an open mind and knowing that I have much to learn in my field allowed me to learn new content knowledge and strategies for teaching my students.

Analysis of Self as Practitioner

Though I encountered many obstacles involving time, family crises, work obligations, and a lack of understanding about how to proceed with my study, I have learned that I can do difficult things by continuing to work and learn and ask questions.

When it seemed that I had put all I had into it, and still was not finished, a new thought or idea came to me or was presented to me that allowed me to continue.

I have higher expectations for myself since finishing this study, and I found that I enjoy research and gaining a better understanding of others. I want to continue to learn what teachers and others need to be able to improve their skills and then try to find ways I can help provide tools that will help them.

What I discovered the most during this journey is that I will never know enough. I will always need to search the hearts, fears, and joys of others to know what I can do to help them. Just reading about what some people have to say about a problem is not enough to develop a viable solution. I need to ask those who are trying to do their best with a problem what they think and what they think would help them the most. Only then can I hope to understand enough to be able to help create a solution to the problem.

Analysis of Self as Project Developer

The purpose of this project was to understand teachers' perceptions about their experiences learning and teaching math. It was sometimes difficult to keep in mind that I had to create a project to help the teachers. I found myself wanting to make changes to the way I taught high school math because of what I learned. I wanted to do so much and change the participants' circumstances in ways that were not possible. There was not enough time to be able to start over with these teachers and allow them to take math again from the beginning so they could possibly enjoy math and have a change of perceptions. I had to find a place to start helping them based on where they were in their content knowledge and skills because they were already in the classroom and time was important. How many more students would miss out on the excellent teachers these

individuals could be with more content knowledge and strategies to teach math? The teachers needed to be prepared to move forward and continue to learn as math instruction changes to meet the needs of a changing world.

I learned how to complete this study and create the project through the help of my professors and mentors at Walden University and my supportive family who made suggestions along the way that helped me to refocus and return to the plan. I know future projects will also require help and support from others. I did not do this project study by myself.

Reflection

This project has been long, but well worth the effort. I have learned that organization and perseverance are the keys to completing any task, especially those that are difficult and could inspire social change. Creating a project to help teachers improve their math content knowledge and skills in teaching are now a part of my being and why I am a principal. I want all teachers to feel confident that their students are successful because of what the students learned while in their class. This is truly rewarding. I plan to continue to use the skills I have learned through this journey to continue to search out the needs of teachers and help them become more effective in the classroom.

Implication, Applications, and Direction for Future Research

Many elementary teachers struggle to teach math (Protheroe, 2008). The purpose of this study was to understand teachers' perceptions about teaching math and how that has affected their students' math achievement. Understanding why these teachers do not feel prepared was critical in understanding what needed to be done to solve the problem. The data gathered for this project detailed what these teachers believed to be the problem-

lack of content knowledge and strategies to teach math, and the project was designed to improve their content knowledge and skills so they could be more effective teachers.

Implications

Though different schools, districts, and states adhere to different math standards, there is a commonality in mathematics content. Teachers do not all have the same skills, though they are teaching in the classroom (Protheroe, 2008). Elementary teachers need to be prepared with an appropriate level of content knowledge and strategies to be able to prepare their students to be mathematically competent.

Math standards, practices, and strategies have changed over the last several decades due to advances in technology and new discoveries for the uses of mathematics in the world. This study could provide data that could be used by teacher preparation programs to improve prospective teacher courses. Teachers need administrators who will support them and provide professional development that is timely and meets the needs of a changing classroom environment. Teacher development programs developed by districts and schools could use the data from this study to create programs to help their teachers continue to learn and develop their math skills and be more effective teachers.

Applications

The data and project from this study could be useful to other schools. The school in the study is not the only one to have teachers who struggle with student achievement in math (Booker, Booker, & Goldhabe, 2009; Erskine, 2010). The data from the study could be useful to help administrators understand the perceptions of teachers at their school, and the project could be used to help their teachers become more effective elementary math teachers. Though the data and project could be useful for schools and teachers

already in the classroom, it may be better to share the study with those who prepare the teachers before they reach the classroom.

The data from this study could be made available to teacher preparation programs so prospective teachers could be better prepared before they reach the classroom. The perceptions of the teachers in the study could be discussed in teacher preparation courses to bring out into the open the frustration that some teachers have as they enter the classroom and feel unprepared to teach elementary math. Having dialogue about the perceptions shared in this study could help teacher preparation programs be planned to be more effective in helping prepare teachers for teaching elementary math.

Directions for Future Research

The small sample for this study, five teachers who participated at one charter school in the Southwest United States, may not provide enough data to allow for generalization to a larger population. Future researchers should include charter schools in other parts of the United States and larger traditional public schools as well. Through the study of a larger population, researchers would show the accuracy of the findings of this study (Cresswell, 2008) and could add more information that could be useful in preparing all teachers to be more effective in the classroom.

Future researchers should also include a sampling of elementary teachers who are unknown to the researcher so data could be collected through varied methods such as individual and focus group interviews where probing and clarifying questions could be asked of the participants.

Project Impact on Social Change

Students have varying degrees of success while learning math in school. If this project is successful, educational leaders could use this model to improve teacher effectiveness in improving their students' math achievement. A lack of student math achievement in the United States is a national concern (A Nation at Risk, 1983; PISA, 2009), and student improvement is necessary for the United States to maintain its standing in the world's economy (OECD, 2009).

Summary of Section

The purpose of this study was to understand teachers' perceptions about learning and teaching math. Elementary teachers need to feel that they are prepared to teach math to be effective teachers (Aiken, 1970; Briley, 2012). Because not all teachers begin teacher preparation programs with the same math and teaching skills, it is important that these programs be effective in helping teachers to gain content knowledge and to develop strategies to become effective elementary teachers. By understanding the perceptions of current elementary math teachers, teacher preparation programs will be better able to create coursework to meet prospective teachers' needs. With the changes in math standards and content in classrooms, it is imperative that teacher preparation programs have as much information as possible about the perceptions of current teachers about teaching math to incorporate into their programs so that all prospective teachers are prepared to meet the challenges they will face as they teach elementary math.

The data from this case study can be added to the body of knowledge already known about teacher perceptions about teaching math and student achievement. Though the data from this study included only a few teachers, the data are important as they

support a trend (Glesne, 2011) found by past researchers that many elementary math teachers do not feel fully prepared to teach math (Ball et al., 2005; Briley, 2012; Bursal & Paznokas, 2006). This project could have a positive impact on social change as teacher preparation programs in college and teacher development programs use the data and analysis to develop more programs to help teachers be more effective in the classroom. The application of this study could be beneficial because it is current information and could help preservice and classroom teachers feel that their concerns are being addressed as they prepare to be more effective classroom teachers.

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Appendix A: The Project

The data analysis identified two main areas of need for the teachers at the charter school. The data indicated that the teachers felt that they were not prepared for teaching elementary math and wanted help in the areas of acquiring elementary mathematics content knowledge and in learning new math teaching strategies. A typical program of three days of group professional development could be improved upon by extending the professional development throughout the school year and by using a more individualized instructional approach (Brown, 2010; Killion, 2015; Wolters & Daughtery, 2007). Teachers at such a wide range of grade levels (K-5), may have widely varied levels of content knowledge and knowledge of teaching strategies. Using this extended professional development plan as a guide, the focus school's administration may be able to provide the teachers with an effective program and help each teacher develop math content knowledge beginning at current levels of knowledge (Erskine, 2010; Cowen, Barrett, Toma, & Troske, 2015; Hadley & Dorward, 2011; Hine, 2015).

The teacher development plan will address both areas of need indicated by the data analysis. The content knowledge component will be addressed through math coaching in content knowledge by a teacher from the charter school's high school math department. Professional development may be more effective if provided in a coaching type of setting with someone the teacher knows, such as a colleague, and feels comfortable with when asking for help (Killion, 2015). Teaching strategies will be addressed through the 3-day professional development math coach lessons and teacher participation in three community college courses of elementary level Singapore Math. As the teachers progress through their coursework and receive individualized instruction by

the math coach, it is expected that the teachers will learn more about mathematics and become more effective in teaching elementary math and their students' academic achievement will improve (Swackhammer et. al, 2009). The plan's projected start date may be adjusted based on approval by the district.

Components of the Teacher Development Plan

The teacher development plan has three main components which are (a) testing to determine individual teachers' areas of weakness using the My Math series from McGraw-Hill, (b) montly math coaching by the math coach from the high school to help teachers gain content knowledge, in these areas, and (c) the research-based coursework from the community college's Singapore Math courses to help teachers learn new strategies and concluding with a two day follow-up by the teachers and math coach to give teachers the opportunity to ask any final questions and to celebrate their successes. A fourth component has been added as a Walden University requirement to create a minimum 3-day professional development workshop which is included in Appendix A. The district will have the option of whether to include the 3-day professional development in their program.

The Kindergarten through fifth grade teachers will meet the first day of the professional development program with administration and the math coach to discuss the plan, expectations for successful completion of the professional development program with the math coach, and the requirement to maintain a passing grade in each of the three Singapore Math courses. Testing will also begin this first day of the the session and will conclude by the morning of the second day. The math coach will begin teaching concepts that are used by the math coach including some Singapore Math methods, the Austrian

Method of Subtraction, division by addition method, fraction methods, and creating equations to solve math word problems. During the first three days, the math coach will also schedule monthly tutoring sessions with each teacher. The two days of follow-up will occur for two consecutive days after teacher check-out day at the end of the school year.

Goals

The data analysis indicated that teachers wanted professional development to help them gain content knowledge and learn more strategies for teaching math. Therefore, there are two goals. The first is for teachers to gain content knowledge and understand the math concepts contained in the My Math curriculum from McGraw-Hill which is the current math text used by the teachers. The math coach will tutor teachers individually in their areas of need. The second goal is for them to learn new math strategies for teaching math. This will be accomplished through math coaching and by teachers successfully completing the three online Singapore Math courses at the elementary level. The goals will be met if the survey at the end of the professional development program indicates that at least four out of five of the teachers who participated in the program rate the professional development program a minimum of 4 on the scale for six or more questions out of the first nine questions. Question 10 is for administrator use only.

Testing and Math Coaching (Tutoring)

Individual or small group tutoring can be an important component of a teacher development program (Brown, 2010). During the first two-day session of professional development, teachers will take the first through sixth grade final exams from the currently used math course texts, My Math (2013) published by McGraw Hill. The math

coach will grade the exams and create a needs profile for each teacher to be used to develop a tutoring plan. Through the tutoring component, teachers will receive help in specific skill areas in which they say they are not comfortable teaching or test scores indicate they do not fully understand a concept. Each teacher will meet with the math coach as often as practical, but no less than once per month during the school year for at least thirty minutes for each tutoring session.

The teacher's first activity is to take the final exams from each student grade level textbook, grades one through six (there is no Kindergarten final exam). Though the tests will not be timed, it is expected that it will take no longer than two days for the teachers to be finished with the testing. As teachers finish each grade level test, the math coach will grade the tests and develop an individual plan for each teacher including the number of hours recommended for the teacher to meet with the math coach for tutoring each month. Teachers will meet with the math coach on the second day of testing, after their tests have been scored by the math coach to receive their scores. The math coach will provide each teacher with a list of the concepts they did not answer correctly, and a recommendation for a schedule for coaching sessions. Each teacher and the math coach will schedule times for coaching each month for the next nine months when they receive their scores based on the amount of time the math coach feels will be needed to teach the needed skills. The math coach will also help teachers as needed as they take the Singapore Math courses throughout the year. Additional time may be added or eliminated from the coaching schedule based on individual progress.

The math coach will provide administration with the scores for each teacher's exams and the schedule for coaching sessions. The coach will maintain a record of the

skills taught, examples of work completed by the teacher, and a record of attendance at the tutoring sessions and submit these to administration monthly. Administration will review the records and may attend some of the coaching sessions and provide feedback to the teacher and coach regarding progress.

The coach may recommend teachers receive tutoring in groups if more than one teacher needs help with the same skill. Teachers may also request group tutoring. The tutoring is an important component of the teacher development plan and teachers will be required to meet with the math coach as the schedule describes.

Course Work

The second component of the teacher development plan is the completion of three Singapore Math online courses through the community college. The charter school administration recommended these courses for the elementary teachers as a research-based program for helping teachers learn how to solve word problems. The courses are designed to offer teachers new strategies for teaching students a systematic approach to solving math problems. Teachers will take all three courses in order: Singapore Math: Number Sense and Computational Strategies, Singapore Math Strategies: Model Drawing for Grades 1-6, and Singapore Math Strategies: Advanced Model Drawing for Grades 6-9. Though none of the teachers are teaching sixth through ninth grades at this time, the Singapore Math content at the sixth through ninth grades completes the Singapore Math program and can help teachers understand what will be expected of their students in future grade levels. Teachers who know what their students will be expected to know in future courses are better able to prepare their students to be successful in higher level math courses (Abrams, 2011).

Course names and a summary of the course content and start dates will be written on the teacher development calendar kept in the school's tutoring lab and in the administation office as the dates become available. The teachers will check the calendar each week at the regularly scheduled Monday teachers' meeting to select their courses. All of the courses begin every two weeks during the school year. Teachers must work through the courses in order, but they may choose start dates that meet their needs as long as the courses are all completed before the end of the school year. This will give time for the math coach to work with them if there are any questions about the last course before the teacher development completion date.

To enroll in a course, the teacher will notify administration of the course and start date they have chosen and administration will pay for the course and give the teacher their username and password. Teachers will work on the courses independently and make any notes or copy any of the coursework to show the math coach if the teacher needs help. (The math coach has taken all three courses in the past and so is familiar with the coursework.) The courses include tests which will be printed after being graded in the course, and then given to the math coach so that progress in the courses can be monitored and tutoring offered if necessary.

Two Day Follow-up

The last component of the teacher development plan will be a two day workshop after the teacher check-out day at the end of the school year. The teachers will re-take the final exams from the first through sixth grade textbooks on the first day. The math coach will grade the tests as they are completed and prepare any additional training needed by teachers so they are able to understand and correctly solve all of the questions from the

exams. even if this takes time beyond the completion date of the teacher development program. The math coach will have a group discussion with the teachers about the Singapore Math courses and offer any tutoring that teachers request. The math coach will return copies of the course tests and coursework so that teachers will be able to review and remember any concepts they struggled with so they will not forget important concepts that were difficult and get extra help from the coach.

On the second day of the follow-up, the teachers will have an opportunity for tutoring. The afternoon on day two, teachers and the math coach will have at least an hour to discuss their thoughts about the teacher development program. They will also have the opportunity to celebrate their accomplishments. Certificates will be awarded by the math coach and administration to document their completion of the teacher development program. Administration will leave and the math coach will distribute the end of program questionnaire. The questionnaire will be a ten question likert scale document that will be completed individually by each teacher (See Appendix E). After a teacher turns in the questionnaire to the math coach, they will be excused. The math coach will collect all of the questionnaires and average the scores on questions two through nine. Questions 1 and 10 are not relevant to the teachers' feelings about the effectiveness of the teacher development program. The math coach will calculate and not the average score for each question and then calculate the average score for questions two through nine and submit this and any other documents from the teacher development sessions to administration within two days of the end of the program. The questionnaire averaged scores, changes in teachers' scores from the two administrations of the final exams, and the Singapore Math course grades will be used to determine the success of the

teacher development program. Success will be achieved if at least three out of five of the teachers feel that they have gained content knowledge and strategies and that their time spent doing the professional development was worth it.

Training Goals and Outcomes

A teacher development plan should have clear goals and outcomes that can be assessed. There are two goals of this plan: teachers will gain math content knowledge that will allow them to feel prepared to teach their students, and they will learn new strategies for teaching their students so they can effectively teach elementary math and improve their students' academic math achievement. To assess whether teachers have gained content knowledge two types of information will be collected. The coach will maintain records showing each teacher's work including their initial tests and scores and work completed during tutoring, and their end final exam scores. The coach will evaluate the teacher's progress with a letter grade based on the teacher's mastery of content. The coach the Kindergarten teacher. The professional development will be deemed ineffective if either of the two measures, growth of number of correct answers from the beginning to the end of program test and is not met. Since it is not expected that the teachers' student test scores will be available before the end of the teacher development program, these scores cannot be used this year as part of the teacher development assessment, but may be used the next school year and beyond.

Intended Audience

The intended audience for this teacher development will be stakeholders at the charter school. The elementary teachers will attend the coaching sessions and complete the Singapore math courses. The math coach will administer the final exams, recommend

tutoring sessions to meet teachers' needs, tutor teachers, communicate with administration about each teacher's progress, compare initial and end of plan final exam scores, and submit grades. Administration will oversee the process giving recommendations as needed. The results of the study and recommendation for professional development will be shared administration who will submit a report to the governing board at a regularly scheduled board meeting as soon as practical after the end of the program.

Timeline

The charter school has asked that the teacher development program be completed during the 2016-2017 school year. After Walden University approves this project study, I will meet with administration the findings of the study and the recommendations in the teacher development plan and answer any questions administration may have. Expectations of administration will be clearly stated and guidelines for teachers will be approved before the beginning of the school year when teachers meet the week of August 17th.

The math coach will administer the final exams to the teachers the first two weeks of the school year and make recommendations for a tutoring schedule the third week. Teachers will sign-up for the Singapore Math courses as soon as the courses are made available and take them in the correct order. The teachers will attend tutoring sessions as recommended by the math coach and administration. The first week of June 2017, the teachers will re-take the final exams and the math coach will grade them and assign letter grades to each teacher based on their mastery of the concepts taught during tutoring, Singapore Math course grades, and final exam scores from the end of program testing.

Teachers will meet with the math coach for a final discussion of their test scores and grades before the teachers complete the end of program questionnaire.

The teachers will complete the end of program evaluation questionnaire after they receive their final exam scores from the math coach. The math coach will submit all documents and scores to administration by the end of the third week of June 2017. Administration will compile the information collected and prepare for a meeting with the governing board. No personally identifiable information will be discussed at the board meeting, but teachers and the math coach will be invited to attend the board meeting to hear the discussion of the teacher development program. Time will be given at the meeting after the presentation for teachers and math coach to add any comments they wish to make. After careful consideration of the professional development program's effectiveness, the governing board, administration, the math coach, and the teachers will determine if any further action should be taken.

Day 1

Materials:

White board/markers

Projector and PowerPoint Slide1

McGraw Hill test pages for grades 1-4, scratch paper, pencils for teachers

Answer Keys for trainer

Hundreds Number Chart

(Calculators are not allowed for any of the tests.)

8:30- 9:00 am Greeting and introductions as needed

- Administration will explain the professional development program and the school's expectations for successful completion. Q and A session.

9:00-10:00 am

Teachers will take the grades 1-2 tests.

10:00- 10:15 am Break

10:15- 11:30 am Presentation of concepts

- Don't do it on paper first....use concrete items!
- Counting from zero/ charting numbers 1-100

- Grouping by tens/ count by 10's, add by 10's
- Decomposing numbers

11:30- 12:30 Lunch

12:30- 1:30 pm

Teachers will take grades 3-4 tests.

1:30- 1:45 pm Break

1:45- 3:30 pm Presentation of concepts

- Place value
- Vocabulary
- Austrian method of subtraction
- Reading big numbers
- Throwing out problems all day

Assessment of learning: Teacher observation, questions and answers during presentation, review of teachers' class notes to be sure of understanding. Re-teach any misunderstood concepts during the next day of training.

End of day 1

Day 2

Materials:

White board/markers

Projector and PowerPoint Slide 2

McGraw Hill test pages for grades 5-6, scratch paper, pencils for teachers

Answer Keys for trainer

(Calculators are not allowed for any of the tests.)

8:30- 9:00 am Greeting and Teacher get-together-time

9:00- 9:15 am

Review day one concepts. Math coach will answer any questions

9:15- 10:30 am

Teachers will take grades 5-6 tests

10:30-10:45 Break

10:45- 11:00 am

- Teachers will write down any question numbers they had trouble with for the coach to plan to teach the next day.

11:00-11:30 am Presentation of concepts

- They only have to memorize 15 multiplication facts- show tricks

11:30-12:30 Lunch

12:30- 1:45 pm Presentation of concepts

- More than one way to divide- and it's not by multiplying down the side of the paper use- addition to divide
- Fractions are just pieces so compare them to understand them...ordering fractions

1:45- 2:00 Break

2:00-3:30 pm Presentation of concepts

- Order of operations
- Solving equations with a box, a blank or a variable
- Writing equations from words

Assessment of learning: Teacher observation, questions and answers during presentation, review of teachers' class notes to be sure of understanding. Re-teach any misunderstood concepts during the next day of training.

End of day 2

Day 3

Materials:

White board/markers

Projector and PowerPoint Slides 3, 4, 5

Paper, pencils for teachers

Certificates of Completion for Participants signed by administration

8:30-9:00 am Greeting Teacher get-together-time

9:00-10:30 am Presentation of concepts

- Decimals work the same way
- Percents like an equation
- Build a mixture problem

10:30-10:45 Break

10:45-11:30 am

Teachers work in groups to solve problems from concepts taught (worksheets)

11:30-12:30 Lunch

12:30- 1:30 am

Set up tutoring schedule with individual teachers

1:30- 3:00 pm

- Go over group work. Ask for other strategies that were used to solve any of the problems and discuss.
- Discussion of expectations for completion of individual components of theprofessional development- completing Singapore Math Courses and tutoring sessions with the math coach3:00-3:30 pm
- Coach and administrator closing remarks. Recognition of accomplishments of teachers. Presentation of completion certificates by administration.

3:30- 4:00 pm Refreshments and feedback.

Day One Trainer Notes

1. NOT on paper first!!!! Always teach concretely then use paper and symbols. Children need to touch and see as many things as possible, especially when they are young.

2. There are many ways to understand something...just like there are many different ways to make a sandwich. Students don't all get it the same way, though everyone learns the same way-by thinking, and the teacher needs to understand multiple ways to solve math problems so the students can have many ways to think about the problems. This first three days of professional development is meant to help you develop a few possibly new ways to look at numbers and things you can do with them. Some of what you will see is content knowledge and other things are teaching strategies. Let's start with counting.

3. Starting with zero instead of one to teach counting helps students understand the purpose of zero. After all, we have nothing before we have one! (Show hundreds chart.)

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89

90 91 92 93 94 95 96 97 98 99

Both columns and rows follow 0 through 9...much less confusion! We always start in the ones column to build a number though we read from the other direction (that's just how it's done-get used to it and teach it!) Look at the columns- the ones column number is the same as we go down which shows adding 10. Going through a row, the 10's number doesn't change until we have added 10 to the row, then we have to show that we have ten more by changing the 10's column number and we start over again until we fill up to 10 again.

A little more.... Show teachers that building 10's is much easier by showing that the last number always follows order, but so does the first number. We can only put up to nine in a column so we don't want to cause confusion by going to 10. This is the first place students start getting confused about numbers, and it happens in Kindergarten! Tell students that zeros are place holders and mean there is nothing for that column, but that zeros are so important we want to understand them. (Explain how zero works and keeps a column filled so we see that we have two or more columns, just none for that column.)

Once students are comfortable building a chart through nine, they can add to it easily! Use the chart to count by 10's from any number, it's easy to just drop to the next row. Really push knowing how to change things by 10 and when we go to the next row, we made a new group of 10 to get there. Talk about how the tens you already have can be grouped together or taken apart to use when needed.

We need to teach children to take apart numbers. This is called decomposing in Singapore Math...students learn every possible way to break a number apart and the groups that can be made to equal it. This will help them with mental math later. Be sure

they can do all numbers through 10 before you go farther. This will also help them memorize their facts. Decomposing also helps them develop their own methods of combining numbers-much better when they start adding officially because they are already doing it, and subtraction will also make much more sense.

The next thing is helping students add, that means AND. When we add we do something more to the number we already have. This concept is important to know so we know what we are trying to do. Get one cube, AND now get another, how many do they have. And means to do something more and that is add and the number of what you have gets bigger. Vocabulary is important so use it wisely. Have the children say it the way you do and get comfortable with it. Use the correct words along with what they mean as often as possible when teaching a new word or concept. Using AND for addition will be important in understanding addition of integers later on. We are building with everything we teach. Think of how what you say and do will affect the children later in their math studies.

Say: If I have three AND get 2 more, how many do I have altogether? Altogether means I don't stop with only three-I keep going and count both piles without stopping. (Count with them many times). Don't do it on paper until they do it proficiently out loud. Have each child do it for you individually. Check them!!!!

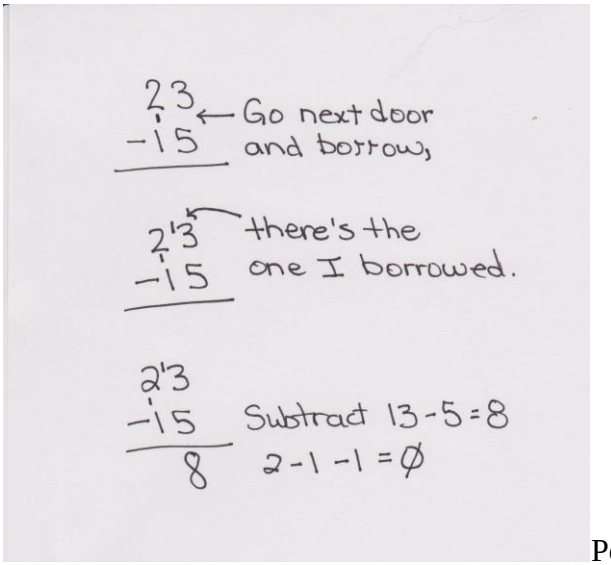
Say: I have three AND I add 2 more, that means the same thing as I get 2 more. How would you tell me to add 3 and 4?

Now that they are great with adding one digit numbers, show them that it doesn't change with double digit, etc. No carrying yet. The My math series does a fine job of teaching carrying and the vocabulary is what they need for the state tests. Use it! Next

concept: Subtraction. Just as with adding you say "If I have one and then... this time it's take away...what happens? The number gets smaller because we took some. Have children see the difference between adding and subtracting...don't just think it's obvious to them, it might not be. Again do all this concretely before expecting students to write it on paper.

Doing double digits without borrowing needs to happen until they are comfortable. Then we change it up with what most people are used to for borrowing. Use blocks of 10 things hooked together somehow to work with double digits. Then show it works the same way no matter how many columns you have. You could draw a page with columns to help students keep it straight.

Then for borrowing. Show breaking apart the ten next to the ones column singles so there will be enough and how that takes a 10 from the 10's column. Use objects, draw things, whatever it takes. Be sure they understand they are taking 10 from the next column because each change in the number there tells how many groups of 10 are there.



PowerPoint Slide 1

Ask what would they do if they had 23 items and needed to take away 15. That's easy if you are just counting back and taking things away. What if it's on paper and you don't have items. You could draw them all out, but that would take too long with really big numbers. We have options. Remember that the column next door has groups that can be broken apart and used to have enough. Show on paper the Austrian method explaining as you go.

Say: If I have 3 can I take away 5? Nope....go next door and borrow, as you put a small number one under the 2, and there's the one I borrowed, as you make a small number one by the 3. That's now 13 because the 10 you borrowed and the 3 you have equals 13. Now you can take away 5 and get 8. Write that so you don't forget it. Now go to the next column. Take the one you borrowed from the 2 and take away the one that's part of the 15 and you have none left there. It's not going to hold a place so don't write anything there.

Practice this several times the get the kids excited with a huge problem and show how fast they can subtract using this method. Always say the process as you do it. Maybe let some of the kids race each other to get done. Any child or adult at any age can change to this method with just a little practice. And you don't have to teach different steps to teach borrowing across zeros. The same words and process works for that too!

Reading Big Numbers

Reading big numbers is very challenging for some students. Place value is not always an easy concept to understand. By the middle of first grade, students can learn about very large numbers, if time was taken to teach place value to 100. They need to understand that each time we fill a column after nine things, we move to the next column.

The numbers would soon get very hard to read if we didn't break them up into pieces, so every 3rd column, we put a comma. Each comma has a name. To read big numbers, we read the numbers between each comma, and then say the comma's name. Example: 435,675 is read: four hundred thirty-five (say the name of the comma) thousand, and finish reading six hundred seventy-five. Show many examples and add commas to make the numbers bigger. Students only have to be able to read numbers to 999 and memorize the names of the commas!

Throwing Out Numbers All Day

Use numbers as much as possible throughout the day. Have students count and calculate. Give them mental math problems as well. Be sure to make some of them challenging (those who are a little more advanced will appreciate it.) You can even have students explain how they got the answer. They may love teaching the class how they did it. Accept multiple correct ways to work a problem. Encourage multiple ways!

End of day one trainer notes.

Day 2 Trainer Notes

Multiplication facts are not as daunting as many students believe them to be. There are not 100 facts that need to be memorized. Yes, there is multiplication involved, but we don't have to show them 100 facts at once.

If you look at a chart, there is a row of zeros, ones, twos, fives, tens...and if you learn the threes, you also learned one of the fours. If you learn from the double numbers such as 3x3, 4x4, etc. you have learned all of the ones before it that belong to the facts. Draw the chart on the board and wipe out the ones that are the same and ones that have the easy rules. Show how the nines work. Explain that the products for the nines tables have a unique pattern. Write this chart on the board in front of the teachers so they start thinking about the ways they have learned how to remember the nines.

1	2	3	4	5	6	7	8	9	10
9	9	9	9	9	9	9	9	9	9
09	18	27	36	45	54	63	72	81	90

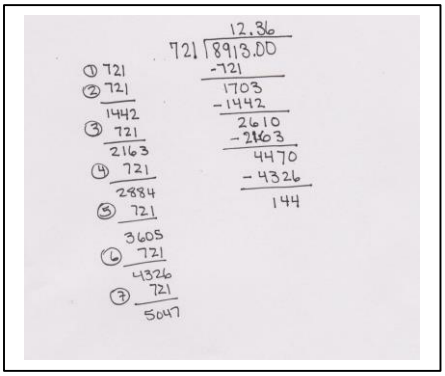
To find each answer, look at the factor that is not the 9. Take one away from it and use that as the first number in the answer. Then figure out what must be added to the first number to reach nine. Example: 3 x 9 = 27, take one away from 3 and get 2, then 2+7=9 so the answer is 27. This works for all of the nines except 0x9, and we already know zero times anything is zero. When you have shown the previous "tricks", you are left with 15 facts to learn.

These facts are learned one each day for fifteen days. Take a piece of paper and fold and then tear the paper into six rectangles. Write the same fact and its answer on

each rectangle. The students should put one fact on items they will see often each day, such as the bathroom mirror, the bedroom door, etc. Then as they see one of the "flash cards," they are to look at it and say the fact, then with their eyes closed, visualize the fact while they say it. Then go on about their day. Do this each time they see the fact. At bedtime, they should close their eyes, visual the fact, and say it without looking at it first. If they know it, the next morning, change all but one fact to another fact they want to learn. This is especially useful for teaching students that think they will never learn the facts, because there are so many.

More Than One Way to Divide:

Division can be difficult for students. There are many steps and many ways to make a mistake. If one doesn't know all of their facts or have a way to figure them out quickly, then it's nearly impossible. Unfortunately, this is the time when many students stop learning math-it's just too hard to do it-their lack of knowledge caught up with them and they can't do the problems. Teach the add to divide method.



PowerPoint Slide 2

Step 1: Division is putting the dividend into groups the size of the divisor. Ask- if I have 8 can I make a group of 721? No. If I have 89 can I make a group of 721? No. If I have 891 can I make a group of 721? Yes, so my first answer will go on the last number of

891. To find the answer, write 721 on the paper and continue to add 721's until your answer passes or is exactly 891. Label each 721 showing how many of them you added to get past 891. Draw an arrow to the answer to the addition problem where it past 891.The number of times you added 721 which should appear just above the arrow will be placed on top of the division box above the 1 in 891. The answer the arrow is pointing at will be subtracted from the dividend then bring down the next number. Add again if necessary on the side to reach the number you got when you subtracted and brought down. Continue to do this for each number needed. This method is not ideal and student should still learn their multiplication facts, but for those who haven't and must move on in math, this is an option.

Ordering Fractions

Ordering fractions can be time consuming if one has to find common denominators for them and compare numerators. It's much easier to cross multiply bottom to top and compare the products. The one with the biggest number on top is the bigger fractions. Show examples.

Order of Operations

Show examples of positive and negative number addition and subtraction. Addition is read as "and", subtraction is to be changed to addition and the sign next to it changed to its opposite. We say "change the sign and the one next to it.

When multiplying and dividing, if the signs are the same, the answer is positive. Show several examples of building problems to lengthy ones with multiple numbers.

PEMDAS (Parenthesis, Exponents, Multiplication, Division) is the key to the order in which all problems are solved. Students must work from left to right across the

problem doing all parentheses and exponents as they are encountered in order, the start again and do all multiplication in order as encountered, then start again and do all addition and subtraction in order as encountered. For the first example, the student would multiply +5 times -3 first. Then start over and add -3 to the first answer, the change the subtraction sign to addition and the negative sign on the -6 to a positive sign and add to get the answer. Say if I have five times three and the signs are opposite, I get -15. Then if I owe three and owe 15, I owe 18. Then I have +6 so I owe 12 or -12.

(-3)+(+5)(-3)-(-6)=

Another example: (+12/3)-(+3)+(+2)(+3)-(-4)=

Solving Equations:

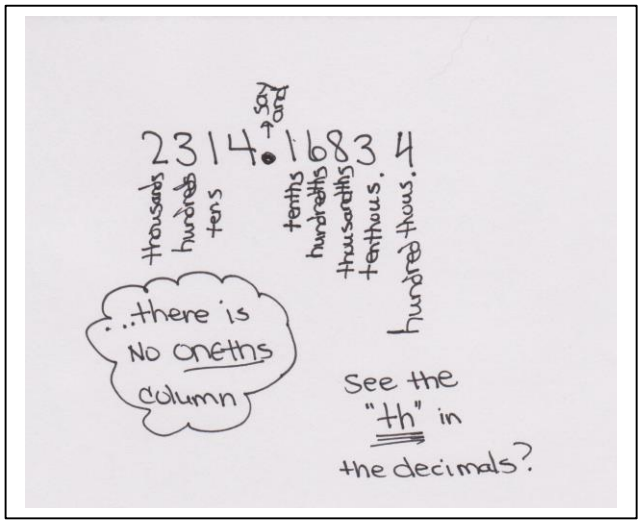
Most textbooks show boxes, blank lines, or open places in equations for younger students, but they have not been told that these are equations, and they have not been shown how to solve them as an equation.. Students can be shown examples with concrete objects such with one of the same thing on each side and an X on one side and a number on the other. Show how taking away the same thing from each side shows what the X equals. Do this several times. Then show adding to both sides, etc. Show several examples. After students understand how this works it is much easier to put it to paper for them. Ask, what is the object of an equation? To get the variable by itself- and keep doing the opposite operation to everything on the same side as the variable, and what you do to one side you do to the other side as well. Example problem: Find two consecutive numbers whose sum is 17. Show how to make blanks, the addition sign, and the equals sign. Define all vocabulary. Show that both odd and even consecutive numbers are X and X+1. End of day 2 trainer notes.

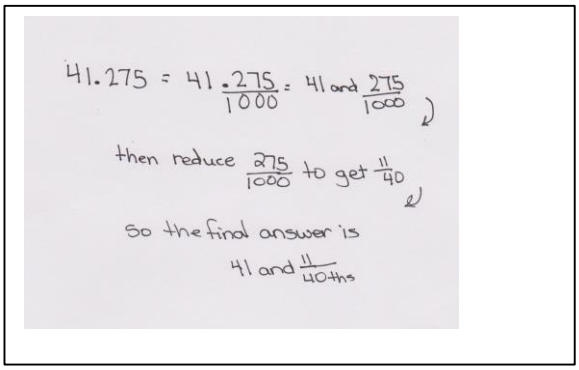
Day 3 Trainer Notes

Decimals

Students learning about decimals need to understand that decimals are written going the "other way," from the way we build whole numbers, because they are smaller than whole numbers. Break or cut some things into pieces. Tell them that we usually call things like that 1/2 or 2/3, but they can also be called by decimal names. Ask students how many pieces would they need to break a candy bar into to share with 2 other friends. Be sure they understand they are not using 2 or 3 candy bars in their thoughts!

Explain that sometimes the number of pieces get to be too many to want to write as a fraction, and there are other reasons to want to write the parts of a whole differently. Decimals are another way to write fractions. (Teach place value of decimals. Then show how to write zeros under each number and a 1 under the decimal point to read the decimal.)





PowerPoint Slides 3 and 4

It is important to practice this at the beginning of teaching about decimals because students need to understand how to read something complex before they can use it.

Percents Like an Equation

Many students get confused about whether they multiply or divide to find the answer to a percent problem. Setting them up like equations makes it easier, because one just solves an equation. There are 3 types of percent problem wording:

30% of 180 is what?

30% of what is 60?

What percent of 180 is 60?

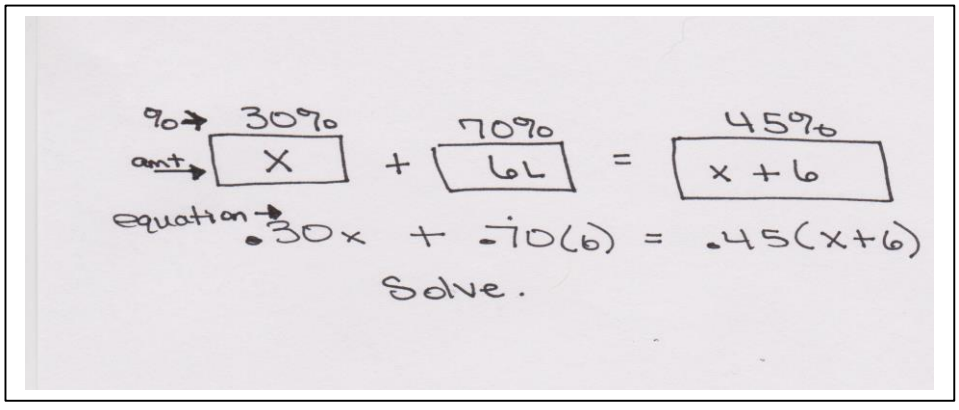
Use ___% of _____=_____ Say blank percent of blank equals blank. Fill in the blanks. Do several of each kind.

Build a Mixture Problem

Now to use percents. Mixture problems are a common type of problem in testing. Using percentage set up can make it much easier.

Problem: How much 30% acid solution should be mixed with 6 liters of a 70% solution to make a 45% solution? Show creation of the box+box= bigger box.

PowerPoint Slide 5



Set up the equation by multiplying what's on top of the box by what's inside the box. Notice the addition sign in between the boxes. That is what goes inside the box on the other side, and in an equation what's on one side equals what's on the other side.

End of day three trainer notes.

Test pages for participants from McGraw Hill- My Math (2012 Edition) Grades1-6

Grade 1 End of Year Test pages AG187-AG190

Grade 2 Benchmark Test 4 End of Year pages 324-330

Grade 3 Benchmark Test 4 End of Year pages 372-380

Grade 4 Benchmark Test 4 End of Year pages 377-385

Grade 5 Benchmark Test 4 End of Year pages 326-335

Grade 6 Course 1 Benchmark Test End of Year pages 304-313

Appendix B: Questionnaire

1. How did you feel about your success while in elementary and high school math, and what experiences made you feel that way?
2. What were your experiences in college math courses that have affected your perceptions/feelings about teaching math?
3. Do you feel you know enough about math to easily teach your students and even move up a grade level or two and still easily teach your students?
4. Do you feel you were well prepared to teach math, or do you feel that you were not adequately prepared when you entered the classroom as an elementary teacher?
5. What are your perceptions/feelings about teaching math in the classroom?
6. What are your perceptions/feelings about your textbooks and resources for the math classes you teach?

Appendix C: Chart of Participant Responses

Participants who agreed with each statement:

Question 1. What are your perceptions/feelings about your success while in elementaryand high school math, and what experiences made you feel that way?

- Disliked math, avoided 1 4 6
- Math was easy 2
- Math was hard 4 5
- Just followed procedures, little if any understanding 1 2 3 4
- Tutoring offered, not helpful 3
- Better in middle school or high school 5
- Teacher taught, no exploration 1 2 3
- Not interesting 5
- Teacher ignored me/ treated me like I couldn't learn math 1 4 6

Question 2. What were your experiences in college math courses that have affected your perceptions/feelings about teaching math?

- Undergraduate classes frustrating as high school 1 2
- College instructor broke down concepts 1 2
- Rules not explained, didn’t help in college 1
- College courses too fast, assumed you knew how to do math 4
- No help in how to teach students, you should know math, just do it 4
- No strategies presented “unravel the unknown” 4
- Learned, Marilyn Burns teaching style to help all students learn 3

- Learned to teach in math methods class, somewhat helpful 5

Question 3. Do you feel you know enough about math to easily teach your students and even move up a grade level or two and still easily teach our students? Explain why you feel this way. (Example: If your certificate is for K-8, do you feel you have the math content knowledge to change to a higher grade in those grade levels and be an effective math teacher?)

- Feel comfortable now from "on the job training" 1
- Feel comfortable now 2 5
- Strong curriculum to teach from helps 1
- Get comfortable and then standards change again 4
- Can go several grades beyond 3

Question 4. Do you feel you were well prepared to teach math, or do you feel that you were not adequately prepared? If you feel you needed more preparation, what could have been done differently to help you be better prepared?

- Did not feel well prepared by college to teach my own classroom 1 2 3 5
- Only required to take one college course for math preparation 1 4
- I should have taken more courses at the community college for teaching math 1
- Comfortable but not comfortable to teach all the levels in my classroom 3
- My personal experiences learning math were better than college preparation 4

Question 5. What are your perceptions/feelings about teaching math in your classroom?

- Prefer to teach other subjects 4 5
- Only consider teaching math okay, not great 4 5
- Grown to enjoy/ easier now 1 2
- Not comfortable with new standards all the time 4
- Was not given enough time to learn to teach math 3

Question 6. How do you feel about your textbooks and resources for the math classes you teach?

- Breaks things down 1
- Good teaching strategies 1 3
- Standards covered better 1 2 3
- Okay only if you use all of the resources 2
- Don't like much, not enough practice problems, goes too fast 4 5

Appendix D: Teachers' Program Evaluation Questionnaire

Please circle the number that best describes how you feel about each statement using:
1=Strongly disagree, 2=Disagree, 3=Neither Disagree nor Agree, 4=Agree,
5=Strongly Agree

1. I usually enjoy participating in teacher development programs.

1 2 3 4 5

2. Taking the final exams to help identify areas for content knowlege coaching was effective.

1 2 3 4 5

3. The math coaching content knowledge activities helped me gain content knowledge for teaching elementary math.

1 2 3 4 5

4. The math coaching strategies activities helped me learn new strategies for teaching elementary math.

1 2 3 4 5

5. The coaching sessions were worth my time.

1 2 3 4 5

6. The Singapore Math courses helped me develop more content knowlege for teaching math.

1 2 3 4 5

7. The Singapore Math courses helped me develop more stragies for teaching math.

1 2 3 4 5

8. The Singapore Math courses were worth my time.

1 2 3 4 5

9. This teacher development program helped me learn more math content and strategies to teach elementary math more effectively.

1 2 3 4 5

10. I would like to talk to administration about this teacher development program or additional teacher development.

1 2 3 4 5