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Elementary Teacher Perceptions of Eureka Math

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ELEMENTARY TEACHER PERCEPTIONS OF EUREKA MATH

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Approval Page

This dissertation was submitted by Lindsay Harmon Walker under the direction of the persons listed below. It was submitted to the Gardner-Webb University School of Education and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Gardner-Webb University.

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Abstract

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The purpose of this study was to examine the perceptions of elementary teachers teaching the Eureka Math program using a mixed methods approach. The participants were Grades K-5 elementary teachers from 10 elementary schools within the same school district located in the southwestern region of North Carolina. Quantitative data were collected via a 4-point Likert scale survey distributed via Google Forms. Qualitative data were collected via an open-ended question from the survey and an interview group. The data were collected to answer the research question, "How do elementary teachers experience teaching mathematics using the Eureka Math program?" The researcher designed the survey around the four components of the elementary Eureka Math lesson plan. Interview group questions were developed following an analysis of data from the survey and open-ended responses to gain a deeper understanding of teacher experiences and confidence to teach the Eureka Math components. Data analysis of the interview group responses entailed the researcher identifying meta-themes, themes, and patterns, which further validated survey responses. The researcher found participants in this study confident to teach all four components of the Eureka Math lesson plan. Recommendations for future research included conducting a study with students and parents to further determine their confidence levels regarding the four components of the Eureka Math program.

Keywords: teacher perceptions, mathematics instruction, elementary

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Chapter 1: Introduction

Introduction

According to Bishop (1991), “Human beings everywhere and throughout time have used mathematics” (Bishop, 2001, p. 346). The history of mathematics dates back to spoken words, geometric discoveries, and clay tablets and through mathematical texts of early civilizations (Burton, 2007). Mathematical concepts such as numbers, measurement, interpreting data, and problem-solving can be found in one's personal, financial, political, ethical, and social decision-making (Willis, 2010). Throughout daily life routines and situations, numeracy skills are used to calculate tips, pay bills, and even record scores of a sporting event (Smith, 2017). Everyday experiences and personal interests such as sports, video games, and social networking involve numbers, quantities, and a variety of mathematical concepts (Walkington, Sherman, & Howell, 2014). Gains in finance, science, and technology have been related to the command of mathematical skills one possesses (National Mathematics Advisory Panel [NMAP], 2008a). Mathematics is a vital skill for employment and higher education (No Child Left Behind, 2002); therefore, many scientists believe that mathematics is a key to understanding the world, which is reflected in the well-known saying cited by Dean Schlicter, “Go down deep enough into anything and you will find mathematics” (Wooten, 2015, p. 2).

Mathematical understanding and competence can impact one’s future (National Council of Teachers of Mathematics [NCTM], 2000). According to the American Diploma Project (2007), 62% of American entry level jobs include mathematics skills such as algebra, geometry, data interpretation, probability, and statistics. Young children participate in daily mathematics activities by counting, sorting, singing, reading, playing

games, measuring, predicting, and using their senses of the world around them (National Association for the Education of Young Children, n.d.). Even before children enter kindergarten, they have acquired mathematical knowledge related to numbers and can create various outcomes for dealing with numbers (Westwood, 2008).

Problem

Language plays an important role in learning mathematics (Hughes, Powell, & Stevens, 2016). For example, after a child has learned to talk, they begin to use their mathematical knowledge to speak and even use the count words for counting objects (Fuson, 1988). Most children enter school with a number sense that is relevant to learning formal mathematics (National Research Council [NRC], 2009). As children enter kindergarten, they can use their counting experiences to solve basic addition, subtraction, multiplication, and division problems (Kilpatrick, Swafford, & Findell, 2001). Understanding mathematics at the elementary level is fundamental, since mathematics is a cumulative subject that builds upon skills and previous knowledge (NCTM, 2014).

According to Duncan et al. (2007), early proficiency in mathematics predicts later academic achievement more than any other academic skill. A child's mathematical achievement at an early age can affect their literacy and social skills; however, in a large portion of schools across America, students are not demonstrating the mathematical achievement necessary to compete at a global level (U.S. Department of Education, 2004). According to OECD (2013), the 2012 PISA report discovered that students in the United States perform better with cognitively less demanding mathematical skills and abilities. The weaknesses lie in higher cognitive demanding skills such as solving real

world mathematical problems where students must translate mathematical terms and connect their findings to real-world problems.

For many years, students across the United States in Grades 4-8 have demonstrated a decline in their mathematical performance (Cai & Lester, 2010; Higgins, 1997; National Center for Education Statistics [NCES], 2010). The first international study of mathematics was conducted in 1967 and revealed that United States 13-year-olds finished next to last compared to 10 other industrialized nations. In 1992, another international report concluded that United States 9-year-olds came in next to last compared to 14 other national groups (O'Brien, 1999). In 1995, a curriculum-based report called Trends in International Mathematics and Science Study (TIMSS) was created to measure math and science data based on the performance of fourth- and eighth-grade students every 4 years. According to the third TIMSS report, United States students in fourth and eighth grade are outperformed by other industrialized nations (Gonzales et al., 2004). The 2007 TIMSS study reported United States students ranked 11th of 36 industrialized countries of fourth-grade students analyzed. Additionally, only 10% of fourth-grade students reached the TIMSS advanced international benchmark, the highest point on the mathematics scale, scoring eighth of 36 countries analyzed; however, fourth-grade students in seven countries of 50 total had statistically higher average math scores than fourth-grade students from the United States (Provasnik, Gonzales, & Miller, 2009). The 2007 TIMSS study showed some improvement for United States eighth-grade students but they still performed lower than 10 of the 37 reporting countries (NCES, 2008). Even with an increase from previous years in proficiency, the former United States Education Secretary Arne Duncan stated, "While student achievement is up

since 2009 in mathematics, it's clear that achievement is not accelerating fast enough for our nation's children to compete in the knowledge economy of the 21st Century" (NCES, 2011, p. 42).

The 2011 TIMSS study showed some improvement for United States fourth-grade students, although they still performed lower than 11 other nations and no better than 12 (NCES, 2012). According to Loveless (2017), the Brown Center Report on American Education stated, "TIMSS fourth grade scores have stayed solidly above the international mean of 500 for the entire 20 year period of 1995-2015, and the latest score of 539 represents a statistically significant gain from the score of 518 in 1995" (pp. 7-8). Mullis, Martin, and Lovelace (2016) reported that five East Asian countries, Singapore, Hong Kong SAR, Korea, Chinese Taipei, and Japan, achieved the highest ranking for fourth- and eighth-grade mathematics based on the 2015 TIMSS data.

According to the National Assessment of Educational Progress (NAEP, 2015), United States fourth-grade students had an increase of only one percentage point since the 2007 results and 28 percentage points since 1990. NAEP (2015) showed that 27% of eighth graders could not correctly shade one third of a rectangle, and 45% could not solve a word problem that required dividing fractions, leading to only 35% of eighth-grade students in the U.S. scoring at the proficient level in mathematics (U.S. Department of Education, 2008, p. 3).

The Glenn Commission Report, *Before It's Too Late* (U.S. Department of Education, 2000), gave the following reasons for the United States to improve mathematics proficiency:

1. The rapid pace for change in both the increasingly interdependent global

economy and in the American workplace demands widespread mathematics and science related knowledge and abilities;

2. Our citizens need both mathematics and science for their everyday decision-making;
3. Mathematics and science are inextricably linked to the nation's security interests; and
4. The deeper, intrinsic value of mathematical and scientific knowledge shapes and defines our common life, history, and culture. Mathematics and science are primary sources of lifelong learning and the process of our civilization. (p.7)

Research from Phillips (2007) determined that mathematics literacy can affect adults throughout various situations; but 78% of adults cannot explain how to compute the interest paid on a loan, 71% cannot calculate miles per gallon on a trip, and 58% cannot calculate a 10% tip for a lunch bill. Phillips's research supports that a large portion of students and adults also have difficulties with fractions, a foundational skill essential to success in algebra. The NMAP (2008b) report stated that the education of mathematics impacts one's college and career choices as well as one's income. According to the Nation's Report Card (NAEP, 2015) 25% of American high school seniors were proficient in math, and 37% percent of students were prepared for college-level math. The 2011-2012 Survey of Adult Skills found that 58 million adults in the United States lack basic numeracy skills and have difficulty applying mathematical skills to real life problems (Program for the International Assessment of Adult Competencies, 2013). To prepare themselves for college or careers, postsecondary and non-college-

bound students must acquire mathematics skills because achievement in mathematics is positively related to early labor market success (Wang & Goldschmidt, 2003). In order to demonstrate growth in the areas of problem-solving, critical thinking, reasoning, and perseverance at the high school level, students must have an understanding of how to apply their foundational mathematics skills to complex tasks (Wang & Goldschmidt, 2003). According to Furner & Duffy (2002), "many children, including those with disabilities and those without disabilities, as well as adults, do not feel confident in their ability to do math" (p. 68). These individuals frequently display a dislike for math-related activities because the workload is difficult and brings a sense of fear (Beilock & Willingham, 2014).

The U.S. Department of Education (2000) stated four fundamental reasons students need to succeed in mathematics: (a) the demands of our changing economy and workforce, (b) our government's need for a competent citizenry, (c) the link between mathematics and science to our nation's security, and (d) the deeper value of mathematical and scientific knowledge in the preservation of our history. Student achievement related to mathematics can decline when instructional strategies are not rigorous enough, when teachers no longer display high expectations, or when students have trouble expressing their mathematical understanding (Blackburn, 2014). According to DuFour and Fullan (2013), student achievement will increase when students are exposed to effective instructional strategies and practices. National and state assessments also reveal that students in North Carolina are being outperformed by students in other countries as well as other states (NAEP, 2013; OECD, 2013). Ma's (1999) study of mathematics education in high-performing countries found that the mathematics

curriculum in the United States needs to become more focused on the "doing" of mathematics in order to improve mathematics achievement. According to Kepner (2010), mathematically proficient students make sense of mathematics when they have opportunities to use their prior knowledge and show an understanding of the problem by using multiple representations. Student learning and teacher practices in the classroom impact mathematical proficiency.

Purpose of the Study

Throughout the United States, many math initiatives and reforms have evolved, and most schools have taken drastic steps to improve mathematic instruction. According to Wilson (2013), United States mathematics instructional reforms and debates have centered around memorization, calculation, and reasoning since the 19th century. The National Defense Education Act of 1958 established a focus on improving mathematics education by providing states with funds to improve the methods of instruction and materials within the mathematics classroom. The "new math" movement of the 1960s and early 1970s brought change to mathematics instruction when educators and the public recognized that mathematical skills were vital to developing technologically adept citizens (Herrera & Owens, 2001). According to Barnhill (2011), "Voices were raised in the call to go "back to the basics" in schools across the nation, bringing a new breath of life to the progressive movements of the first half of the century" (p. 20). The new math movement changed instruction by offering opportunities for students to explain their mathematical thinking process through the use of inquiry and discovery. This new approach to instruction was also difficult for teachers and parents as they struggled with new ways to teach mathematics (Herrera & Owens, 2001). The standards movement of

the 1980s brought another avenue of change to mathematics instruction, with its continuous emphasis on student investigation and discovery. The standards movement was the opposite of the back-to-the-basic approach where students were taught through memorization and directed learning (Wright, 2012). In 1989, NCTM released the Curriculum and Evaluation Standards in School Mathematics. The standards called for students to be more active in their learning through the use of group work, discovery learning, technology communication, and conceptual understanding with a de-emphasis on paper-and-pencil calculations, teaching by telling, and memorization of rules and algorithms (Latterell, 2008; Ocken, 2001; Morrow & Kenney, 1998).

A current math initiative involves the adoption of more rigorous and measurable standards for learning known as the Common Core State Standards (CCSS). These standards were developed for mathematics and English language arts in 2010 and have since been adopted by 46 states in the United States as well as the District of Columbia (Alberti, 2012). The standards were an initiative of the National Governors Association Center for Best Practices and Council of Chief State School Officers (2010). According to Common Core State Standards Initiative (CCSSI, 2010), the primary goal is "To deliver on the promise of common standards, the standards must address the problem of a curriculum that is 'a mile wide and an inch deep.' These standards are a substantial answer to that challenge" (p. 3). The standards are grade specific and intended to align instruction so students are more prepared for college and/or career readiness after high school graduation (Heck, Weiss, & Pasley, 2011; Porter, McMaken, Hwang, & Yang, 2011). The National Governors Association Center for Best Practices and Council of Chief State School Officers stated the following in reference to the new standards:

> The English-language arts and mathematics standards for grades K-12 were developed in collaboration with a variety of stakeholders including content experts, states, teachers, school administrators and parents. The standards establish clear and consistent goals for learning that will prepare America's children for success in college and work. (Common Core State Standards Press Release, NH Department of Education, n.d., para. 1)

"The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students" (CCSS, 2015, para. 1).

According to CCSS (2015), the mathematics standards are a set of processes and procedures that can improve student proficiency through content and practice. The NCTM process standards were adopted as CCSS's process standards (CCSS, 2015). These process standards are problem-solving, reasoning and proof, communication, connections, and representations (NCTM, 2000).

The proficiency standards were identified by NRC's report, Adding It Up (CCSS, 2015). These proficiency standards are adaptive reasoning; strategic competence; conceptual understanding (comprehension of mathematical concepts, operations, and relations); procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently, and appropriately); and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy; CCSS, 2015, para. 1). According to Hughes et al. (2016), "Children should learn mathematics skills in accurate contexts that provide a solid foundation on which to build more complex skills in later grades" (p. 8). CCSS serve as an attempt to

reduce inequality in education (Schmidt & Burroughs, 2013) and move away from the "drill and kill" method of preparing students (Meier, Kohn, Darlington-Hammond, Theodore, & Wood, 2004).

Math instruction throughout the United States is diverse and varied (Dossey, McCrone, & Halvorsen, 2016). For decades, mathematics instruction centered around drill and practice. Students memorized math facts and procedures without much attention to the conceptual understanding of the problem presented (O'Connell & SanGiovanni, 2015). Albert and Kim (2013) indicated that mathematical instruction does not work when students are taught by stating terms and rules. This approach to learning overlooks problem-solving and collaborative discourse. According to Seeley and Burns (2015), "Overemphasizing fast fact recall at the expense of problem-solving and conceptual experiences gives students a distorted idea of the nature of mathematics and of their ability to do mathematics" (p. 95). Unfortunately, many students from a traditional mathematics classroom will have difficulty transitioning the skills learned because they do not fully understand the concepts of mathematics. They have only learned to repeat specific processes (Boaler, 1998).

Saxon Math is a teacher-directed scripted curriculum for Grades K-12 that follows the traditional approach to learning mathematics (Saxon Math, 2019). Primary lesson components for Grades K-3 include the math lesson and written practice, which also includes guided practice and homework (What Works Clearinghouse, 2017). The instructional approach throughout Saxon Math is centered around the teacher and the student. The role of the teacher is to explain, demonstrate, and guide. Saxon publishers have created their math programs around an incremental approach, continual review, and

ongoing cumulative assessments that are dispersed across the span of a school year (Saxon Math, 2019). "Saxon Math systematically distributes instruction, practice, and assessment throughout the year as opposed to grouping related concepts into units or chapters" (Beltzner, n.d., "Program Highlights," para 2.). Concepts are introduced by the teacher in small increments in order to build complexity and ensure long-term mastery. Students spend time observing the skill and then receive guided practice, followed by distributed practice. Students also participate in daily routines that drive the concepts and procedures taught. The instructional activities throughout Saxon Math are often repeated through a routine that follows an explicit instructional approach (Agodini, Harris, Thomas, Murphy, & Gallagher, 2010).

Shellard and Moyer (2002) identified three components of effective mathematics instruction: teaching for conceptual understanding, developing children's procedural literacy, and promoting strategic competence through meaningful problem-solving investigations. Kilpatrick et al. (2001) determined that one's conceptual understanding impacts their mathematical thinking. "Students with conceptual understanding know more than isolated facts and methods. They understand why a mathematical idea is important and the kinds of contexts in which is it useful" (Kilpatrick et al., 2001, p. 118). The ability to use what has been learned previously to learn new things and solve problems is what is important (Raths, 2002). According to Doabler, Nelson, and Clarke (2016), "When mathematics instruction is systematically organized and explicitly presented, it can minimize student confusion and promote early understanding of complex mathematical topics" (p. 302).

Eureka Math is a CCSS-aligned curriculum written by a team of teachers and

experts for Grades PreK-12. The curriculum connects mathematical concepts to real-world problems, giving students the opportunity to develop a conceptual understanding. The curriculum revisits concepts and provides opportunities for students to use various mental strategies to solve problems. Students are taught how to put previously learned knowledge into practice and focus on the process instead of the answer.

The lesson structure of Story of Units for prekindergarten through fifth grade consists of fluency, concept development, application problem, and student debrief ("How to Implement A Story of Units," 2013). Each lesson throughout Story of Units is structured to incorporate fluency so students can build automatically, revisit previously learned material, anticipate future concepts, and strategically preview or build skills for the day's concept development ("How to Implement A Story of Units," 2013). According to Baroody (2006), fluency with basic addition facts can be defined as "the efficient, appropriate, and flexible application of single-digit calculation skills and is an essential aspect of mathematical proficiency" (p. 22). A fluency approach to learning does not involve speed or drill. Fluent students are taught to use the facts they have mastered through decomposition and recomposition of numbers while developing a strong mathematical understanding (Kling, 2011).

The participants of this study used a variety of mathematical programs before transitioning to Eureka Math. Saxon Math was a program previously used by the studied school district. The purpose of this study was to examine the experiences of elementary teachers from a southwestern school district in North Carolina delivering Eureka Math components.

Research Question

How do elementary teachers experience teaching mathematics using the Eureka Math program?

Significance of the Study

According to the U.S. Department of Commerce, science, technology, engineering, and mathematics collectively known as STEM careers and professionals "drive our nation's innovation and competitiveness by generating new ideas, new companies, and new industries" (Langdon, McKittrick, Beede, Khan, & Doms, 2011, p. 1). One's mathematical skills can impact the STEM professionals, those who will earn 26% more, on average, each year than their non-STEM counterparts (Langdon et al., 2011). According to Hagedorn and Purnamasari (2012), one of every seven students in the United States receives a degree in engineering or math compared to students in Singapore or China, where one of every three students receive a degree in engineering or math. The low graduation rate in the field of STEM across the United States can threaten America's ability to compete in a global society and to provide economic growth (Hagedorn & Purnamasari, 2012).

Teachers must have the knowledge and skills to create opportunities for students to become mathematically proficient; and at the same time, they must foster a learning environment that allows students to use their mathematical ideas and thinking (Ball, 1993). According to Marzano and Toth (2014), "Teachers will have to embrace a shift in their instructional methods, the strategies on which they rely to teach content, to methodically empower students to successfully own their learning at the highest levels of complexity" (p. 10). Effective instructional practices that support proficiency in

mathematics include conceptual understanding, procedural knowledge, computational fluency, and problem-solving (NMAP, 2008a).

Learning how teachers perceive their abilities to teach mathematics using the Eureka Math program can provide the studied school district some insight to guide levels of professional learning support based on the results of the study. The studied school district and educators can rely on the research from the study to promote effective instructional practices such as procedural fluency, conceptual understanding, problem-solving, and collaboration within the mathematics classroom based on the experiences of teachers. School districts and teachers must rely on research to help them make decisions about effective instructional practices to implement.

Context of the Study

The researcher conducted this study using 10 Title I elementary schools located in the southwestern region of North Carolina. Three elementary schools feed into Zone 1, three elementary schools feed into Zone 2, and four elementary schools feed into Zone 3. These schools were chosen for the study based on recommendation by the superintendent, willingness to participate, and to represent each school zone in the district. The total population for the 10 elementary schools is 3,674 students. The school district has a student population of approximately 8,500 students. Participants included kindergarten through fifth grade general education teachers in the 10 elementary schools. Zone 1 employs 58 classroom teachers, Zone 2 employs 55 classroom teachers, and Zone 3 employs 65 classroom teachers.

All elementary schools within the studied school district have been teaching the Eureka Math program in kindergarten through fifth grades since the 2013-2014 school

year. To support this study, the researcher collected and analyzed 4-year historical North Carolina end-of-grade (EOG) math proficiency data across the studied school district. The Figure illustrates the percentage of students in Grades 3-5 who were proficient on the North Carolina EOG mathematics exam and compares the North Carolina EOG scores percent proficient for Grades 3-5 by school, zone, and year. According to these data, since the 2013-2014 school year, North Carolina EOG math proficiency scores for third through fifth grade across the district have shown an upward trend.

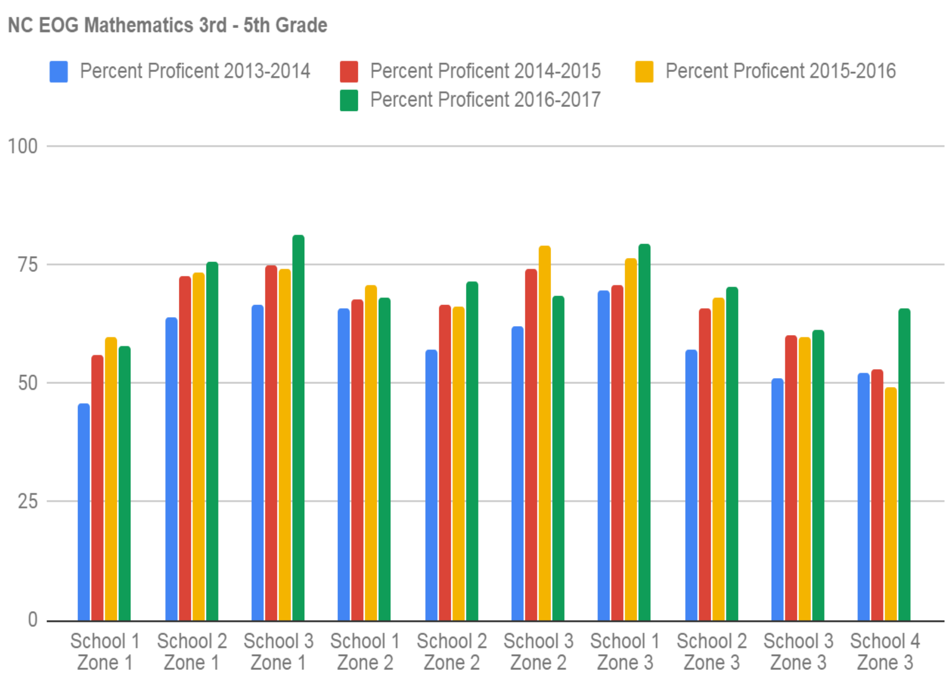

Figure. North Carolina EOG Mathematics Grades 3-5 Proficiency Scores.

Individual schools within each zone have varying positive proficiency scores from the 2013-2017 school years. Data from EOG proficiency scores reveal that Zone 1 and Zone 3 had a relative gain in mathematic proficiency rates within a 4-year period. Two of three schools within Zone 1 had a total of 15.9% increase from the 2013-2017 school years. Two of four schools within Zone 3 had a total of 13.2% increase from 2013-2017.

Proficiency rates declined the second year of implementation of Eureka Math in each zone with four of 10 schools.

District-wide third grade North Carolina EOG math proficiency for the 2013-2014 school year was 68.8% proficient, with a 6% increase from August 2013 to June 2017. Fourth grade North Carolina EOG math proficiency for the 2013-2014 school year was 57.2%, with a 9% increase from August 2013 to June 2017. Fifth grade North Carolina EOG math proficiency for the 2013-2014 school year was 51.0%, with a 15.8% increase from August 2013 to June 2017.

Based on analysis of all North Carolina EOG tests during the 2016-2017 school year, nine of 10 elementary schools within this district met or exceeded growth, six of 10 elementary schools met growth, and three of 10 elementary schools exceeded growth. Third grade North Carolina EOG math proficiency for the 2016-2017 school year was 74.8% proficient, with a 1.4% increase from the 2015-2016 school year. Fourth grade North Carolina EOG math proficiency for the 2016-2017 school year was 66.7% proficient, with a 2.3% increase from the 2015-2016 school year. Fifth grade North Carolina EOG math proficiency for the 2016-2017 school year was 66.8% proficient, with a 2.2% increase from the 2015-2016 school year.

Definition of Terms

Conceptual knowledge. Knowledge of mathematical concepts and understanding of the relationships and connections between concepts (Ben-Hur, 2006; Schwartz, 2008).

Eureka Math. The instructional program used by the researched school district to instruct students in Grades K-5 in mathematics instruction.

Title I. The legislation that provides federal funding to improve academic achievement for socioeconomically disadvantaged students.

NCTM. A nonprofit, nonpartisan educational organization founded in 1920 dedicated to improving the teaching and learning of mathematics from prekindergarten through high school. NCTM's mission is to ensure the highest quality mathematics education for all students (NCTM, 2000).

Procedural knowledge. Knowledge of rules and procedures to solve mathematical problems accurately (CCSSI 2010, p. 6).

Summary and Overview

Mathematics proficiency can be obtained when mathematics instruction involves opportunities for students to interact with the teacher and the content being taught (Ball, 2003). Chapter 1 provides an overview of the problem, which centers around math proficiency in the United States. Through various readings and research regarding mathematics instruction, the researcher outlined the opinions of experts in the field of education. The research suggests that many students in the United States are not meeting the mathematical demands when compared to students in other countries. Chapter 1 also provides a brief look the history of mathematics, the different types of mathematics instruction, and CCSS. Chapter 2 of this dissertation consists of an in-depth review of the related literature. Subsequent chapters outline the methodology, present the findings, analyze the data, and draw conclusions from the data.

Chapter 2: Literature Review

The purpose of this study was to describe the experiences of teaching mathematics using the Eureka Math program in an elementary setting. Chapter 2 explores the literature available that supports effective mathematics instruction in the elementary setting. The literature explored correlates to the Eureka Math lesson plan components and best practices for teaching mathematics. The review of the literature for this study was organized into the following sections: (a) procedural fluency, (b) conceptual understanding, (c) problem-solving, (d) collaboration, and (e) mathematics discourse.

Procedural Fluency

The Common Core State Standards for Mathematics (CCSSM) document supports the need for students to demonstrate procedural fluency, which it a "skill in carrying out procedures flexibly, accurately, efficiently, and appropriately" (CCSSI, 2010, p. 6). Baroody (2006) described basic fact fluency as, "the efficient, appropriate, and flexible application of single-digit calculation skills and … an essential aspect of mathematical proficiency" (p. 22). Procedural fluency builds on a foundation of conceptual understanding, strategic reasoning, and problem-solving (National Governors Association Center for Best Practices and Council of Chief State School Officers, 2010; NCTM, 2000, 2014). According to Willis (2011), fluency is also viewed as a foundation for high level mathematics such as algebra. Furthermore, learning simple arithmetic facts and principles should be fun and enjoyable. Fluency activities should not emphasize memorization of mathematical facts (Boaler, 2015).

Educational organizations such as NCTM and NMAP recognize the importance of

procedural fluency and its relationship to solving various mathematical problems. NCTM (2000, 2014) advocated for curriculum to incorporate mathematical fluency practice. NMAP (2008b) acknowledged that research focused on how children learn, demonstrates the benefits of conceptual understanding, procedural fluency, and automatic recall of facts. According to NMAP (2008a), there are limited numbers of curriculum programs that incorporate effective fluency practice.

Procedural fluency is vital for problem-solving because it helps reduce cognitive load as students tackle increasingly complex problems within the ever-expanding number system (Sousa, 2008). All students need to have a deep and flexible knowledge of a variety of procedures, along with an ability to make critical judgments about which procedures or strategies are appropriate for use in particular situations (NRC, 2001, 2005, 2012; Star, 2005). Teachers can create a classroom that supports procedural fluency by providing the students with learning experiences that are connected to mathematical ideas (Kilpatrick et al., 2001). Kilpatrick et al. (2001) noted the need for students to employ procedures from other mathematical experiences in order to strengthen their understanding because not all situations are alike in mathematics; therefore, students should be allowed the opportunity to build on familiar methods and select relevant procedures that are connected to an entire class of mathematical problems without relying on individual problems (Kilpatrick et al., 2001).

Conceptual Understanding

Educational researchers in mathematics argue that teaching for conceptual understanding begins with the teacher. Teachers must have a deep understanding of the subject matter and understand how to teach mathematical relationships (Manouchehri &

Goodman, 1998; Wu, 1999). According to NCTM (2000), teachers who have a deep understanding of the subject matter understand the why behind the mathematical relationships and know how to choose appropriate instructional strategies that will help students bridge the gaps in their own understanding of mathematical concepts. According to Ball (2003), students in kindergarten through 12^{th} grade lack necessary skills to understand algebra and mathematical content they have learned; therefore, educators should implement instructional activities that build on algebra skills and allow students to make connections to the content learned.

In a study conducted by Kazemi and Stipek (2008), data from four elementary teachers determined that teaching for conceptual understanding in the mathematics classroom was challenging. The teachers noted that their previous mathematical learning experiences affected their instruction, and the trainings they received during teacher preparation programs did not focus on teaching mathematics from a conceptual, problem-solving perspective. The focus of this study allowed Kazemi and Stipek to portray conceptual understanding in the mathematics classroom as (a) an explanation that consists of a mathematical argument, not just a procedural description; (b) mathematical thinking involved understanding relations among multiple strategies; (c) errors provided opportunities to reconceptualize a problem, explore contradictions in solutions, and pursue alternative strategies; and (d) promoting collaborative work that involved individual accountability and consensus building through mathematical argumentation. Kazemi and Stipek stated, "for over a decade the mathematics education community has encouraged teachers to shift their classroom practices away from an exclusive focus on computational accuracy and toward a focus on deeper understandings of mathematical

ideas, relations, and concepts" (p. 123).

According to NRC (1990), factors such as prior understandings, interests, beliefs, learning styles, and attitudes influence the mathematical understanding for students. Some researchers have studied conceptual knowledge and its relationship to developing mathematical skills. One's conceptual knowledge in relation to mathematics has been defined as the knowledge of abstract concepts and general principles (Byrnes & Wasik 1991; Canobi, 2009; Rittle-Johnson, Siegler, & Aliali, 2001). According to the NCTM (2014), "Conceptual understanding establishes the foundation and is necessary, for developing procedural fluency" (p. 7).

Many researchers of mathematics support the desire for conceptual and procedural knowledge in the mathematics classroom. According to Kendall (2011), the purpose of CCSSM was to promote conceptual understanding instead of relying on a set of procedures or steps when solving math problems. NRC (2001) defined conceptual knowledge as "an integrated and functional grasp of mathematical ideas" (p. 118); therefore, conceptual knowledge is often thought of as an understanding of the principles, relationships, and connections between the pieces of knowledge within a domain (Hiebert & Wearne, 1996). According to Booth (2011), "students with a strong conceptual knowledge about a topic are likely to continue to learn more because their prior knowledge makes it easier for them to process and use new information related to the topic" (p. 33).

Byrnes and Wasik (1991) defined procedural knowledge as, "knowing how or the knowledge of the steps required to attain various goals. Procedures have been characterized using such constructs as skills, strategies, productions, and interiorized

actions" (p. 777). According to Blote, Van der Burg, and Klein (2001), teaching for procedural knowledge requires teachers to focus on practices that support skills and procedures so students can solve mathematics efficiently. NMAP (2008b) recommended that educators focus on both the concepts and skills related to mathematical problem-solving so students can be prepared for various topics in algebra that require the development on conceptual understanding. Conceptual and procedural knowledge do not develop independently (Star, 2005). Rittle-Johnson, Schneider, and Star (2015) determined that both longitudinal and experimental studies indicate that "procedural knowledge leads to improvements in conceptual knowledge, in addition to vice versa. The relations between the two types of knowledge are bidirectional" (p. 591).

Ma (1999) studied the procedural and conceptual understanding of 23 elementary teachers in the United States and 72 Chinese teachers by asking the teachers to explain how they would teach subtraction with grouping. The study yielded results from showcasing that higher percentages of procedural knowledge were found in the 83% of U.S. teachers as opposed to 14% by Chinese teachers. Teachers in the U.S. focused on teaching subtraction by focusing on the algorithm and direct instruction. Ma's research noted that educators can teach mathematical concepts through a variety of solutions as well as have a conceptual understanding of the concept. Many elements contribute to improving one's conceptual understanding of mathematics such as student dialogue and justification of procedures as well as executing procedures (Kazemi, 1998). Schoenfeld (2014) shared that teachers support classroom dialogue when "students explain their ideas and reasoning … students respond to and build on each other's ideas" (p. 408).

Hallett, Nunes, and Bryant (2010) studied the individual differences of fourth and

fifth graders at eight different schools to determine if students learn fractions through conceptual understanding, procedural understanding, or a combination of both. The researchers placed students into five cluster groups identified as lower procedural, lower conceptual, higher procedural and lower conceptual, higher conceptual and lower procedural, and higher conceptual and higher procedural. The cluster analysis revealed that some fourth- and fifth-grade students learning fractions rely more on concepts, while others rely more on procedures, and some students rely on both. The researchers also noted that there are two types of children who struggle with fractions: one group that has problems with conceptual knowledge and one group that has problems with procedural knowledge. As determined by the study, students who possessed both conceptual and procedural understanding outperformed the other students; therefore, conceptual knowledge is critical to understanding the logical relationships and interconnectedness among concepts.

Keiser (2012) conducted a study that examined how sixth-, seventh-, and eighth-grade students solved division computations by giving each student a two problem division assessment and allowing students to discuss their problem-solving process regarding several division problems. Data from the division assessment concluded that a majority of the middle school students lacked proficiency but had a more conceptual understanding than past students who participated in the study. Only four of 91 students solved the first problem using the long division algorithm, and only two used it correctly. The discussions used during this study allowed students to identify relationships between their approach and another student's approach in solving a division problem due to modeling and testing their understanding. As the researcher modeled different strategies,

the student could view the standard algorithm on one side of the paper and an invented strategy created by the student. As the students discussed their understanding of division with others, they were able to progress towards a conceptual understanding of division and not just rely on the standard algorithm. According to the NRC (2001), students can reflect on the conceptual and notational features of mathematical strategies when they are given the opportunity to express their understandings during a conversation. According to Kinzer, Virag, and Morales (2011), when students have the opportunity to share different mathematical strategies or processes with others around them, their individual mathematical understanding increases as those who are involved in their discussion.

Problem-Solving

According to Posamentier and Krulik (2009), "A problem is a situation that confronts the learner, that requires resolution, and for which the path to the answer is not immediately known" (p. 2). The NCTM (2000) defined mathematical problem-solving as the means of engaging in a task where the solution is not known in advance. Children must construct their own meaning by using prior knowledge to find the solution they are seeking. Problem-solving in the mathematics classroom is not only vital to learning mathematics, but the process allows students to develop and expand their mathematical thinking. Problem-solving at an early age requires teachers to create mathematical learning opportunities where children can develop their own ideas, communicate with others, and discuss the mathematical process used as well as the process that did not work (Lopes, Grando, & Ambrosio, 2016).

Cai (2003) stated that teachers must be viewed as a facilitator of knowledge before effective problem-solving can take place. When the teacher takes on the role of

facilitator, the students are provided with opportunities where they feel empowered and engage in productive struggle (Cai, 2003). Sharing errors and mistakes provides opportunities for students to discuss their understanding or misconceptions of concepts (Michaels, O'Connor, & Resnick, 2008); therefore, the teacher can develop conversations that are rich in mathematical content (Burns, 2013). Teachers often have a hard time taking on the role of facilitator because they want to help their students and do not like to see their students struggle (Cai, 2003). According to Hintz (2014), "If only correct ideas regularly receive attention, the mathematics that gets explored is limited, and the students whose original ideas were incorrect may hold on to incorrect mathematics" (p. 320).

To build problem-solving skills in American students, NCTM requires that students solve open-ended mathematics problems with a demonstration of the explanations and processes used to arrive at the correct answer (NCTM, 2000). Teachers can use the researched-based visual tool known as a graphic organizer to explain the explanations and processes of a problem (Baxendell, 2003). According to Zollman's (2009) research, the use of graphic organizers in the mathematics classroom promotes problem-solving and communication skills. The four corners and a diamond graphic organizer used in Zollman's research served as a pictorial representation to help students organize their mathematical ideas, methods, thinking, and writing in any order. Students worked in a nonhierarchical order of the graphic organizer by completing five areas of the graphic organizer. The five areas were (a) what do you need to find; (b) what do you already know; (c) brainstorm possible ways to solve this problem; (d) try your ways here; and (e) what things do you need to include in your responses, what mathematics did you learn by working this problem? Following this process encouraged students to make

connections between various concepts and mathematical ideas before they identified a solution. Zollman stated, “all teachers reported dramatic improvements in students’ mathematics scores on open-response items after implementing the four corners and a diamond graphic organizer” (p. 7).

Rivera and Baker (2013) believed that there are four research-based guiding principles for using graphic organizers: simplicity, color coding, use of manipulatives, and use of task analysis. According to Jimenez, Browder, and Courtade (2008), the graphic organizer must be created to allow the students to break down the complex information into simpler terms. According to Rivera and Banker, color coding is an approach to guide students through the problem-solving process because students learn ways to construct meaning and explore the mathematics process with colors. Fountas and Pinnell (2001) believed that the use of graphic organizers is essential to the learning environment since students can organize their own ideas, arrange information, understand the order of ideas, use a concrete representation to understand an abstract idea, and understand how complex ideas are related. According to Ellis (2004), when a student completes a graphic organizer, a limited amount of semantic information is needed to understand the problem.

According to Witzel, Mercer, and Miller (2003), manipulatives are important tools for students to use during the problem-solving process because the students could explain their thinking easily and turn abstract information into concrete representations. A teacher can provide instructional support by using various manipulatives, models, and multiple representations in the mathematics classroom as a way for students to understand the problem or concepts as well as visualize their own mathematical ideas

(Haas, 2002). Many researchers have demonstrated that manipulatives are an effective tool to introduce mathematical understanding (Carbonneau, Marley, & Selig, 2013). Teachers have long used manipulatives as a way to explore and test of the understanding of concrete representations to abstract concepts (Moyer, 2001). Manipulatives in the mathematics classroom are vital when the task is related to conceptual understanding, problem-solving, skill mastery, and communicating mathematical ideas (Burns, 2007; Goldsmith, 2001). Burns (2007) noted that math manipulatives served as a learning tool to support the various ability levels of students in the classroom; therefore, students can use manipulatives to make sense of concept, test their idea, or justify their thinking. According to Goldsmith (2001), when students have access to manipulatives, they can develop higher-order thinking skills, investigate the concepts of mathematics, and develop strong arguments regarding the mathematical concept with justification. "Manipulatives, models, and multiple representations is a method of instruction characterized by teaching students techniques for generating or manipulating representations of algebraic content or processes whether concrete, symbolic, or abstract" (Haas, 2002, p. 73). According to Hass (2002), this process is helpful when students synthesize their ideas to illustrate a problem through manipulating materials, models, and visual aids.

"Electronic technologies–calculators and computers–are essential tools for teaching, learning, and doing mathematics. They furnish visual images of mathematical ideas, they facilitate organizing and analyzing data, and they compute efficiently and accurately" (NCTM, 2000, p. 24). Virtual manipulatives can be used in the mathematics classroom to foster visual representations using a variety of computer programs (Moyer,

Bolyard, & Spikell, 2002). Virtual manipulatives support problem-solving skills by helping the student understand a new topic or specific skill by using pictorial, verbal, and symbolic representations while allowing them to move objects in the same way they would move concrete manipulatives (Moyer-Packenham, Salkind, & Bolyard, 2008). According to Paek (2012), teachers who used the virtual manipulative called Puzzle Blocks to teach multiplication concepts to first- and second-grade students saw an increase in their students' understanding of multiplication. The study revealed that students benefited from the visual feedback, auditory narration, and touch experience from the visual manipulative.

Kindler (1999) shared that a pictorial representation "allows students to construct meaning through connections across symbol systems" (p. 330). Furthermore, Marzano, Pickering, and Pollock (2001) suggested that nonlinguistic representations such as graphic representations, physical models, mental pictures, pictures and/or pictographs, and kinesthetic movements are effective practices that support instruction within and outside of the classroom. Woleck (2001) studied an elementary mathematics classroom to determine the significance of pictorial representations. The study determined that visual representations such as pictures, tables, or diagrams help students communicate their mathematical findings to others and help students solve various math problems on their own. Woleck witnessed students creating math stories as a visual representation to explain their reasoning. The math stories the students created with their drawings were useful tools for students who had difficulty solving word problems.

NCTM (2000) standards from kindergarten through Grade 12 support the need of spatial reasoning in the mathematics classroom. The geometry standard reinforces the

need for instructional programs to enable students to "use visualization, spatial reasoning, and geometric modeling to solve problems" (NCTM, 2000, p. 41). Alongside the geometric standard, NCTM (2000) promotes a problem-solving standard that highlights four outcomes through enabling students to "build new mathematical knowledge through problem solving; solve problems that arise in mathematics and other contexts; apply and adapt a variety of appropriate strategies to solve problems; [and] monitor and reflect on the process of mathematical problem solving" (p. 41). Additionally, NRC (2006, as cited in Gurganus, 2017) suggested that spatial thinking promotes mathematical problem-solving and reasoning skills; "spatial thinking can be learned and it should be taught in all levels of the education system" (p. 3).

Research from Van Essen and Hamaker (1990) concluded that upper-elementary students' problem-solving performance improved after students had the opportunity to solve word problems using visual representations and drawings of the problem. The key to this study was to focus on schematic drawings of the problem to improve one's problem-solving approach. Hegarty and Kozhevnikov (1999) studied sample mathematical drawings of 33 sixth-grade students using visual representations. The researchers compiled the student's work into two categories: schematic and nonschematic drawings. Schematic drawings were defined as resembling a diagram with spatial relations, proportions of the objects, and details that relate to the problem. Nonschematic drawings were defined as having details in the picture that do not relate to the solution of the problem. Hegarty and Kozhevnikov stated the use of schematic visual representations were associated with problem-solving achievement. In discussing the importance of visual representations in the classroom, Tripathi (2008) noted, "researchers

have found that they play an important role in determining and nurturing problem-solving ability" (p. 441).

Representation is a process standard in Principles and Standards for School Mathematics (NCTM, 2000). According to NCTM, students from prekindergarten through Grade 12 should be immersed in instruction that will allow students to "select, apply, and translate among mathematical representations to solve problems" (p. 67). Imm, Stylianou, and Chae (2008) suggested that internal representations are integral to supporting one's mathematical thinking when the representation is meaningful to the student. When students' internal representations are valued in the mathematics classroom, "students are being respected for what they know and bring to the classroom community of learners and are supported in their efforts" (Imm et al., 2008 p. 459). Furthermore, teachers can value their students' internal representations by providing choices about the strategy, representation, and mathematical operation. In return, students can investigate the context and the problem by justifying their thinking to the teacher or classmates. Sharing one's representation is a crucial part of problem-solving. All students must be held accountable and understand how to explain their representations in a respectful manner because meaningful dialogue becomes available to everyone involved. As noted by Imm et al., "Making mathematics a part of the culture of the community occurs when we acknowledge that a particular representation was not imposed by an outside authority but was created by mathematician among us" (p. 461).

Collaboration

Collaboration involves people working together on the same task instead of working in isolation (Dillenbourg, Baker, Blaye, & O'Malley, 1996). Vaughan, Nickle,

Silovs, and Zimmer (2011) noted that "students working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats" (p. 113). Cooperative learning is one teaching strategy that allows students of all abilities and backgrounds the opportunity to work together in groups to solve problems and complete tasks that are aligned to the goals and objectives of the content (Kagan & Kagan, 2009).

According to Johnson, Johnson, and Holubec (2008), cooperative learning groups are categorized into three types of groups: formal, informal, and cooperative base groups. Formal cooperative learning groups allow students to complete a task together by focusing on shared learning goals and complete joint specific tasks. The duration of time spent together in the group can include one class period or several weeks. The roles and responsibilities of each group member is to complete the task and make sure all students are participating. Informal cooperative learning groups allows students to work together by focusing on a joint learning goal. During this time, teachers are encouraged to lecture, model or show a video on the subject matter being taught. Students participate in discussions that only last a few minutes or one class period to clarify the material they learned. Cooperative base groups allow students to work together in heterogeneous groups on a regular basis for an entire school year or duration of one semester. The students' roles and responsibilities involve student accountability based on the group's goals, support, and encouragement.

Wiggins (2000) studied collaborative grouping and shared understanding in an elementary music classroom. Wiggins analyzed the students' interactions as they created a song in ABA form in a small group setting. Data from this study revealed that when

students had the opportunity to collaborate, they shared and defended their ideas with other groups. Collaboration increased as students had the opportunity to participate in problem-solving and decision-making tasks. According to Stump, Hilpert, Husman, Chung, and Kim (2011), collaborative learning promotes gains in student achievement when students communicate, share ideas, and gather feedback from peers; therefore, students who can construct their own meaning to others within the group become engaged in learning. In addition, small group student collaboration activities create an environment for students to build their self-confidence (Jolliffe, 2007). According to Johnson and Johnson (2009), there are five essential elements that take should take place before students can work collaboratively in small groups:

- Positive Interdependence: The task requires a state of interdependency where all students a contributing. At the beginning of the task, the student is aware of his or her learning goal and understands that the success of the task is determined by everyone's effort.
- Individual and Group Accountability: The task requires students learning from each other so they can grow individually. At the beginning of the task, the students are aware that the group is held accountable for achieving their goals and each student is held individually accountable to the group contribution.
- Promotive Interaction: The task requires students to collaborate in a face-to-face setting where they share resources and encourage feedback from others. At the beginning of the task, the students are aware that the group is responsible for explaining how to solve problems through a variety of ways.

- Appropriate use of Social Skills: The task requires students to function as team by demonstrating leadership skills, trust, provide leadership, or conflict management. At the beginning of the task, the students are aware that their teamwork skills impact their learning.
- Group Processing: The task requires students to discuss how they are achieving their goals through the roles and responsibilities of the teammates. At the beginning of the task, the students are aware that their teammates actions can be useful or not useful. At the beginning of the task, the students are aware that they must develop on how their teammates will work together.

According to Burns (2000), when students work in a small group, each student is held accountable for achieving their goals as well as contributing to the group.

Effective collaboration begins when the students have opportunities to connect with the teacher and learn from each other. “The most powerful learning experiences arise when students learn from other another” (Clark, 2017, “Interactions,” para. 10). There must be a classroom atmosphere of “respect, transparency and an appreciation of differences” (McManus, 2008, p. 5). Gasser (2011) indicated that collaboration contains components such as teacher support and time to collaborate. Students benefit from collaboration when they are allowed to share and discuss their ideas as well as others. Barron (2003) stated that collaboration does not come natural to some and “true communication takes co-regulation: a willingness and openness to be influenced by the other” (p. 337). Barron’s study explained the interactions and effectiveness during small group problem-solving. Students who could not solve the problem lacked communication that aligned with the situation and also reflected a need for students to

protect their independence of strong problem skills. The data from Barron's study supported that if students were solving mathematical problems in a problematic group, their individual score might determine that the student would be better off working alone; however, data from Barron's study also supports a positive correlation for students in successful groups outperforming their peers working in unsuccessful groups. Further research indicates that mathematical communication allows students to share their ideas and understanding in various ways (NCTM, 2000). Through collaboration, mathematical ideas become reflective, refined, deliberated, and modified (NCTM, 2000). When students can collaborate and communicate their thoughts orally or in writing, their thinking is expressed in a clear and conclusive way (NCTM, 2000). Teachers should provide time for conversations, arguments, and rationales so students can explore diverse perspectives in order to improve their mathematical thinking (NCTM, 2000).

In order to explore the instructional activities in mathematics classrooms across Melbourne, Australia, researchers gathered feedback from fifth- and sixth-grade students as part of the research project known as Task Types in Mathematics Learning (TTML). In one school, the researchers used the responses from 12 students in fifth grade and six students in sixth grade to determine the students' ideas about mathematics. Students provided the researcher with math stories regarding classroom scenarios by writing about the following prompts:

- Write about the sorts of questions or problems you like to answer
- Write about what you like to be doing and
- What you like the teacher to be doing

Based on the responses from the students, it appeared that students enjoyed

working collaboratively to solve or create mathematics problems with a partner or in a small group as long as the teacher provided feedback and support. Seven students preferred working in groups or pairs, five students wanted to share their work with the rest of the class, and one student wanted to help younger students explore a variety of mathematical concepts as well as be able to sit and talk during math class. Furthermore, students in this study stated that they did not enjoy instructional activities that involved rote memorization, problems posted on the board with instructions to solve and copy, and worksheets (O'shea, 2009). Knighten (2017) acknowledged that students benefit from mathematical instructional activities that promote the value of student thinking, reasoning, and general methods that allow students to make connections to their own learning or familiar contexts.

Student Debrief or Mathematics Discourse

Studies regarding mathematical dialogue support that this type of learning environment is beneficial (e.g., Chapin & O'Connor, 2013; Fraivillig, 1999; O'Connor, 1998; Wood, Williams, & McNeal, 2006). NTCM's Principles to Action (NCTM, 2014) described discourse as, "the purposeful exchange of ideas through classroom discussion, as well as through other forms of verbal, visual, and written communication" (p. 29). Mathematical discourse is created when students are provided with opportunities to share their own mathematical ideas and thinking (Ennis & Witeck, 2007). NCTM's (2000) process standards suggest that the main outcome of developing mathematical reasoning in the elementary classroom involves

> People who reason and think analytically tend to note patterns, structure, or regularities in both real-world situations and symbolic objects; they ask if those

> patterns are accidental or if they occur for a reason; and they conjecture and prove. Reasoning mathematically is a habit of mind, and like all habits, it must be developed through consistent use in many contexts. (p. 56)

According to Smith and Stein (2011), mathematical discourse seeks to combine student thinking with a purpose and answering meaningful questions that will allow the students to communicate their mathematical reasoning skills. According to Schifter (1998), in a discourse community, the students are not the only ones who benefit and learn. The teachers learn as well as they create multiple opportunities for students to share ideas about mathematics.

Studies from Chapin and O'Connor (2004) and Chapin, O'Connor, and Anderson (2003) supported the use of mathematical discourse in the mathematics classroom with four primary goals supported by the teacher's questioning. The first goal involves the student clarifying his or her own mathematical thinking. The second goal allows the student to share his or her own thinking with others. The third goal requires the student to deepen his or her own reasoning of the task. The fourth and final goal allows the student to share his or her reasoning skills with others. The research study from Chapin et al. (2003) with fourth- through seventh-grade students and teachers reinforces when a teacher generates questions or discussions or uses conversational actions from productive *talk moves*, success is achieved with the four goals above.

Productive talk moves used in the study by Chapin et al. (2003) include

- "Revoicing" by both teacher and students – restating a previous speaker's utterance and asking whether the restatement is correct
- Teacher – initiated a request that a student repeat a previous contribution by

another student

- Teacher's elicitation of a student's reasoning
- Teacher's request for students to add on
- Teacher wait time

As Chapin et al. (2003) noted, "it takes students a great deal of practice to become solid and confident mathematical thinkers" and the whole-class discussion "talk format provides a space for that practice" (p. 19). Effective discourse in the mathematics classroom begins with the teacher. The teacher must communicate expectations of the math talk and model mathematical explanations so the students can explain and justify their responses in multiple settings (Anthony & Walshaw, 2009).

Cribbs and Linder (2013) classified in their case study the importance of classroom discourse by researching a fifth grade mathematics teacher's instructional practices. The fifth-grade teacher created classroom discourse to foster a learning environment where students could explain their mathematical thoughts and explanations. During observations, the teacher served as a facilitator and rarely worked out mathematical problems without asking the students to explain or identify the mathematical concepts. The teacher connected math to real-life situations to promote meaningful discourse. Because the teacher positioned students' funds of knowledge as "legitimate ways of knowing and learning mathematics in the classroom" (Cribbs & Linder, 2013, p. 76), all students had opportunities to engage in the mathematics discourse, knowing that "their knowledge and experiences were valued by the teacher and their peers" (Cribbs & Linder, 2013, p. 76). As Smith and Stein (2011) stated,

Many mathematics teachers believe that students learn through sharing their

> ideas, listening to and critiquing the ideas of others, and by having others critique their approaches to problem solving. Classroom discussions in which these activities occur do not materialize out of thin air. (p. 69)

McClain and Cobb (2001) examined the relationship between establishing norms and creating mathematics discourse in a first-grade classroom. They found that when a teacher established norms to support discourse, the students were able to explain and justify their reasonings behind the math problem. The norms also allowed the students to take part in acceptable explanations and mathematical differences between their peers and teacher. The shift in discourse "gave rise to intellectual challenges that otherwise would not have occurred" (McClain & Cobb p. 253). Planas and Gorgorio (2004) believed, "The notion of norms … has profound social implications; not only does it include definitions of what is acceptable, but it also encompasses the values … within the classroom" (p. 20).

Kazemi (1998) conducted a study involving four elementary teachers who allowed their students to participate in mathematics discourse by establishing a set of sociomathematical norms to guide the quality of discourse. Kazemi believed that there are four sociomathematical norms that guide mathematical discourse that also supports the mathematical content and one's conceptual understanding. The norms are

- Explanations consisted of mathematical arguments, not simply procedural summaries of the steps taken to solve the problem.
- Errors offered opportunities to reconceptualize a problem and explore contradictions and alternative strategies.
- Mathematical thinking involved understanding relations among multiple

strategies.

- Collaborative work involved understanding relations among multiple argumentation.

Furthermore, Kazemi suggested that the four sociomathematical norms led to positive classroom discourse in one of the studied classrooms. There were significant differences between the classrooms in this study due to the above sociomathematical norms. The classroom where students spent more time contributing to both whole group and small group discourse activities along with opportunities to reason and justify their solutions by explaining specific information regarding the content or one's thinking improved their problem-solving and conceptual understanding.

Educational researchers in mathematics argue that successful discourse in a classroom involves productive talk about mathematics where students are sharing their ideas (Chazan & Ball, 1999; Heaton, 2000; Yackel & Cobb, 1996). Sherin (2002) conducted a year-long case study in an eighth-grade mathematics classroom using classroom observations, teacher journal reflections, and teacher interviews. The researcher analyzed 20 lessons with various stages of support to study classroom discourse centered around process and content. At the beginning of the study, the teacher established structure by focusing on the process of discourse and then the content of discourse. After a few weeks of determining roles and responsibilities with students during discourse and allowing students to comment on each other's ideas that were not mathematical through a teacher-centered approach, the teacher felt comfortable to move towards discussions focused on mathematical content. The teacher's weekly reflections allowed him to generate questions that allowed students to talk about mathematics and

respond by explaining their results and methods used. Sherin reported, “during the months of October, November, and December over 85% of the lessons were rated as high on both process and content” (p. 216). Throughout the study, the teacher stated that he had to shift his instruction to balance the process and the content of the discourse by using three components of class discussion such as idea generation, comparison and evaluation, and filtering. The three components allowed students to take on different roles where their ideas were the key component of the discourse. Sherin’s research concluded that the “three components can be thought of as a framework that highlights the ways in which different processes were used by the teacher to make progress on content issues” (p. 220).

Relation to Eureka Math

CCSSI (2010) required instruction aimed at supporting procedural fluency, conceptual understanding, problem-solving, collaboration, and mathematical discourse. According to National Governors Association Center for Best Practices and Council of Chief State School Officers (2010), CCSS for elementary mathematics supports learning concepts through procedural skills and conceptual understanding. The elementary standards ensure a solid foundation of whole numbers, addition, subtraction, multiplication, division, fractions, and decimals. The framework of understanding concepts and procedures through application allows students to continue to expand on a variety of mathematical content as they enter middle school and high school. The teacher therefore will need to have a deep understanding of conceptual understanding and a variety of instructional tools to promote mathematical success for all students. Eureka Math is aligned to CCSS and provides teachers with the knowledge and tools to

implement the instructional shifts required by CCSS.

According to How to Implement A Story of Units (2013), Eureka Math teaches mathematical concepts and skills that build upon each grade level allowing students to make connections to previously taught strategies and models. Each lesson in the K-5 curriculum, known as Story of Units, includes a lesson structure of fluency practice, application, concept development, and student debrief. The suggested time frame for each lesson includes a total of 60 minutes with a breakdown of each component and time including 15 minutes for fluency practice, 5 minutes for application, 30 minutes for concept development, and 10 minutes for student debrief. The fluency practice component supports one's procedural fluency by promoting automaticity and student engagement. Students have the opportunity to spend at least 10 minutes each day solving fluency activities that revisit previously learned material in order to develop automaticity, anticipate future concepts, and/or strategically preview or build skills for the new lesson. The fluency activities such as Sprints, counting exercises known as "happy counting" or "skip counting," choral response, and rapid whiteboard exchanges (RWBE) can be found in each module to support one's conceptual understanding, application, and mathematical practices. Fluency Sprints are computer-generated worksheets with Side A and Side B of similar skills that can be computed mentally. Students complete as many problems from Side A within the time frame and then move to Side B with the goal of improving, even if is only by one more. Happy counting includes counting forward or backwards. Skip counting is used to support multiplication. During the choral response, students are given a signal by the teacher before they verbalize the response as a whole group. The student's response can include a variety of concepts such as addition and subtraction

strategies, tens, place value, multiplication, or units. When teachers use RWBE as a fluency activity, students can share their work with a partner. RWBE is a practical tool for students to utilize when practicing skills that require more written support or work space. RWBE consists of a sequence of 10 to 20 problems on a specific topic or skill where the problems start out simple and then become more challenging. Students solve the problems using a personal whiteboard and a dry erase marker so students can hold up their board for the teacher to view. The teacher should prepare the problems in a way that allows the teacher to reveal them to the class one at a time. Skills that could be used during RWBE include addition, subtraction, renaming of units, problems using a number line, place value, multiplication, and fractions ("How to Implement A Story of Units," 2013).

According to How to Implement A Story of Units (2013), the second component of the Eureka Math lesson plan structure is known as the application problem. Application problems are identified as single step word problems, multi-step word problems, brainteasers or puzzles, and exploratory tasks. By solving a variety of application problems, students can apply their skills and understandings in a variety of ways using real-world mathematics problems. Students can use concrete, pictorial, and abstract representations during the problem-solving process too. Grawn (n.d.) stated that the "read, draw, and write" (RDW) problem-solving strategy is used during the application problem to help students develop a deep understanding of the mathematical concepts within a word problem. The roles RDW include

1. R**EAD** the problem. Read it over and over…. And then read it again.
2. D**RAW** a picture that represents the information given. During this step

students ask themselves: Can I draw something from this information? What can I draw? What is the best model to show the information? What conclusions can I make from the drawing?

3. W**RITE** your conclusions based on the drawings. This can be in the form of a number sentence, an equation, or a statement.

The 3-step process of RDW allows students to express their thoughts in a drawing. Drawing a model allows students to visually determine specific operations or patterns within the word problem and determine the best model to solve the problem (Grawn, n.d.).

The third component of the Eureka Math lesson plan structure is known as concept development. According to How to Implement A Story of Units (2013), "Concept Development elaborates on the "how-to" of delivery through models, sample vignettes, and dialogue, all meant to give teachers a snapshot of what the classroom might look and sound like at each step of the way" (p. 23). It is the primary lesson component, in which new learning is introduced. During the concept development, new learning goals and objectives are established, and students have the opportunity to use their prior knowledge to grasp the new learning that is introduced. The final component of the concept development is the problem set. Students complete a problem set that consists of simple to complex mathematical tasks that can be solved independently. Completion of the problem set depends on the students. According to Petre (2016),

> Students above grade level will most likely complete more problems, which will challenge them due to the minimized scaffolding and more abstract work as they work across the page. Students working at grade level may complete half of the

> problem set, providing practice with the strategies taught throughout the Concept Development. Students working below grade level should be able to successfully complete the first couple of problems due to the extra scaffolding. ("In the Field," para. 1)

The fourth component of the Eureka Math lesson plan structure is known as the student debrief. Students have the opportunity to participate in daily debriefs using the problem set. Having completed the problem set, students can verbalize mathematical patterns, make connections to the current learning and previous learning, and even correct any misconceptions. During the student debrief, students have the opportunity to reflect regarding what they have learned by answering a series of questions independently, whole group, or with a partner. During the student debrief, the teacher serves as a facilitator. The teacher should ask probing questions and circulate around the room to provide support when needed. The lesson format provides sample dialogue or suggested questions for teachers to use as they interact with students or help students reflect on their learning. The closing of each student debrief consists of students completing an "exit ticket." The exit ticket serves as a quick formative assessment to provide the teacher with some insight on the students' learning. Gibbs (2016) stated the exit ticket should not be taken as a grade since the tasks on the exit ticket involve material from the present lesson. How to Implement A Story of Units (2013) defined the exit ticket

> as a two fold process: to teach students to grow accustomed to being held individually accountable for the work they have done after one day's instruction, and to provide the teacher with valuable evidence of the efficacy of that day's work—which is indispensable for planning purposes. (p. 12)

As students take part in the decision-making process of their own learning, they can make connections between the lesson, concepts, strategies, and tools on their own ("How to Implement A Story of Units," 2013).

Conclusion

The review of literature conducted by the researcher identified different instructional approaches that are outlined in the Eureka Math program. The reviewed research contains studies conducted in settings ranging from kindergarten through 12th grade. In the following chapter, the researcher outlines the methodology that was employed to answer the research question.

Chapter 3: Methodology

Introduction

The purpose of this study was to describe the experiences of teaching mathematics using the Eureka Math program in an elementary setting. This chapter outlines a description of the mixed methods design used in the study. The chapter also includes the research question, research design, data collection, data analysis, and summary.

Research Question

How do elementary teachers experience teaching mathematics using the Eureka Math program?

Research Design

This study followed a mixed methods design in order to study elementary teacher experiences of teaching Eureka Math. The mixed methods design is defined as, "An approach to inquiry that contains both qualitative and quantitative approaches, and the mixing or integrating both approaches in a study" (Creswell, 2014, p. 244). Teachers reflected on their experiences, the lesson components of Eureka Math, and the implementation of Eureka Math by participating in an online survey and contributing in interview groups. With a mixed methods study, the researcher will have the opportunity to study the everyday life of the setting that is being study (Creswell, 2014). On the other hand, qualitative research can provide an understanding of individuals or groups to determine how the meaning of the individual or groups relate to a certain problem (Creswell, 2014). Combining quantitative and qualitative methods provides a wide range of data to help answer the research question (Gall, Gall, & Borg, 2007). Creswell (2014)

identified that two theories are tested in quantitative research to support the relationship among variables by using numerical data or statistical procedures. By using a mixed methods design, philosophical assumptions are created through the use of quantitative and qualitative data. (Creswell, 2014).

Quantitative Survey Data

An electronic survey (Appendix A) was chosen to gather feedback regarding kindergarten through fifth-grade teacher experiences while using the Eureka Math program. In order to provide data to answer the research question, a 15-question survey with one open-ended question was administered to 10 elementary schools within a common school district. All kindergarten through fifth-grade teachers in the 10 participating schools were invited to participate in the survey via email through the use of Google Forms. The researcher created an informational email including an invitation to participate in the study, detailed information regarding the purpose of the survey (Appendix B), and a consent letter. Participants were given a 3-week time frame to respond to the survey. The researcher sent an email reminder to participants and principals indicating the survey was still open for responses at the end of the first week in order to have an effective response rate. The survey consisted of a 4-point Likert scale, with the following options: strongly agree (A), agree (B), disagree (C), strongly agree (D), and strongly disagree for 16 questions. A Likert scale was chosen because of the well-known quality of this type of scale and the ease for the participants to rank their answers (Allen & Seaman, 2007). One open-ended question was added because the researcher and the committee believed providing the respondent with the opportunity to answer an open-ended question would assist with the formulation of questions for the

interview focus groups. An electronic survey was chosen because all participants have access to complete the survey through the district's email system and an electronic survey allows for quicker responses. According to Jansen, Corley, and Jansen (2006), "E-mail surveys provide the researcher with the ability to reach a large number of potential respondents quickly and relatively cheaply, and to receive any completed surveys in a correspondingly short amount of time" (p. 4). The data collected allows the researcher to build patterns, categories, and themes from the bottom up (Creswell, 2009).

Survey Validation

In order to validate the survey, 12 elementary general education teachers who had been teaching Eureka Math in a neighboring school district and who are not participants in this study piloted the survey in the fall of 2016. The researcher distributed copies of the survey via email to the pilot test group giving the group an option to print the survey and write on the hard copy or provide feedback in the form of a return email. All 12 participants provided feedback via the hard copy. Minor revisions were made by the pilot group, such as emending word choice and sentence structure. Feedback from the teachers were used to refine the survey and ensure that the questions presented would measure what the researcher was attempting to measure (Creswell, 2008). The survey was also reviewed by the director of elementary education of the neighboring school system in the summer and fall of 2016 for clarity and feedback. The researcher adjusted the survey based on the feedback from the director of elementary education that asked the participants for demographic information. The information requested by the researcher included the following:

- What is your gender?

- What grade level or levels do you currently teach?
- How many years you have taught your current grade level?
- What grades have you previously taught?
- What is your highest degree?
- Are you Nationally Board Certified?

Interview Focus Groups

Interview groups were used in this study to validate the survey information and provide feedback regarding kindergarten through fifth-grade teacher experiences while using the Eureka Math program. The researcher ensured that teachers from multiple grade levels were represented in the study to obtain a well-rounded perspective of kindergarten through fifth-grade teachers. Qualitative components of data collection such as the open-ended question attached to the survey to drive the interview group questions. According to Creswell (2008), when respondents answer open-ended questions, they are able to voice their unconstrained opinions. Kindergarten through fifth-grade teachers from each elementary school within the district were invited to participate in the interview group. The researcher created a separate Google Form (Appendix C) including two questions that were attached to the survey confirmation page inviting participants to participate in the interview group. The two questions included the question, “Would you be willing to participate in an interview group and share your experiences regarding Eureka Math?” The participants who responded “yes” were asked to include their name, grade level, and email in a separate box. Participants who responded “yes” were recorded in alphabetical order by last name and grade level. A randomized list was generated using Excel to select potential candidates for each

interview group. The researcher sent the randomly selected participants an invitation email (Appendix D). Follow-up phone calls were made to selected participants who failed to respond to the email invitations. One interview group was used to gather data. The interview group met after school in a conference room at the district office from 3:30-4:35). The questions for the interview group were developed from an analysis of the survey results. According to Creswell (2008), when participants can answer open-ended questions, their responses voice their unconstrained opinions. Each interview group participant had the opportunity to share her thoughts regarding a series of open-ended questions. The researcher did not make the names of any participants public nor share the names of participants in any type of published print. The researcher recorded the interview session and encouraged discussion within the group.

Data Collection and Steps

Prior to any data collection, the researcher obtained permission to conduct the study. The researcher submitted a written request to the superintendent of the district and contacted the principals of all elementary schools via email seeking permission at both the district and building levels. The steps for data collection included

1. The researcher distributed the survey via Google Forms.
2. The researcher collected surveys for a 3-week period.
3. The researcher analyzed the survey data.
4. After completion of data analysis, the researcher developed interview group questions based on the analysis including themes from the survey data and open-ended questions.
5. The researcher used indiscriminate sampling by creating a list of participants

varying from each grade level kindergarten through fifth grade. The researcher arranged dates and times for the group to meet for those who agreed to participate.

6. The researcher contacted a third party to transcribe the audio files and then reviewed results from the interview group before analyzing the data.

Data Analysis

Data were collected via (a) an online survey using a Likert scale and (b) interview groups. Once the survey was closed, the data from the survey were moved into a spreadsheet and uploaded into the Social Science for Windows (SPSS) system. SPSS was utilized to calculate a mean, median, and mode from the data retrieved from the survey's Likert scale findings. The researcher also used the chi-square instrument to compare elementary teachers' confidence levels regarding each component of the Eureka Math program from the Likert scale to one's grade level taught, years of teaching experience, and years of teaching Eureka Math. The chi-square instrument allowed the researcher to determine if one's confidence level regarding each component of the Eureka Math program had a positive or negative association to one's grade level taught, years of teaching experience, and years of teaching Eureka Math. Tables were used to display two categorical variables at a time. The results from the chi-square also helped the researcher determine the mean score for each theme in the survey.

To summarize the information collected from the survey, the researcher created various tables. Descriptive statistics were used to describe the background and experience information from each participant. Tables 1-3 included a breakdown of the participants by grade level taught, years of teaching experience, and years using Eureka

Math in their classroom with an identification of the percentage and the number of participants within each table. Tables 4-15 include survey responses from each participant, the participant's grade level, and the participant's confidence level regarding each component of Eureka Math. Tables 16-27 include survey responses from each participant, the participant's years of teaching experience, and the participant's confidence level regarding each component of Eureka Math. Tables 28-39 include survey responses from each participant, the participant's years of teaching Eureka Math, and the participant's confidence level regarding each component of Eureka Math. The categorical variables included in tables are the participant's grade level and the participant's confidence level regarding each component of Eureka Math, the participant's years of teaching experience and the participant's confidence level regarding each component of Eureka Math, and the participant's years of teaching Eureka Math and the participant's confidence level regarding each component of Eureka Math. Using the chi-square instrument, the researcher identified the p value of the two categorical variables in Tables 4-39 and determined if there was an association.

Interview group questions were generated based on the responses from the survey and open-ended question. An interview group protocol was used to serve as an agenda for the participants. The interview group was recorded by the researcher and transcribed by a third party. The researcher analyzed transcripts from one interview group in order to identify common themes and verify data. Themes were reviewed and applied by the researcher in order to make connections to the teachers' experiences, reflections of teaching Eureka Math, and current literature review. A frequency distribution table was used to represent specific findings. Quotes from participants in the interview group were

included to illustrate key ideas, beliefs, and experiences regarding the lesson components of Eureka Math. Narratives from the participants' quotes were developed to support the quantitative and qualitative data.

The following information was identified in a table: the theme being discussed, the number of participants in the interview groups who provided information regarding the theme, and the percentage of participants in the interview groups who discussed the theme.

Summary

The purpose of this study was to examine the experiences of elementary teachers from a southwestern school district in North Carolina delivering Eureka Math components. The study occurred in 10 elementary schools which were in the southwestern region of North Carolina. All kindergarten through fifth grade general education teachers were invited to participate in the survey. Inviting all teachers to participate allowed the researcher to gain a deep understanding of each teacher's lived experiences while using the Eureka Math program. The interview group participants included a representation from kindergarten through fifth grade. The researcher used an indiscriminate sampling by creating a list of participants varying from each grade level, kindergarten through fifth grade, in order to gain an overall perception of the teachers' experiences, observations, and beliefs of teaching Eureka Math. The data were analyzed and reviewed by using a mixed methods study using the chi-square instrument and various tables to represent the findings. The researcher collected survey data and generated interview questions based on the survey results. All responses were centered around elementary teacher experiences of teaching Eureka Math. The results of this

study were shared with administrators and county administration within the district of study.

Chapter 4: Results

Introduction and Overview

The purpose of this mixed methods study was to study elementary teacher experiences of teaching Eureka Math by answering this research question, "How do elementary teachers experience teaching mathematics using the Eureka Math program?" This chapter presents an introduction and overview, details of the data collection processes, data analysis, and reports of the results within the study.

The county in which the study took place is located in the southwestern region of North Carolina. The population of the county is 66,551 and is made up of 87% Caucasian, 10% African American, and 3% Hispanic/Latino. According to the United States Census Bureau (2017), 18.6% of the county's population lives in poverty. Ten Title I elementary schools located in the southwestern region of North Carolina were used for this study.

Tables 1-3 summarize the information collected from the survey responses. The tables below identify the percentage, number of participants, the grade level taught, years of teaching experience, and the years of using Eureka Math in the participant's classroom.

Table 1

Grade Level Taught

Grade Level	Percentage of Participants	Number of Participants
Kindergarten	22.8	18
1st Grade	19.0	15
2nd Grade	20.3	16
3rd Grade	13.9	11
4th Grade	12.7	10
5th Grade	11.4	9

Table 2

Years of Teaching Experience

Years of Experience	Percentage of Participants	Number of Participants
0-3 years	8.9	7
4-10 years	35.4	28
11-20 years	35.4	28
21-more than 21 years	20.3	16

Table 3

Years of Teaching Eureka Math

Years	Percentage of Participants	Number of Participants
1 years	2.5	2
2 years	8.9	7
3 years	16.5	13
4 years	31.6	25
5-more than 5 years	40.5	32

The demographic data contained in the tables allowed the researcher to develop an understanding of who the participants were. The data revealed an experienced group of teachers participated in the survey. This was important data for the researcher to collect because the researcher was able to connect demographic data from the survey to other areas of the study. This information was also used when the researcher analyzed the one open-ended survey question and interview group responses to determine if a particular grade level or the participant's years of experience supported their experiences of teaching mathematics and confidence to teach the Eureka Math components.

Data Collection and Analysis

In designing the study, the researcher used a mixed methods approach. The researcher chose to conduct a mixed methods study with a survey including an open-ended question and an interview focus group as the primary means of data collection. An

online survey (Appendix A) was administered to math teachers in Grades K-5 who taught mathematics using the Eureka Math program on a daily basis. The survey was developed and distributed via Google Forms to all certified classroom teachers at 10 elementary schools within the studied district. Included in the survey were three initial questions asking participants which grade level they taught, years of teaching experience, and years of teaching Eureka Math at the time they responded to the survey. Twelve questions were administered on the online survey using a 4-point Likert scale, giving the following options: strongly agree (A), agree (B), disagree (C), strongly agree and (D), strongly disagree. The 12 questions were selected based on the components of the Eureka Math program with a focus around one's confidence level. Three questions were developed around each of the four components of the Eureka Math program. The questions were placed in order based on the Eureka Math lesson plan structure. One open-ended question at the end of the survey allowed participants to describe their experience with Eureka Math. The survey was available for 3 weeks. At the end of the third week, the researcher analyzed the responses and determined common themes based on each question.

After the survey was conducted, the researcher used the SPSS Statistics Software, Version 23 to run chi-square tests. The researcher ran a chi-square test on each of the survey questions related the lesson plan components of Eureka Math. Results were analyzed by using a chi-square statistical test to explain the distribution of responses across two categorical variables using a 4-point Likert scale. The researcher assigned a numeric rating using the following Likert agreement scale

- 1=Strongly Disagree

- 2=Disagree
- 3=Agree
- 4=Strongly Agree

The tests were used to determine whether there is a significant association between the participant's grade level and the participant's confidence level regarding each component of Eureka Math by recording the *p* value from each chi-square test. Using the *p* value to indicate significance, a *p* value is considered significant if it is less than .05, and it is not significant if it is above 0.05.

The researcher chose to examine the participants' confidence level to teach, monitor, and provide feedback throughout each component of the Eureka Math lesson plan. Within the survey, questions 4, 5, and 6 addressed the participants' confidence levels to teach, monitor, and provide feedback throughout the fluency practice. Tables 4, 5, and 6 show the responses to the survey questions by each participant and are organized by their grade level.

Table 4

Confident to Teach Fluency Practice by Grade Level

	Confident to Teach Fluency Practice								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten					15	83.3	3	16.7	18
1st Grade					13	86.7	2	13.3	15
2nd Grade	1	6.3			12	75.0	3	18.8	16
3rd Grade					7	63.6	4	36.4	11
4th Grade			1	10.0	8	80.0	1	10.0	10
5th Grade			1	11.1	7	77.8	1	11.1	9
Total	1	1.3	2	2.5	62	78.5	14	17.7	79

Table 5

Confident Monitoring Students During Fluency Practice by Grade Level

	Confident Monitoring Students During Fluency Practice								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten					15	83.3	3	16.7	18
1st Grade					14	93.3	1	6.7	15
2nd Grade	1	6.3			11	68.8	4	25.0	16
3rd Grade					7	63.6	4	36.4	11
4th Grade	1	10.0			8	80.0	1	10.0	10
5th Grade			1	11.1	7	77.8	1	11.1	9
Total	2	2.5	1	1.3	62	78.5	14	17.7	79

Table 6

Confident Providing Feedback Throughout Fluency Practice by Grade Level

	Confident Providing Feedback Throughout Fluency Practice								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			1	5.6	15	83.3	2	11.1	18
1st Grade			1	6.7	13	86.7	1	6.7	15
2nd Grade	1	6.3			11	68.8	4	25.0	16
3rd Grade					8	72.7	3	27.3	11
4th Grade			2	20.0	7	70.0	1	10.0	10
5th Grade			1	11.1	8	88.9			9
Total	1	1.3	5	6.3	62	78.5	11	13.9	79

The data revealed that 76 of 79 teachers feel confident to teach fluency, 77 of 79 teachers feel confident monitoring students during the fluency practice, and 73 of 79 teachers feel confident providing feedback throughout the fluency practice. The teachers who participated in the survey are confident with the fluency component as outlined in the Eureka Math lesson plan. The researcher conducted a chi-square test on each of the survey questions to compare the participants' grade level and the participants' confidence

level regarding the fluency component. The significance of the two variables grade level and confidence to teach fluency practice had a *p* value of .549. There is no association between the participants' grade level and confidence to teach fluency practice. The significance of the two variables grade level and confidence monitoring students during fluency practice had a *p* value of .493. There is no association between the participants' grade level and confidence monitoring students during fluency practice. The significance of the two variables grade level and confidence providing feedback during fluency practice had a *p* value of .295. There is no association between the participants' grade level and confident providing feedback during fluency practice.

Within the survey, questions 7, 8, and 9 addressed the participants' confidence level to teach, monitor, and provide feedback throughout the application problem. Tables 7, 8, and 9 show the responses to the survey questions by each participant and are organized by their grade level.

Table 7

Confident to Teach Application Problem During Application Problem by Grade Level

Confident to Teach Application Problem During Application Problem									
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			2	11.1	12	66.7	4	22.2	18
1st Grade					12	80.0	3	20.0	15
2nd Grade	1	6.3			9	56.3	6	37.5	16
3rd Grade					7	63.6	4	36.4	11
4th Grade					7	70.0	3	30.0	10
5th Grade			1	11.1	7	77.8	1	11.1	9
Total	1	1.3	3	3.8	54	68.4	21	26.6	79

Table 8

Confident Monitoring Students During Application Problem by Grade Level

	Confident Monitoring Students During Application Problem								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			2	11.1	12	66.7	4	22.2	18
1st Grade					13	86.7	2	13.3	15
2nd Grade	1	6.3			10	62.5	5	31.3	16
3rd Grade					7	63.6	4	36.4	11
4th Grade					7	70.0	3	30.0	10
5th Grade			1	11.1	7	77.8	1	11.1	9
Total	1	1.3	3	3.8	56	70.9	19	24.1	79

Table 9

Confident Providing Feedback Throughout Application Problem by Grade Level

	Confident Providing Feedback Throughout Application Problem								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			2	11.1	13	72.2	3	16.7	18
1st Grade					13	86.7	2	13.3	15
2nd Grade	1	6.3			10	62.5	5	31.3	16
3rd Grade					8	72.7	3	27.3	11
4th Grade					7	70.0	3	30.0	10
5th Grade			1	11.1	7	77.8	1	11.1	9
Total	1	1.3	3	3.8	58	73.4	17	21.5	79

The data revealed that 75 of 79 teachers feel confident to teach the application problem, 75 of 79 teachers feel confident monitoring students during the application problem, and 75 of 79 teachers feel confident providing feedback throughout the application problem. The teachers who participated in the survey are confident with the application component as outlined in the Eureka Math lesson plan. The researcher conducted a chi-square test on each of the survey questions to compare the participants' grade level and the participants' confidence level regarding the application component.

The significance of the two variables grade level and confident to teach the application problem had a p value of .613. There is no association between the participants' grade level and confidence to teach the application problem. The significance of the two variables grade level and confident monitoring students during the application problem had a p value of .591. There is no association between the participants' grade level and confident monitoring students during the application problem. The significance of the two variables grade level and confidence providing feedback during the application problem had a p value of .625. There is no association between the participants' grade level and confidence providing feedback during the application problem.

Within the survey, questions 10, 11, and 12 addressed the participants' confidence level to teach, monitor, and provide feedback throughout the application problem. Tables 10, 11, and 12 show the responses to the survey questions by each participant and are organized by their grade level.

Table 10

Confident to Teach Concept Development by Grade Level

	Confident to Teach Concept Development								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			1	5.6	14	77.8	3	16.7	18
1st Grade			1	6.7	11	73.3	3	20.0	15
2nd Grade	1	6.3			11	68.8	4	25.0	6
3rd Grade			2	18.2	6	54.5	3	27.3	11
4th Grade					7	70.0	3	30.0	10
5th Grade			1	11.1	6	66.7	2	22.2	9
Total	1	1.3	5	6.3	55	69.6	18	22.8	79

Table 11

Confident Monitoring Students During Concept Development by Grade Level

	Confident Monitoring Students During Concept Development								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			1	5.6	14	77.8	3	16.7	18
1st Grade					13	86.7	2	13.3	15
2nd Grade	1	6.3			11	68.8	4	25.0	16
3rd Grade			2	18.2	6	54.5	3	27.3	11
4th Grade					6	60.0	4	40.0	10
5th Grade			1	11.1	6	66.7	2	22.2	9
Total	1	1.3	4	5.1	56	70.9	18	22.8	79

Table 12

Confident Providing Feedback Throughout Concept Development by Grade Level

	Confident Providing Feedback Throughout Concept Development								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			2	11.1	12	66.7	4	22.2	18
1st Grade					13	86.7	2	13.3	15
2nd Grade			1	6.3	12	75.0	3	18.8	16
3rd Grade			2	18.2	6	54.5	3	27.3	11
4th Grade					6	60.0	4	40.0	10
5th Grade			1	11.1	6	66.7	2	22.2	9
Total			6	7.6	55	69.6	18	22.8	79

The data revealed that 73 of 79 teachers feel confident to teach the concept development, 74 of 79 teachers feel confident monitoring students during the concept development, and 73 of 79 teachers feel confident providing feedback throughout the concept development. The teachers who participated in the survey are confident with concept development component as outlined in the Eureka Math lesson plan. The researcher conducted a chi-square test on each of the survey questions to compare the participants' grade level and the participants' confidence level regarding the concept

development component. The significance of the two variables grade level and confidence to teach the concept development had a *p* value of .841. There is no association between the participants' grade level and confidence to teach the concept development. The significance of the two variables grade level and confident monitoring students during the concept development had a *p* value of .526. There is no association between the participants' grade level and confidence monitoring students during the concept development. The significance of the two variables grade level and confidence providing feedback during the concept development had a *p* value of .695. There is no association between the participants' grade level and confidence providing feedback during the concept development.

Within the survey, questions 13, 14, and 15 addressed the participants' confidence level to teach, monitor, and provide feedback throughout the student debrief. Tables 13, 14, and 15 show the responses to the survey questions by each participant and are organized by their grade level.

Table 13

Confident to Teach Student Debrief by Grade Level

	Confident to Teach Student Debrief								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			3	16.7	14	77.8	1	5.6	18
1st Grade			2	13.3	13	86.7			15
2nd Grade			4	25.0	10	62.5	2	12.5	16
3rd Grade			4	36.4	6	54.5	1	9.1	11
4th Grade			1	10.0	9	90.0			10
5th Grade			2	22.2	7	77.8			9
Total			16	20.3	59	74.7	4	5.1	79

Table 14

Confident Monitoring Students During Student Debrief by Grade Level

	Confident Monitoring Students During Student Debrief								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			3	16.7	14	77.8	1	5.6	18
1st Grade			2	13.3	13	86.7			15
2nd Grade			3	18.8	11	68.8	2	12.5	16
3rd Grade			4	36.4	6	54.5	1	9.1	11
4th Grade			1	10.0	9	90.0			10
5th Grade			2	22.2	7	77.8			9
Total			15	19.0	60	75.9	4	5.1	79

Table 15

Confident Providing Feedback Throughout Student Debrief by Grade Level

	Confident Providing Feedback Throughout Student Debrief								
	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
Kindergarten			2	11.1	15	83.3	1	5.6	18
1st Grade			2	13.3	13	86.7			15
2nd Grade			4	25.0	9	56.3	3	18.8	16
3rd Grade			4	36.4	6	54.5	1	9.1	11
4th Grade			1	10.0	8	80.0	1	10.0	10
5th Grade			2	22.2	7	77.8			9
Total			15	19.0	58	73.4	6	7.6	79

The data revealed that 63 of 79 teachers feel confident to teach the student debrief, 64 of 79 teachers feel confident monitoring students during the student debrief, and 64 of 79 teachers feel confident providing feedback throughout the student debrief. A majority of the teachers who participated in the survey are not as confident with the student debrief component as the other components outlined in the Eureka Math lesson plan. The researcher conducted a chi-square test on each of the survey questions to compare the participants' grade level and the participants' confidence level regarding the

concept development component. The significance of the two variables grade level and confident to teach the student debrief had a *p* value of .631. There is no association between the participants' grade level and confidence to teach the student debrief. The significance of the two variables grade level and confidence monitoring students during the student debrief had a *p* value of .665. There is no association between the participants' grade level and confidence monitoring students during the concept development. The significance of the two variables grade level and confident providing feedback during the student debrief had a *p* value of .451. There is no association between the participants' grade level and confidence providing feedback during the student debrief.

The researcher chose to examine the participants' years of teaching experience and survey questions 4, 5, and 6 to determine if there was an association between the variables. Tables 16, 17, and 18 show the responses to the survey questions related to the fluency component by each participant and are organized by their years of teaching experience.

Table 16

Confident to Teach Fluency Practice by Years of Teaching Experience

	Confident to Teach Fluency Practice								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			1	3.6	22	78.6	5	17.9	28
11-20 years					25	89.3	3	10.7	28
>=21 years	1	6.3			10	62.5	5	31.3	16
Total	1	1.3	2	2.5	62	78.5	14	17.7	79

Table 17

Confident Monitoring Students During Fluency Practice by Years of Teaching Experience

Confident Monitoring Students During Fluency Practice									
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years	1	3.6			22	78.6	5	17.9	28
11-20 years					26	92.9	2	7.1	28
>=21 years	1	6.3			9	56.3	6	37.5	16
Total	2	2.5	1	1.3	62	78.5	14	17.7	79

Table 18

Confident Providing Feedback Throughout Fluency Practice by Years of Teaching Experience

Confident Providing Feedback Throughout Fluency Practice									
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			2	28.6	4	57.1	1	14.3	7
4-10 years			2	7.1	23	82.1	3	10.7	28
11-20 years			1	3.6	25	89.3	2	7.1	28
>=21 years	1	6.3			10	62.5	5	31.3	16
Total	1	1.3	5	6.3	62	78.5	11	13.9	79

The data revealed that teachers with 4-20 years of experience are the most confident to teach, monitor, and provide feedback during the fluency practice as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching experience and the participants' confidence level regarding the concept fluency. The significance of the two variables years of teaching experience and confidence to teach the fluency practice had a p value of .189. The data revealed that there is an association between the participants'

years of teaching and confidence to teach fluency practice. The significance of the two variables years of teaching experience and confident monitoring students during the fluency practice had a *p* value of .023. There is an association between the participants' years of experience and confidence monitoring students during the fluency practice. The significance of the two variables years of teaching experience and confident providing feedback during the fluency practice had a *p* value of .053. There is an association between the participants' years of teaching and confidence providing feedback during the fluency practice.

The researcher chose to examine the participants' years of teaching experience and survey questions 7, 8, and 9 to determine if there was an association between the variables. Tables 19, 20, and 21 show the responses to the survey questions related to the application problem by each participant and are organized by their years of teaching experience.

Table 19

Confident to Teach Application Problem During Application Problem by Years of Teaching Experience

Confident to Teach Application Problem During Application Problem									
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			2	7.1	19	67.9	7	25.0	28
11-20 years					23	82.1	5	17.9	28
>=21 years	1	6.3			7	43.8	8	50.0	16
Total	1	1.3	3	3.8	54	68.4	21	26.6	79

Table 20

Confident Monitoring Students During Application Problem by Years of Teaching Experience

	Confident Monitoring Students During Application Problem								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			2	7.1	20	71.4	6	21.4	28
11-20 years					24	85.7	4	14.3	28
>=21 years	1	6.3			7	43.8	8	50.0	16
Total	1	1.3	3	3.8	56	70.9	19	24.1	79

Table 21

Confident Providing Feedback Throughout Application Problem by Years of Teaching Experience

	Confident Providing Feedback Throughout Application Problem								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			2	7.1	22	78.6	4	14.3	28
11-20 years					24	85.7	4	14.3	28
>=21 years	1	6.3			7	43.8	8	50.0	16
Total	1	1.3	3	3.8	58	73.4	17	21.5	79

The data revealed that teachers of 4-20 years of teaching experience are the most confident to teach, monitor, and provide feedback during the application problem as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching experience and the participants' confidence level regarding the application problem. The significance of the two variables years of teaching experience and confidence to teach the application problem had a p value of .086. The data revealed that there is no association between the

participants' years of teaching and confidence to teach application problem. The significance of the two variables years of teaching experience and confidence monitoring students during the application problem had a *p* value of .050. There is an association between the participants' years of experience and confidence monitoring students during the application problem. The significance of the two variables years of teaching experience and confidence providing feedback during the application problem had a *p* value of 0.29. There is no association between the participants' years of teaching and confidence providing feedback during the application problem.

The researcher chose to examine the participants' years of teaching experience and survey questions 10, 11, and 12 to determine if there was an association between the variables. Tables 22, 23, and 24 show the responses to the survey questions related to the concept development by each participant and are organized by their years of teaching experience.

Table 22

Confident to Teach Concept Development by Years of Teaching Experience

	Confident to Teach Concept Development								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			2	28.6	4	57.1	1	14.3	7
4-10 years			1	3.6	21	75.0	6	21.4	28
11-20 years			1	3.6	23	82.1	4	14.3	28
>=21 years	1	6.3	1	6.3	7	43.8	7	43.8	16
Total	1	1.3	5	6.3	55	69.6	18	22.8	79

Table 23

Confident Monitoring Students During Concept Development by Years of Teaching Experience

	Confident Monitoring Students During Concept Development								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			1	3.6	20	71.4	7	25.0	28
11-20 years			1	3.6	24	85.7	3	10.7	28
>=21 years	1	6.3	1	6.3	7	43.8	7	43.8	16
Total	1	1.3	4	5.1	56	70.9	18	22.8	79

Table 24

Confident Providing Feedback Throughout Concept Development by Years of Teaching Experience

	Confident Providing Feedback Throughout Concept Development								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			3	10.7	18	64.3	7	25.0	28
11-20 years			1	3.6	24	85.7	3	10.7	28
>=21 years			1	6.3	8	50.0	7	43.8	16
Total			6	7.6	55	69.6	18	22.8	79

The data revealed that teachers with 4-20 years of teaching experience are the most confident to teach, monitor, and provide feedback during the concept development as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching experience and the participants' confidence level regarding the concept development. The significance of the two variables years of teaching experience and confidence to teach the concept development had a p value of .053. The data revealed that there is no association

between the participants' years of teaching and confidence to teach concept development. The significance of the two variables years of teaching experience and confidence monitoring students during the concept development had a *p* value of .158. There is no association between the participants' years of experience and confidence monitoring students during the concept development. The significance of the two variables years of teaching experience and confidence providing feedback during the concept development had a *p* value of .197. There no association between the participants' years of teaching and confidence providing feedback during the concept development.

The researcher chose to examine the participants' years of teaching experience and survey questions 13, 14, and 15 to determine if there was an association between the variables. Tables 25, 26, and 27 show the responses to the survey questions related to the student debrief by each participant and are organized by their years of teaching experience.

Table 25

Confident to Teach Student Debrief by Years of Teaching Experience

	Confident to Teach Student Debrief								
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			8	28.6	20	71.4			28
11-20 years			5	17.9	22	78.6	1	3.6	28
>=21 years			2	12.5	12	75.0	2	12.5	16
Total			16	20.3	59	74.7	4	5.1	79

Table 26

Confident Monitoring Students During Student Debrief by Years of Teaching Experience

Confident Monitoring Students During Student Debrief									
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			7	25.0	21	75.0			28
11-20 years			5	17.9	22	78.6	1	3.6	28
>=21 years			2	12.5	12	75.0	2	12.5	16
Total			15	19.0	60	75.9	4	5.1	79

Table 27

Confident Providing Feedback Throughout Student Debrief by Years of Teaching Experience

Confident Providing Feedback Throughout Student Debrief									
Teaching Experience	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
0-3 years			1	14.3	5	71.4	1	14.3	7
4-10 years			7	25.0	21	75.0			28
11-20 years			5	17.9	22	78.6	1	3.6	28
>=21 years			2	12.5	10	62.5	4	25.0	16
Total			15	19.0	58	73.4	6	7.6	79

The data revealed that teachers with 4-20 years of experience are the most confident to teach, monitor, and provide feedback during the student debrief as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching experience and the participants' confidence level regarding the student debrief. The significance of the two variables years of teaching experience and confidence to teach the student debrief had a p value of .401. The data revealed that there is no association between the participants' years of teaching and confidence to teach student debrief. The significance of the two

variables years of teaching experience and confidence monitoring students during the student debrief had a *p* value of .481. There is no association between the participants' years of experience and confidence monitoring students during the student debrief. The significance of the two variables years of teaching experience and confidence providing feedback during the student debrief had a *p* value of .092. There is no association between the participants' years of teaching and confidence providing feedback during the student debrief.

The researcher chose to examine the participants' years of teaching Eureka Math and survey questions 4, 5, and 6 to determine if there was an association between the variables. Tables 28, 29, and 30 show the responses to the survey questions related to the fluency component by each participant and are organized by their years of teaching Eureka Math.

Table 28

Confident to Teach Fluency Practice by Years Teaching Eureka Math

	Confident to Teach Fluency Practice								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					5	71.4	2	28.6	7
3 years			1	7.7	11	84.6	1	7.7	13
4 years					21	84.0	4	16.0	25
>=5 Years					25	78.1	7	21.9	32
Total	1	1.3	2	2.5	62	78.5	14	17.7	79

Table 29

Confident Monitoring Students During Fluency Practice by Years of Teaching Eureka Math

	Confident Monitoring Students During Fluency Practice								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					5	71.4	2	28.6	7
3 years	1	7.7			10	76.9	2	15.4	13
4 years					21	84.0	4	16.0	25
>=5 years					26	81.3	6	18.8	32
Total	2	2.5	1	1.3	62	78.5	4	17.7	79

Table 30

Confident Providing Feedback Throughout Fluency Practice by Years of Teaching Eureka Math

	Confident Providing Feedback Throughout Fluency Practice								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					6	85.7	1	14.3	7
3 years			3	23.1	8	61.5	2	15.4	13
4 years					22	88.0	3	12.0	25
>=5 years			1	3.1	26	81.3	5	15.6	32
Total	1	1.3	5	6.3	62	78.5	11	13.9	79

The data revealed that teachers with 4 years or more of experience teaching Eureka Math are the most confident to teach, monitor, and provide feedback during the fluency practice as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching Eureka Math and the participants' confidence level regarding the concept fluency. The significance of the two variables years of teaching Eureka Math and confidence to teach

the fluency practice had a *p* value of .000. The data revealed that there is an association between the participants' years of teaching Eureka Math and confident to teach fluency practice. The significance of the two variables years of teaching Eureka Math and confidence monitoring students during the fluency practice had a *p* value of .000. There is an association between the participants' years of teaching Eureka Math and confidence monitoring students during the fluency practice. The significance of the two variables years of teaching Eureka Math and confidence providing feedback during the fluency practice had a *p* value of 0.00. There is an association between the participants' years of teaching Eureka Math and confidence providing feedback during the fluency practice.

The researcher chose to examine the participants' years of teaching Eureka Math and survey questions 7, 8, and 9 to determine if there was an association between the variables. Tables 31, 33, and 33 show the responses to the survey questions related to the application problem by each participant and are organized by their years of teaching Eureka Math.

Table 31

Confident to Teach Application Problem During Application Problem by Years of Teaching Eureka Math

Confident to Teach Application Problem During Application Problem									
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					4	57.1	3	42.9	7
3 years			1	7.7	11	84.6	1	7.7	13
4 years					19	76.0	6	24.0	25
>=5 years			1	3.1	20	62.5	11	34.4	32
Total	1	1.3	3	3.8	54	68.4	21	26.6	79

Table 32

Confident Monitoring Students During Application Problem by Years of Teaching Eureka Math

	Confident Monitoring Students During Application Problem								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					4	57.1	3	42.9	7
3 years			1	7.7	10	76.9	2	15.4	13
4 years					21	84.0	4	16.0	25
>=5 years			1	3.1	21	65.6	10	31.3	32
Total	1	1.3	3	3.8	56	70.9	19	24.1	79

Table 33

Confident Providing Feedback Throughout Application Problem by Years of Teaching Eureka Math

	Confident Providing Feedback Throughout Application Problem								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					5	71.4	2	28.6	7
3 years					11	84.6	2	15.4	13
4 years					22	88.0	3	12.0	25
>=5 years			2	6.3	20	62.5	10	31.3	32
Total	1	1.3	3	3.8	58	73.4	17	21.5	79

The data revealed that teachers with 4 or more years of experience teaching Eureka Math are the most confident to teach, monitor, and provide feedback during the application problem as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching Eureka Math and the participants' confidence level regarding the application problem. The significance of the two variables years of teaching Eureka Math and

confidence to teach the application problem had a *p* value of .000. The data revealed that there is an association between the participants' years of teaching Eureka Math and confidence to teach the application problem. The significance of the two variables years of teaching Eureka Math and confidence monitoring students during the application problem had a *p* value of .000. There is an association between the participants' years of teaching Eureka Math and confidence monitoring students during the application problem. The significance of the two variables years of teaching Eureka Math and confidence providing feedback during the application problem had a *p* value of .000. There is an association between the participants' years of teaching Eureka Math and confidence providing feedback during the application problem.

The researcher chose to examine the participants' years of teaching Eureka Math and survey questions 10, 11, and 12 to determine if there was an association between the variables. Tables 34, 35, and 36 show the responses to the survey questions related to the concept development by each participant and are organized by their years of teaching Eureka Math.

Table 34

Confident to Teach Concept Development by Years of Teaching Eureka Math

	Confident to Teach Concept Development								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years			1	14.3	4	57.1	2	28.6	7
3 years					12	92.3	1	7.7	13
4 years			1	4.0	20	80.0	4	16.0	25
>=5 years			2	6.3	19	59.4	11	34.4	32
Total	1	1.3	5	6.3	55	69.6	18	22.8	79

Table 35

Confident Monitoring Students During Concept Development by Years of Teaching Eureka Math

	Confident Monitoring Students During Concept Development								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year	1	50.0	1	50.0					2
2 years					5	71.4	2	28.6	7
3 years					11	84.6	2	15.4	13
4 years			1	4.0	20	80.0	4	16.0	25
>=5 years			2	6.3	20	62.5	10	31.3	32
Total	1	1.3	4	5.1	56	70.9	18	22.8	79

Table 36

Confident Providing Feedback Throughout Concept Development by Years of Teaching Eureka Math

	Confident Providing Feedback Throughout Concept Development								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year			1	50.0	1	50.0			2
2 years					5	71.4	2	28.6	7
3 years					11	84.6	2	15.4	13
4 years			2	8.0	19	76.0	4	16.0	25
>=5 years			3	9.4	19	59.4	10	31.3	32
Total			6	7.6	55	69.6	18	22.8	79

The data revealed that teachers with 4 or more years of experience teaching Eureka Math are the most confident to teach, monitor, and provide feedback during the concept development as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching Eureka Math and the participants' confidence level regarding the concept development. The significance of the two variables years of teaching Eureka Math and

confidence to teach the concept development had a *p* value of .000. The data revealed that there is an association between the participants' years of teaching Eureka Math and confidence to teach the concept development. The significance of the two variables years of teaching Eureka Math and confidence monitoring students during the concept development had a *p* value of .000. There is an association between the participants' years of teaching Eureka Math and confidence monitoring students during the concept development. The significance of the two variables years of teaching Eureka Math and confidence providing feedback during the concept development had a *p* value of .269. There is no association between the participants' years of teaching Eureka Math and confidence providing feedback during the concept development.

The researcher chose to examine the participants' years of teaching Eureka Math and survey questions 13, 14, and 15 to determine if there was an association between the variables. Tables 37, 38, and 39 show the responses to the survey questions related to the concept development by each participant and are organized by their years of teaching Eureka Math.

Table 37

Confident to Teach Student Debrief by Years of Teaching Eureka Math

	Confident to Teach Student Debrief								
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year			1	50.0	1	50.0			2
2 years					6	85.7	1	14.3	7
3 years			4	30.8	9	69.2			13
4 years			5	20.0	19	76.0	1	4.0	25
>=5 years			6	18.8	24	75.0	2	6.3	32
Total			16	20.3	59	74.7	4	5.1	79

Table 38

Confident Monitoring Students During Student Debrief by Years of Teaching Eureka Math

Confident Monitoring Students During Student Debrief									
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year			1	50.0	1	50.0			2
2 years					6	85.7	1	14.3	7
3 years			4	30.8	9	69.2			13
4 years			4	16.0	20	80.0	1	4.0	25
>=5 years			6	18.8	24	75.0	2	6.3	32
Total			15	19.0	60	75.9	4	5.1	79

Table 39

Confident Providing Feedback Throughout Student Debrief by Years of Teaching Eureka Math

Confident Providing Feedback Throughout Student Debrief									
Years Teaching Eureka Math	Strongly Disagree		Disagree		Agree		Strongly Agree		Total
	N	%	N	%	N	%	N	%	
1 year			1	50.0	1	50.0			2
2 years					6	85.7	1	14.3	7
3 years			3	23.1	10	76.9			13
4 years			5	20.0	19	76.0	1	4.0	25
>=5 years			6	18.8	22	68.8	4	12.5	32
Total			15	19.0	58	73.4	6	7.6	79

The data revealed that teachers with 4 or more years of experience teaching Eureka Math are the most confident to teach, monitor, and provide feedback during the student debrief as aligned to the Eureka Math program. The researcher conducted a chi-square test on each of the survey questions to compare the participants' years of teaching Eureka Math and the participants' confidence level regarding the student debrief. The significance of the two variables years of teaching Eureka Math and confidence to teach

student debrief had a *p* value of .708. The data revealed that there is no association between the participants' years of teaching Eureka Math and confidence to teach the student debrief. The significance of the two variables years of teaching Eureka Math and confidence monitoring students during the student debrief had a *p* value of .659. There is no association between the participants' years of teaching Eureka Math and confidence monitoring students during the student debrief. The significance of the two variables years of teaching Eureka Math and confidence providing feedback during the student debrief had a *p* value of .659. There is no association between the participants' years of teaching Eureka Math and confidence providing feedback during the student debrief.

Question 16 in the survey was the only open-ended question: "Describe your experience with Eureka Math?" The question was posed to participants at the end of the survey to give participants the opportunity to share their personal experiences using the Eureka Math program. The researcher incorporated an open-ended question related to one's experiences to determine if participant responses to the question had common themes that could be used to develop follow-up questions for the interview group. Seventy-nine participants responded to the open-ended question, and no one left a blank response. Table 40 includes a sampling of responses for this question on the survey. The samples documented in the table do not include all participant responses, but the samples are short quotes from the complete responses and are a representation that explain the participants' experiences of the Eureka Math program.

Table 40

Question 16: Describe your Experience with Eureka Math

Sample Responses to Question 16
"I was apprehensive when we started the program, but I have grown to love it because of the understanding my students have of math concepts."
"Teaching Eureka Math was challenging at first. It took a lot of time to learn how to teach it but I realized I had to collaborate with my teammates and solve the problems ahead of time to be successful in the mathematics classroom."
"The program is very thorough and my students have the opportunity to explain their findings instead of me always modeling or giving the answer to a problem."
"My students enjoy working with a partner during our math instruction. The program is rigorous and provides opportunities for thinking, reasoning, and questioning."
"My students are engaged during math now and they love the fluency sprints."
"I like the vocabulary examples, visuals, prompting questioning that goes with each lesson. I am able to give stronger feedback to my students and they have concrete methods to apply their mathematical skills now."
"My students can explain their responses to myself and other classmates. They even understand the concepts related to math instead of just the algorithm."
"My students have a very high level of thinking now since they have used the program since kindergarten. They enjoy solving problems with manipulatives and a variety of models introduced in the program. I like to use the tape diagram model to solve or introduce problems."
"The longer I use this program the more confident I have become with my teaching practices and use of it."
"The biggest challenge was convincing parents of the program's goals and objectives. So many of my second grade parents were not used to seeing mathematics presented through conceptual understanding. They were highly skeptical, just as I was at first but through collaboration and examples, I got them on board."
"I like the hands-on approach Eureka Math uses."

Interview Group Responses

Following the survey, an interview group was also used to gather data for the

study. The researcher contacted six female respondents from five elementary schools within the same district, all of whom voluntarily agreed to participate in the study and share their experiences by responding to the interview questions. The participants represented the following grades: 1, 2, and 3. The random selection of the interview participants allowed one teacher to represent first grade, three teachers to represent second grade, and two teachers to represent third grade. Interview group questions were formulated after survey data were compiled to further investigate and clarify respondent confidence to teach, monitor students, and provide feedback to students when teaching the four components of the Eureka Math program. The interview group session was recorded and later transcribed by a third party in order to ensure accuracy and reliability of data collection. Data reduction began with reading and rereading the transcribed data. The researcher coded the transcribed document for themes in order to answer the research question. Analysis of the transcribed interview focus group provided a more detailed picture of the teachers' perceptions and confidence to teach mathematics using the Eureka Math program. A detailed summary of the data is included in this chapter through various tables, narratives, and quoted responses.

The interview group session took place on June 14, 2018 in a conference room at the district central office. The location was convenient for each participant and was a natural environment where everyone could discuss their experience using Eureka Math as a group. The setting was also a familiar place to all participants involved in the study since elementary teachers across the district use the conference room for district level professional development and elementary meetings. According to Gubrium and Holstein (2002), "the environment where any interview takes place has a bearing on the richness

of data collected" (p. 360). Scheduling the group session was challenging, as the end of the school year was quickly approaching. There were several end-of-year events such as summer camps, remediation classes, and testing taking place at each school. Also, for the purpose of scheduling it was more efficient for the researcher and participants to meet at the end of the school day at a centralized location for all. An agreed upon time for the participants to meet as a group was difficult to schedule. The meeting time was changed two times within the week of June 4, 2018. The participants agreed to meet on the last optional teacher workday of the school year at 3:15 pm. Due to time constraints and the number of participants willing to participate in an interview group, multiple interview group sessions were not feasible.

The interview group was recorded using a Phillips recorder and a MacBook Pro using QuickTime player as a backup. The interview group lasted 1 hour and 29 minutes. The interview session was semi-structured and provided rich discussion.

Before the interview focus group started, the researcher introduced herself, explained the Gardner-Webb University IRB Informed Consent Form, and thanked the participants for their support. The researcher used the interview questions with additional probing when necessary to serve as a starting point and allow participants to provide in-depth detail or clarification. Table 41 provides an overview of the participants from each school, including grade level taught during the 2017-2018 school year and the years of teaching experience for each focus group participant.

Table 41

Focus Group Participants

Respondent	School	Grade-Level Taught	Years of Experience
1	Asher Elementary	1	2
2	Asher Elementary	2	13
3	Lakeside Elementary	2	11
4	Mountain View Elementary	2	11
5	Smithfield Elementary	3	21
6	Westwood Elementary	3	18

An interview group protocol was developed for this study to serve as an agenda for the participants. The six questions on the protocol were developed to validate the survey and help the researcher gather deeper explanations of the survey results. The researcher also pulled the most common phrases and/or words from the open-ended survey question to develop three of the six interview questions. Two of the interview questions were asked by the researcher during the interview group. The two questions emerged from participants' comments and experiences regarding student engagement and teacher collaboration. The two questions that were added during the focus group are numbers 5 and 6. Questions for the interview focus group included

1. Tell me about the first time you taught a Eureka Math lesson.
2. How confident do you feel when teaching the components of Eureka Math?
3. How have your instructional practices changed as a result of implementing Eureka Math?
4. How are your students responding to the components of Eureka Math?
5. What has helped you grow as an elementary mathematics teacher?
6. Do you spend a lot of time planning with your colleagues or do you spend time by yourself planning for each Eureka Math lesson?
7. What supplemental resources do you use?

8. What would you like for me to know about Eureka Math and your experiences that was not addressed in the previous questions?

The participants from the interview group were given the opportunity to discuss their personal experiences of Eureka Math. Data from the survey allowed the teachers to expand on their responses and set a clear purpose for explaining the components of Eureka Math along with personal experiences and even provide recommendations for areas of professional development or support. Themes were highlighted from the interview group session and similar themes were noted by various participants or grade levels. Many participants echoed similar comments from the survey questions. The researcher reviewed the transcript in order to identify consistent themes found in the one interview focus group. The researcher's notes during and after the interview group were used to categorize and conceptualize the data in order to produce the teachers' experiences in narrative form including direct quotes from the participants. Table 42 summarizes the meta-themes, themes, and frequency.

Table 42

Frequency Distribution Table of Themes from Focus Group

Meta-Themes	Themes	Number of Responses	Percentages
Program	Challenging	6	100
	Digital resources	6	100
	Importance of conceptual understanding	6	100
	Resources and manipulatives	6	100
Positive Professional Learning and Support	Implementation was strong	6	100
	Supportive	6	100
	Confident	6	100
	Collaborative planning	6	100
	Trust	6	100
	Collaboration	5	83.3
Students Engaged with Curriculum	Success	6	100
	Motivating Students	5	83.3
	Student discussions	5	83.3
	Student engagement	5	83.3

Themes from Question 1

This table is further supported and validated by highlights from interview group interviews. Three themes emerged from answering question 1: challenging, implementation was strong, and supportive.

Challenging. Teachers discussed how Eureka Math was challenging during the first year of implementation.

In response to question 1, Respondent 4 said,

> Using Eureka Math was challenging but after several years of using the program, I enjoy teaching math. I like to model the problems and think out loud with my students. My students can use multiple strategies to solve a problem and they get to decide which one will work. In my classroom my students have the opportunity to share multiple strategies for the application problem and how they

> can come to an answer. That's my favorite part of the math lesson for me. The opportunities for students to discuss, debrief and solve the problems multiple ways is a powerful tool.

Respondent 5 stated,

> I have never worked harder in my teaching career to teach mathematics because I see the big picture now. I was very anxious the first day I taught a Eureka Math lesson. It was very challenging to remember everything but my students are depending on me to teach them correctly. I am very thankful for the support of my grade level and my school has provided a lot of support during the implementation. I can depend on my school to offer suggestions and support.

Implementation strong. Teachers discussed how the implementation of Eureka Math was strong in their school and across the district.

Respondent 6 described how the implementation of Eureka Math was strong:

> Implementing Eureka Math in our district has been strong and I have grown as a teacher due to the professional development opportunities, collaboration with my grade level, and with the support of my principal and elementary coach. I have to admit the first time I taught a lesson, I was scared to death and it was very challenging. We have seen great mathematical results at my school and our students are benefiting from the challenging problems. We have tackled some pains along the way over the last several years but now that our students have had Eureka Math in Kindergarten, first, and second grade they are already familiar with the lesson components. We as teachers are familiar with the lesson components too and are more confident to teach the lessons.

Supportive. Teachers discussed how their colleagues, school, and district were supportive during the implementation of Eureka Math and even now after several years of experience using Eureka Math.

In response to question 1, Respondent 1 talked about how the school was supportive during the first year of teaching the Eureka lessons as a beginning teacher:

> I looked at the lesson plan, standards with my grade level teammates on a weekly basis, and I had to decide what teaching methods worked and how to adapt the lessons to meet my student's needs. The first lesson I taught was hard at first. I was a little slower delivering the content than my colleagues. My colleagues helped me with the pacing and offered many suggestions. If I did not have the support of my school then I would not have been successful.

Themes from Question 2

One's confidence level regarding Eureka Math was discussed during the interview focus group. The researcher found that each participant was confident teaching the lesson components of Eureka Math. Confident was a prominent theme shared by participants. The participants mentioned the word confident 27 times during the interview. Two more themes emerged from the question 2 discussion: the importance of conceptual understanding and success.

Confident. The teachers discussed how the understanding of mathematics helped them became confident to teach the components of the Eureka Math lesson.

In response to question 2, Respondent 2 said,

> I feel very confident when teaching Eureka Math lesson components and I know how to use my students work to drive my instruction. Since I am more confident

> to teach the components after several years of teaching Eureka, I am now using data from the math lessons and exit tickets to modify my instruction. I now analyze my students work instead of just asking myself did my students get the lesson. I look at error patterns with my grade level and we have conversations about the students work. As I teach the Eureka lesson components, my students are explaining the why in mathematics and they are thinking about tens and hundreds instead of just using the standard algorithm to add or subtract.

Respondent 4 echoed that when she reviews student work samples, she is collecting information about the student's strengths and challenges the information gained then helps her make decisions about future instruction.

Importance of conceptual understanding. All teachers discussed the importance of teaching mathematics through conceptual understanding.

In response to question 2, Respondent 6 described the importance of conceptual understanding:

> I feel very confident when teaching the components of Eureka Math because I am focusing on the concepts and standards each day. The district has provided a lot of support so I do not just rely on shortcuts when I teach math. I now understand why my students need to learn the concepts of math not just the algorithm. For example, when I teach division, I am no longer teaching my students to apply a formula. My students have a conceptual understanding of division and can gasp the problem. It is very important that we teach a conceptual understanding to our students at the elementary level.

Respondent 3 described conceptual understanding: "Students are working together,

discussing ideas, experimenting and exploring complex ideas to develop their own procedures for understanding the mathematical concept." Respondent 2 stated,

> I know my students cannot learn math like I did. The level of thinking in the Eureka lessons are much harder for adults than it is for children because you're having to reprogram the way you learned things, but for kids, it's not as hard for them because they're learning it for the first time. It is just harder for teachers and parents because most of us didn't learn math the way our children are learning it today through a conceptual understanding. Learning math through a conceptual understanding works and you have to change your mindset in order to teach conceptually. We must continue to provide opportunities for our teachers and parents to be prepared and confident while assisting with homework and engaging in other math activities.

Success. Teachers discussed how the success of the students and teachers contributed to them feeling confident to teach Eureka Math.

Respondent 5 talked about success of the students and teachers:

> My grade level team and I are very confident to teach the Eureka Lessons because we prepare activities together and we know that the success of our students is a shared responsibility. My students know my expectations when they enter the room and they are successful in math because they know we are all a team trying very hard each day to help the students accomplish their goals in math.

Respondent 6 echoed success of the students by describing the success of students during the math lesson:

> I have seen my students grow so much over the past several years. Having the

data from the exit tickets and problem sets have helped me better understand my student's performance. The data helps me feel successful and confident to teach the Eureka lessons. My students know that they can learn math and they understand the process of the lessons. Their success comes from them taking ownership of the math lesson such as talking and explaining the problems, gaining feedback from others, working in small groups, and daily reflections and myself.

Themes from Question 3

The researcher asked respondents to discuss how their instructional practices had changed since implementing Eureka Math. The two themes that emerged were motivating students along with resources and manipulatives.

Motivation. The teachers' discussions were centered around the students being motivated during the Eureka Math lessons. Several participants shared their views on motivation.

In response to question 3, Respondent 1 said,

Each day my students are motivated during math and have the opportunity to dig deeper into the standards being taught. My students are getting support from their peers and myself because I am no longer taking control of the class. They are taking an active role in the learning environment. I have made some instructional changes that support student motivation especially with our math journals and opportunities for students to read, draw, and write their answers to various word problems. My students enjoy recording their thinking in their math journal because they can refer back to their drawings, models and notes. I am no longer

> teaching mathematics and moving on to the next topic. With the opportunities for my students to interact with a partner or work in their journal I can spend my time listening to their responses or help students make connections as I walk around the room.

Respondent 3 said, “I want all of my students to be motivated during math. If they are motivated then they will retain the information learned and make connections to the real world.”

Resources and manipulatives. The teachers’ discussions commonly found the use of resources and manipulatives in the classroom a successful approach supporting instruction. Respondent 4 described the importance of manipulatives:

> My math instruction includes a lot of manipulatives and resources. Manipulatives such as place value charts, place value disk, counters, dice and more. I even use a lot of visuals such as graphic organizers and charts when my students are working in partner groups. When my students have access to a variety of manipulatives, they can construct their own models, understand the concept and become motivated in the lesson.

Respondent 5 said, “I use manipulatives as a starting point for my lessons so they can visually see what I am talking about.”

Themes from Question 4

Participants discussed how their students were responding to Eureka Math. Two themes emerged from respondents: The students enjoy student discussions and they are engaged during mathematics.

Participants further discussed components of Eureka Math in regard to students

responding to the curriculum. One common theme that emerged from the interview group responses was student discussions. The second theme that emerged was student engagement.

Student discussions. Teachers discussed the use of student discussions as a strategy to help students reflect on their own understanding.

In response to question 4, Respondent 3 said, "My students are thinking about math. I am no longer giving them one way to solve or answer. The students are talking more and can prove their answers." Respondent 5 said, "My students enjoyed the fluency activities and the fluency piece helped the students get excited about math as well as allowed them to discuss their thinking with others." Respondent 4 described student discussion as a critical skill for students now and the future:

> When my students participate in classroom discussions during math they are exposed to a variety of levels of understanding. Their level, their partner's level, and my level of understanding. This allows the students to think and react to the lesson being taught in mathematics. Overall, it helps them learn to develop arguments and build their communication skills.

Student engagement. Respondent 2 said, "Before Eureka Math my students answered procedural questions. Now they have exposure to so many higher order thinking questions as well as their peers' reasoning and they are engaged."

Themes from Question 5

Participants explained that the planning of Eureka Math lessons could not be done in isolation. One common theme that emerged from the groups responses was collaboration.

Collaboration. The teachers emphasized how they have grown as an educator through collaboration.

In response to question 5, Respondent 5 said,

> Collaboration has helped me grow. I collaborate and plan with my grade level on a daily basis. The first few years of teaching Eureka Math we would watch the instructional videos together and teach the problems to each other after school or during our planning time. We talk about student work samples and data weekly. My school is very supportive and the district is very supportive by providing professional development on a needed basis.

Respondent 1 said, "Collaboration is key to being a successful math teacher. Our teachers and principal collaborate together." Respondent 3 described how collaboration allows teachers to think outside the box:

> My grade level team and I collaborate all the time. We ask each other probing questions about mathematics when we meet. We are always thinking about the standards and how we can go beyond just the lesson plan to meet the students need. Over the last several years, our principal has created opportunities for us to share ideas with other grade levels. This has been a big change for me but overall very effective and productive.

The researcher asked all participants to explain how they plan. Collaborative planning was a prominent theme shared by the participants.

Themes from Question 6

Collaborative planning. Teachers shared their comments about how collaborative planning was positive at their school.

In response to question 6, Respondent 1 said,

> Planning alone is not effective. When you lesson plan together you grow as an educator. Collaborative planning is the key to success. We are a team at my school. We help each other when needed and we are always learning together and growing together. In order for my students to understand the multiple ways to solve a problem or understand the various models within Eureka I have to practice and solve the problems ahead of time. The planning and practice with my team not in isolation has helped me grow as a teacher.

Respondent 2 said, "doing the math together with my colleagues helps me determine the best strategies for my students." Respondent 6 described how collaborative planning supports the learning environment:

> When I plan with my colleague's mathematics is the center of discussion. We talk about what our students are learning, we discuss how our students have learned the content, and we discuss the types of questions that we want to use throughout the lesson so our students will get a deep understanding of the mathematics they need.

Respondent 4 said, "We hold each other accountable during planning in order to meet the needs of our students."

Themes from Question 7

Participants explained the different supplemental resources that they used during mathematics. One common theme that emerged from the groups responses was digital resources.

Digital resources. Teachers described how they used digital resources in their

classroom.

In response to question 7, Respondent 3 said,

> I use a digital resource called Zearn as whole group instruction and in centers. I also use various resources from the districts math website to support independent work in my classroom. I like Zearn the best because it is aligned to Eureka Math and my students are engaged as they practice new concepts their own pace.

Respondent 2 answered,

> My students love the digital lessons in Zearn and they stay on task when they are completing lessons in their Zearn account. I use Zearn as an independent activity or fluency warm-up because this resource models the same layout in the Eureka lesson plan. When the students complete their fluency practice online I am not making as many paper copies.

Respondent 5 stated, “My students can complete Zearn at home too.” Respondent 6 answered, “I use the digital Zearn lessons in a small group to scaffold learning and reinforce skills I have previously taught.”

Themes from Question 8

The researcher gathered concluding responses related to each participant’s experiences regarding Eureka math. One common theme that emerged from the group responses was trust.

Trust. The teachers explained that one must trust themselves as they teach the Eureka Math components.

In response to question 8, Respondent 1 said,

> Everyone must remember that you have to trust your judgments, trust your

> colleagues, and most of all trust your students as you teach the Eureka Math lessons. From my experiences, I have learned to trust the suggestions from my teammates and work with others to facilitate learning.

Respondent 6 stated, “When you trust in yourself you are focusing on your instruction instead of just relying on a program.” Respondent 4 said, “When you trust in yourself the strategies that you are trying to teach will flow much easier.” Respondent 2 said, “Trust your instructional coach because she will provide expertise in their subject matter and help guide you as well.”

Summary

The researcher collected and analyzed quantitative and qualitative data for this study. This chapter summarizes the data and explains how the survey responses and interview questions were analyzed. Quantitative analysis yielded that teachers are confident to teach the lesson components of Eureka Math. After study of the survey data, the researcher conducted interview focus groups to provide more information regarding teacher experiences related to implementation and lesson components of Eureka Math

Conclusion

Chapter 5 analyses and further interprets survey and interview group data in relation to research found in Chapter 2. The chapter includes implications for practice, recommendations for further study, and the limitations and delimitations of the study.

Chapter 5: Discussion

Introduction

The purpose of this study was to examine the experiences of elementary teachers from a southwestern school district in North Carolina delivering the Eureka Math components. Mathematics is an essential skill in the 21st century, due to one's ability to think and reason mathematically. Teachers must have the knowledge and skills to represent and explain mathematics in more than one way (Ball, 2003). The history of elementary mathematics and instructional practices used across the United States has been a critical component to various educational reforms. In this chapter, the researcher summarizes results and findings regarding the experiences of elementary teachers delivering the Eureka math components.

The following question guided this study: How do elementary teachers experience teaching mathematics using the Eureka Math program?

The findings in this study summarized the experiences of elementary teachers delivering the Eureka Math components. Data collected from the survey responses and one interview group provided teachers experiences of the Eureka Math program. Teachers also discussed how they taught, monitored students, and provided feedback throughout all components of the Eureka Math program. Their experiences led the researcher to gain a deeper understanding of their confidence to teach all components of the Eureka Math program.

Discussion of Findings

The researcher designed a mixed methods study in which both quantitative and qualitative data were collected and analyzed to determine how confident teachers were

when teaching the components of Eureka Math. Data gathered for this study included survey and interview data that corresponded to the components of the Eureka Math program. Quantitative data were collected via a Likert scale survey which was distributed to all 10 elementary schools in the studied school district. Qualitative data included an open-ended question attached to the end of the survey along with an interview group. Teachers in Grades K-5 were selected to complete the survey and take part in the interview. The multiple data sources collected in this study allowed the researcher to gain a deeper understanding of the participants' experiences and confidence regarding the Eureka Math lesson components.

Findings were based on the data collected and organized by survey and interview responses. Quantitative data findings indicated that teachers were confident to teach the components of Eureka Math. In analyzing the interview data, several themes emerged, with some overlapping, as teachers in the study described their experiences teaching Eureka Math. The data produced three meta-themes and 14 emerging themes:

1. Program: challenging, digital resources, importance of conceptual understanding, resources, and manipulatives.
2. Positive Professional Learning and Support: implementation was strong, supportive, confident, collaborative planning, trust, and collaboration.
3. Students Engaged with Curriculum: success, motivating students, and student engagement.

Through the use of survey and interview groups, the following conclusions were made regarding how elementary teachers experience teaching mathematics delivering the four components of the Eureka Math program. The four components to the Eureka Math

program include fluency practice, application problem, concept development, and student debrief.

Fluency Practice

As previously stated, NCTM (2014) advocated for curriculum to incorporate mathematical fluency practice; therefore, teachers can create a classroom that supports procedural fluency by providing the students with learning experiences that are connected to mathematical ideas (Kilpatrick et al., 2001). Seventy-eight percent of teachers who completed the survey agreed that they felt confident to teach, monitor, and provide feedback throughout the fluency component. Interview group responses validated the survey data. Respondents discussed how the fluency component was important for the mathematical success of their students. According to the teachers, the fluency component helped their students see connections from the counting activities to addition, subtraction, and multiplication. The teachers pointed out that the fluency activities that allowed students to count backwards were linked to subtraction, and the fluency activities that involved skipped counting were linked to multiplication.

NCTM (2014) stated that procedural fluency instruction involves the student making connections to procedures and concepts previously learned as well as engaging in activities that support practice. Teachers emphasized that having the opportunity to make connections from the previous lessons and even new mathematical content was vital for student success. Teachers found the Fluency Sprints, counting exercises, and whiteboard exchange outlined in the Eureka Math lessons to be effective, which validated fluency research conducted by NCTM. Respondent 1 noted, “My students enjoy the Fluency Sprints,” and they complete the whiteboard exchange

activities in small groups. Teachers also indicated that the Fluency Sprints were engaging. Respondent 2 revealed, "My students are always asking for more counting exercises." The data revealed successful fluency practice independently and in small groups, which allowed students to track their mathematical performance. Respondent 5 acknowledged, as students complete the Sprint, they keep track of their progress and students "are very competitive during the fluency activities." According to the survey data, only 3 of teachers indicated on the open-ended survey question that they skipped the fluency component the first year of implementation in order to stay on track with district pacing. The challenges of the program the first several years of implementation were discussed, and an emerging theme of challenging was formulated from the interview group. Respondent 6 from the interview group claimed,

> Teaching fluency at first was time consuming and challenging. There were many challenges the first year of implementation such as keeping up with the pacing of the daily lesson, understanding the lesson plans, and trying to stay positive when teaching mathematics. Not every teacher on my grade level wanted to spend their instructional time on the fluency component. It took most teachers on my team about a year to see the benefits of the fluency component. Now that my grade level is making time for the fluency activities, students are able to explain their thinking and they are not memorizing facts and procedures.

Further conversations centered around fluency and implementation indicated that a system of support and trust must be in place when implementing a new instructional program. Teachers discussed how a system of support involves the district office, elementary coaches, administration, and colleagues within the building. According to

Vanderburg and Stephens (2009), instructional coaches support teachers by sharing strategies and providing ongoing support. Their role is to lead change by focusing on specific areas. Respondent 5 from the interview group indicated,

> The elementary coaches have partnered with our school to create an atmosphere where we are all supported. During the first, several years of implementation of Eureka Math the coaches modeled lessons, analyzed student work, and helped us see the importance of adjusting some of our instructional practices. They have provided professional development support and collaborated with us throughout this process to determine what is working as well as determining if any changes need to be made.

The relationship between the elementary coaches and school was essential to implementation and success of both students and teachers. Teachers believed that the support of the elementary coach during the implementation of Eureka Math supported their understanding of the fluency component as well as the success of their students during the fluency component. Respondent 4 from the interview group noted,

> The elementary coach that visits our school is very supportive and has spent a lot of time understanding the Eureka Math program especially the Fluency component. She has helped my grade level implement the Fluency counting exercises on a consistent basis and has provided various ways to keep our students engaged during the fluency activities. Without her support during the implementation of Eureka Math, I would be lost and behind.

Reid (2008) stated, "Trust is essential for effective working relationships, and that it bonds people together" (p. 8). Based on the shared teacher experiences, teachers had to

trust their colleagues and elementary coaches. Numerous interview group participants mentioned that trusting their colleagues helped them align their instructional practices, reflect on previously taught lessons, and determine appropriate pacing. Respondent 6 explained,

> My colleagues have provided me with a lot of support over the past several years. I have earned their trust and they have earned my trust through daily interactions and collaboration. Their support is so vital because I trust them. I trust them because they are professionals and if we cannot trust each other then we cannot meet the needs of our students and discuss our instructional goals. I have learned to trust their mathematical judgements and work together to understand the components of Eureka Math. Most of all, my trust in them has helped me see a connection between my students Fluency skills and conceptual understanding. Teachers have to trust their colleagues and be willing to allow others to give feedback in regards to student work samples. We have to be open and willing to learn from others as well as offer support to colleagues so they can try new ideas that support student learning as a whole.

The results from the survey and interview group data specified that teaching Eureka Math was challenging at first but overall the experiences of teaching the fluency component supported the students' and teachers' mathematical understanding. Respondent 2 stated,

> My students and I are no longer relying on memorization. We can explain the counting process when adding or subtracting due to the fluency activities. My students know the why behind how they are counting and are using their

> understanding of place value, base ten and addition. The fluency activities have supported other mathematical concepts that I am teaching.

Most teachers shared the various supports that were vital during the implementation of Eureka Math. An outlier was identified by Respondent 1:

> The fluency activities are an important piece to the Eureka Math program but I do not think the fluency component provides the support that others have identified. My students get frustrated with the fluency components at times and I am not totally convinced that the fluency component connects easily with other concepts within the Eureka lesson plan or supports what my students are learning effectively.

Even with the outliers identified by Respondent 1, the majority of survey data and responses indicated that the fluency component opened the doors for various supports inside and outside of the classroom environment.

Application Problem

According to CCSSI (2010), students are problem solvers when they can reason and apply the mathematical concepts learned. Research participants discussed how the application problem component supports problem-solving skills for their students. The data presented reflect the participants experiences delivering the application problem component outlined in the Eureka Math program. According to survey data, 68.4 of the teachers agreed that they were confident to teach the application problem, 70.9 were confident monitoring students during the application problem, and 73.4. were confident to provide feedback to students throughout the application problem. The researcher found that fewer teachers agreed that they were confident to teach the application

problem that the other survey questions related to teaching the components of Eureka Math; however, the responses from the interview group indicated that teachers felt confident to teach the application problem.

Cai (2003) stated that teachers must be viewed as a facilitator of knowledge before effective problem-solving can take place. Teachers emphasized that their role as a facilitator supported their confidence to teach the application problem. The teachers also noted that they had to use various problem-solving skills during the application to help their students make connections to previous learned material. Respondent 3 shared,

> I feel confident to teach the Application Problem because I take on the role of a facilitator when I teach the Application Problem. I guide my students as they solve the Application Problem and I am constantly monitoring their learning by walking around the room and giving feedback. Knowing that I feel confident to teach the Application problem helps me provide a variety of problem solving opportunities during this time of the lesson. When my students see that I am confident they become confident too. Based on the students answers and responses to the Application Problem, I tend to ask challenging questions so they can explain their thinking to myself, the class as a whole, or their table partner. The questions that I ask create opportunities for students to express their mathematical thinking without fear.

Lopes et al. (2016) further stated that effective problem-solving begins with the teacher creating opportunities for children to develop their own ideas. All participants in the interview group believed that when students solved the application problem, they were making connections from previous lessons and were learning how to express their own

mathematical thinking. Respondent 5 confirmed, "I feel confident to teach the Application Problem because I provide opportunities for students to discuss how their understanding supports yesterday's lesson." Respondent 1 conveyed,

> I feel confident to teach the Application Problem because my students are making connections to the problem by using number bonds or various drawings. The drawings help them label their ideas and explain what is happening in the word problem.

Respondent 2 further explained,

> I feel very confident to teach the Application Problem component because this component is usually a review of mathematical concepts for my students. The Application Problem for each lesson usually starts with a five- to seven-minute word problem that involves previously learned concepts. I have become more confident to teach the concept since this component is a short review and practice. When my students complete the Application Problem they use the Read, Draw, and Write strategy. This strategy helps my students visually understand the mathematical connections to the word problem. With RDW they are reading the problem, labeling their drawings, and writing statements to explain the problem solving process that they used during the Application Problem. Knowing that I am confident to teach the Application Problem and use various problem solving techniques helps my students feel confident to express their thinking as well.

Interview group discussions also indicated students were motivated during the application Problem component. Respondent 1 disclosed,

> My students are motivated during the Application Problem. They are always

> asking "When are we going to solve the Problem of the Day?" In my classroom the students see the Application Problem as the Problem of the Day. They see the word problem as a challenge which in returns motivates them to feel comfortable about solving this daily problem. I have taught my students that it is important for them to make connections between other parts of the lesson and other concepts during the Application Problem. Teaching them that it is ok to use what you know to solve a problem or make mistakes during the Application Problem has motivated my students. They do not get frustrated or overwhelmed because they are using strategies to discover on their own thinking.

The results from the survey and interview group showed that teachers were confident to teach the application problem. The results of this data further indicated that the teachers' confidence to teach the application problem led to positive experiences with the delivery of the application problem. Teachers shared strategies to support effective problem-solving during the application problem and felt the application problem supported student motivation.

Concept Development

According to survey data, 69.6 of the teachers agreed that they were confident to teach the concept development, 70.9 were confident monitoring students during the concept development, and 69.6 were confident to provide feedback to students throughout the concept development. Interview group responses validated most of this data. Participants discussed the importance of teachers using various resources and manipulatives throughout the concept development component. Leinwand, Huinker, and Brahier (2014) stated that district leaders and administrators must provide sufficient

resources to develop mathematical success for all students. Respondent 1 revealed,

> District leaders and my principal have provided a lot of resources to help me understand the Eureka Math program and effectively teach the Concept Development component. District leaders have created opportunities for our coaches to attend Eureka Math professional development and in return our coaches have provided school based training. The elementary math website that was developed by coaches and teachers has been my favorite resource because I can pull instructional resources that can be used on my interactive whiteboard or in my students' math journal. I also use the Eureka Math manipulative kits that the district purchased when I am modeling problems from the Concept Development and my students use the manipulatives when they are working independently or in small groups.

Previously cited research indicated that math manipulatives serve as a resource in the classroom and support the students' understanding of a concept. According to Witzel et al. (2003), manipulatives are important tools for students to use during the problem-solving process because the students could explain their thinking easily and turn abstract information into concrete representations. Teachers found manipulatives such as place value disks, 10 frames, dice, two color counters, pattern blocks, and the Rekenrek to be effective which validated the research on math manipulatives. Respondent 4 mentioned, "I use the Rekenrek to help my students understand how to add doubles." Respondent 5 expressed, "I pull out the Rekenrek when students are having trouble adding up to twenty. This is a great manipulative to use in small groups or whole group teaching." Respondent 3 validated the previous responses, "My students like using manipulatives

and I provide a lot of opportunities them to demonstrate mastery with manipulatives because it helps explain their thinking." Respondent 2 expressed,

> Manipulatives help my students understand the new concepts being taught and with the use of manipulatives I can provide a hands-on learning experience during the Concept Development. My students like using the pattern blocks, ten frames, two color counters dot dice, and Rekenrek just to name a few. My students use the two color counters to solve addition and subtraction. My students use the Rekenrek to represent and compose numbers especially when they are trying to find all the ways to make a number or determine the missing addend. I also keep a kit of manipulatives on the students' desk during the math lesson so the students can choose manipulatives that they are familiar with. All of the manipulatives that we use help them extend and build on the concept being taught.

The data from the open-ended question on the survey indicated that 15 of 79 teachers noted that manipulatives were an important tool for the success of their students. One survey participant stated, "My students like using the manipulatives." Another survey participant stated, "Since every child thinks and learns differently, manipulatives are vital in my classroom." Further conversations centered around the use of manipulatives led the interview respondents to share their experiences of developing conceptual understanding with their students. All interview participants believed that the problems outlined in the concept development fostered a conceptual understanding. Smith, Bill, and Raith (2018) stated that when a mathematical concept is represented in various ways, students begin to make connections using different representations which in return promotes conceptual understanding. Responses from the interview group participants

supported this belief. Respondent 6 stated,

> When my students solve the Concept Development problem, they may use visuals, manipulatives, their notes or various resources to explain the why, the how, as well as their mathematical learning by doing. I strongly believe that with various representations and resources, I am building a foundation for my students and fostering a conceptual understanding for them. They in return explore the relationships or the processes outlined in the Concept Development problem on their own. For example, when they subtract, they are not just crossing out numbers. They know the why behind subtraction because they are thinking about how to solve the problem.

Survey and interview group data determined that teachers are confident to teach, monitor, and provide feedback throughout the concept development as outlined in the Eureka Math lesson plan. Interview group data further indicated how resources and manipulatives can foster a conceptual understanding for their students; therefore, teachers believed that the concept development component allows teachers and students to explore and think about mathematics in various ways. The results from teachers found the concept development vital to promoting a conceptual understanding when teaching mathematics to elementary students. Teachers expressed how they promoted a conceptual understanding during the concept development by allowing their students to explain their thoughts, clarify misconceptions, and solve problems various ways.

Student Debrief

Previously cited research indicated that discourse in the mathematics classroom helps students explain and justify their reasoning behind the math problem. According to

survey data, 74.7 of the teachers agreed that they were confident to teach the student debrief, 75.9 were confident monitoring students during the student debrief, and 73.4 were confident to provide feedback to students throughout the student debrief. The interview group shared positive feedback in regard to the sample dialogues and suggested list of questions from the student debrief component. Respondent 3 communicated, “The sample questions allow my students to tell me what they are understanding.” Respondent 5 disclosed, “The responses from my students during the debrief is far beyond where my class was two years ago.” The student conversations from the suggested list of questions from the student debrief helped teachers guide student thinking and allowed the teachers to determine which students were having difficulty with the concept being taught. Respondent 4 mentioned, “Sometimes I ask my students to restate the answer in a different way or even have them use a drawing to explain the question I am asking.” Participants shared how their grade level differentiated the sample questions from the student debrief component and echoed the importance of relying on support from colleagues. Respondent 1 expressed, “Our elementary coach encouraged us to allow students to explain their reasoning both orally and in writing during the student debrief component.”

Interview group participants believed collaboration and collaborative planning led to positive experiences teaching and monitoring the student debrief component. Collaborative practices are defined as, “a systematic process, in which ‘teachers’ work together, interdependently, to analyze and impact professional practice in order to improve individual and collective results” (DuFour, DuFour, & Eaker, 2008, p. 464). Again, interview group participants supported this research. Respondent 2 stated,

> I had to collaborate with my grade level colleagues to determine the appropriate questions from the Student Debrief section and then I had to push myself to collaborate with my students without just giving them the answer. As I planned and worked with my colleagues, I was able to see the benefits of the Student Debrief and I was taking the ideas from others and expanding on what I was already doing during the Student Debrief.
>
> It was very hard at first to teach and monitor the Student Debrief component the first couple of years of implementing Eureka Math because my students were not used to collaborating with their peers and I struggled asking my students rigorous questions about their mathematical understanding.

Ennis and Witeck, (2007) stated that mathematical discourse is created when students are provided with opportunities to share their own mathematical ideas and thinking. Interview responses and survey data from the open-ended question indicated that opportunities for teacher collaboration were crucial to foster student discussions. One survey participant stated, “Teachers implementing Eureka Math must see the importance of collaborating so their students will see the importance of collaborating during the Student Debrief.” Interview participants believed student and teacher collaboration influenced student engagement during the student debrief. Respondent 6 stated, “my students enjoy learning from their peers during the Student Debrief and I love to hear them share their ideas with each other.”

Developing positive relationships with colleagues and creating opportunities to discuss the delivery of lessons and student work samples as well as define teaching practices were described as collaborative supports. Guarino, Santibañez, and Daley

(2006) stated that when teachers work collaboratively with other teachers, they develop supports that are centered around emotional and instructional needs. The teachers discussed learning from each other and making adjustments to their instruction based on the needs of the students. Collaboration, in this study, was strengthened through collaborative planning. The research showed the teachers frequently planned together, reviewed lesson plans, and engaged in activities that supported analyzing standards, student work samples, and examining their own mathematical practice. Incorporating collaborative planning opportunities provides an avenue for teachers to better prepare themselves for the Eureka Math lessons as well as support the student debrief component. The research presented on collaboration in the literature review correlates directly with the findings for this research study in that all six of the interview respondents reflected on the importance of collaboration and collaborative planning.

Digital Resources

In addition to the four components, teachers discussed how digital resources can be incorporated into their daily mathematics instruction to foster student engagement. Kemker (2005) stated that when students have access to digital tools, the students are not only learning the content presented but they are also engaged. According to the open-ended question on the survey, 24 of 79 participants stated that they incorporated digital resources as they delivered the Eureka Math lesson plan. Survey and interview group data suggest a strong need to include digital resources into the mathematics instruction. Interview group responses further indicated that digital resources helped their students understand the lesson content. Respondent 3 stated,

Using various digital resources during the math lesson helps my students

> understand what they are learning and they felt empowered to share their understanding after practicing the content or skill on the iPad. With different digital resources, they are able to apply what they already know and succeed at the same time.

According to the North Carolina Department of Public Instruction Digital Teaching and Learning Division (2016), teachers can use a variety of digital tools and resources to improve their instructional practices as well as student learning. Data from the interview group supported this research. Respondent 4 shared,

> I use digital resources to supplement the concepts in the Eureka Math lesson plan. Most of the time I have my students login to Zearn to complete the fluency practice Sprint online instead of paper/pencil. The digital resources that I use in my classroom do not replace the components of the Eureka Math lesson plan or the delivery of my instruction. Since all students have iPads in our school district, the use of digital resources help keep my students engaged, provide my students with some personalized instruction, and allow them to review the lesson content through a different instructional format. With the digital tools, I feel very confident to teach, monitor, and provide feedback to my students during mathematics. The digital tools have also helped me stay innovated and up to date with new technology.

Interview group data also indicated teachers need ongoing professional development to successfully incorporate digital resources. Koehler and Mishra (2009) stated teaching with technology can be difficult for educators if they do not understand how the digital resources impact their subject matter. Teaching with digital tools can also complicate the

workload of teachers if they lack experience or skill using a particular digital resource. To support the research, Respondent 2 stated,

> I am comfortable using the interactive whiteboard in my classroom but I know I need some professional development involving iPad applications. I am not always prepared to use all of the math applications on the iPad. I want to make learning fun and alive with technology.

Survey and interview group data suggest the need for digital resources. One survey participant stated, "My students enjoy the online math games. They are also engaged when they are playing the games." Teachers positively supported digital resources and shared their experiences using various digital resources; therefore, the need for digital resources was important to the engagement of their students.

Collaborative School Culture of Support

A surprising finding was the teachers' focus on a collaborative school culture of support, resulting in positive experiences for teaching the Eureka Math program. The teachers noted that together, everyone was working to achieve the common purpose of improving the overall mathematics success of their students. Through their sharing of practice, knowledge, and problems, they created a positive, collaborative school culture of support during the implementation of Eureka Math. The teachers felt confident in their mathematical practices and understanding of the Eureka Math components.

Returning to the research in Chapter 2, collaboration was centered around the students working in small groups and collaborating with their peers. According to NCTM (2000), through collaboration, mathematical ideas become reflective, refined, deliberated, and modified. Based on the data, collaboration works equally effectively for

teachers. Participants agreed that their mathematical success comes from a collaborative school culture of support that involves everyone including teachers, teaching assistants, administration, and support staff. This is important to understand and acknowledge and leads to the question of how schools can promote a collaborative school culture when teaching mathematics. These implications could result in further research about collaborative school culture of support to promote effective mathematics instruction.

Conceptual Framework

The researcher found that because of the meta-theme findings: program, positive professional learning and support, and students engaged with curriculum, teachers made positive judgements about their abilities to promote effective mathematics instruction. Initially, the researcher focused the literature review and conceptual foundation of this study on the mathematics concepts that are integral to high-quality instruction such as (a) procedural fluency, (b) conceptual understanding, (c) problem-solving, (d) collaboration, and (e) mathematics discourse. However, after collecting and analyzing these data, the researcher realized that the teacher's perceptions of Eureka Math were heavily influenced not just by those components of mathematical instruction but also by the ways in which they were learners as well. The participants' positive actions, willingness to try new instructional strategies and overall support to meet the needs of all of their students led the researcher to conclude that constructivism and self-efficacy can, and should be included with the conceptual framework guiding this study.

Constructivism

"Constructivism seeks to change existing cognitive structures by allowing students to explore new alternatives" (Yost, Sentener, & Forlenza-Bailey, 2000 p.42).

Participants in this study formed new instructional practices based on their students' experiences following Eureka Math components. Through collaboration with, and the support of colleagues, teachers yielded positive results. The instructional coaches also encouraged constructivist practices with teachers, enabling students to take ownership of their own learning. These practices opened the door for teachers to voice their mathematical understanding and share how their learning grows from the support of others.

Self- Efficacy

Bandura (1994) declared self-efficacy as one's belief to organize and execute the course of action and in return enhance one's personal well-being. The teachers in this study demonstrated a strong sense of self-efficacy. They were confident in their abilities to promote effective student learning in the mathematics classroom. Data from the interview group supported that teachers made judgements about their abilities to promote effective learning and define their practice when needed based on their perceptions of the Eureka Math lesson components. Participants agreed that they were open to new ideas that were presented by colleagues or the instructional coach, as shown by their willingness to try new mathematical manipulatives or strategies.

Implications for Practice

An analysis of data gathered from this mixed methods study shows several implications for further practice. These implications for further practice could result in effective mathematics instruction in the elementary classroom and provide insight into specific needs of the teacher, which in turn could provide the district with instructional support.

Collaboration and collegial support. This study revealed the importance of collaboration and collegial support when implementing a new instructional program. Teachers expressed how the instructional ideas and reflections of their colleagues supported lesson planning and effective implementation of all components within the Eureka Math program. It is evident that teachers in this study have been supporting colleagues within their building. According to the interview group, teachers need scheduled uninterrupted time to meet with their colleagues and elementary coaches. This scheduled time should be set aside where grade-level colleagues and their elementary coach work together to discuss Eureka Math, curriculum questions geared toward mathematics, and an opportunity for everyone to share comments that promote the overall success of their grade level and students. The teachers also identified how the elementary coaches modeled lessons in order to provide effective instructional feedback. It is recommended that the school and district continue to provide opportunities for teachers to support each other. Structures to support consistent instructional support must remain in place despite the turnover of teachers or administration. The school administrators can provide opportunities for teachers to visit other teachers teaching mathematics in their building or visit other elementary mathematics classrooms across the district. When teachers feel a sense of support from other teachers, they in turn can become change agents and are willing to make instructional shifts that will benefit their students overall.

Use of manipulatives and instructional resources. The findings of this study also indicate the value of manipulatives, resources, and conceptual understanding when teaching mathematics. Each interview group participant believed that teachers should

provide opportunities for students to use manipulatives and resources to promote a conceptual understanding when teaching mathematics. It is recommended that elementary coaches continue to provide teachers with various manipulatives and resources to support the needs of all students. The school administrators should conduct conversations with teachers about the manipulatives and resources used in their classroom. The district's elementary education director should continue to ensure conversations are taking place with administrators and elementary coaches to determine if appropriate manipulatives and resources are being used on a consistent basis.

Professional development opportunities. Many teachers felt the district should provide ongoing professional development to all elementary and middle school teachers on how to promote a conceptual understanding when teaching mathematics. It is recommended that the district makes this a priority since Eureka Math is in full implementation at the elementary and middle school level. Monthly after-school professional development opportunities should take place at the district office so teachers have the opportunity to share their experiences with others. Elementary coaches should continue to seek mathematics training so teachers can be supported in the classroom. The researcher further recommends that conversations with grade-level teachers take place to ensure they are teaching students to solve problems various ways. If teachers are to be successful at teaching through a conceptual understanding, they need examples and time invested in professional development.

Reviewing the survey and interview group data, the researcher believes teachers in the studied district would benefit from professional development centered around digital resources and how the resources can support the Eureka Math lesson plans.

Through professional development, teachers have the opportunity to grow as a professional and become up to date with current and new digital resources. Teachers who are implementing digital tools effectively within the district should have conversations with the elementary coaches, school administration, and elementary director to determine appropriate professional development. It is recommended that a survey be administered to elementary teachers to determine specific professional development needs regarding digital tools. As cited earlier, teachers can use a variety of digital tools and resources to improve their instructional practices as well as student learning (North Carolina Department of Public Instruction Digital Teaching and Learning Division, 2016)

Administrative support and professional development. Interview participants also revealed that in order for teachers and students to develop a conceptual understanding of mathematics, administrators need to understand the shifts of instruction taking place within the Eureka Math lesson plan and know how to effectively promote a conceptual understanding of mathematics school wide. Professional development and training geared towards promoting a conceptual understanding in the elementary classroom should be provided to all school administrators. It is suggested that administrators invest time discussing what conceptual understanding of mathematics looks like in their school and offer feedback to other administrators during monthly meetings. School administrators would benefit from receiving feedback and in return they could offer a range of support for their teachers as well as student learning. Elementary coaches and school administrators should develop a walk-through tool to help identify specific instructional strategies that would also foster effective discussions

with classroom teachers. The researcher recommends that the walk-through form include an area for feedback regarding the four components of the Eureka Math lesson plan, a space for school administrators to provide positive comments and a space for reflection. The intent of the professional development and walk-through form would be to inform school administrators and district-level administrators of how they can reinforce a conceptual understanding in the mathematics classroom.

Future Research Recommendations

This study focused on examining the experiences of elementary teachers delivering Eureka Math components. Based on the findings of the study and considering the limitations associated with the study, the researcher recommends several areas for further research. The study sample involved one school district in the southwestern area of North Carolina. The researcher used survey and interview group data to conduct this study. Based on data collected during this study the following recommendations for further research include

- Increase the number of participants in the study. The number of participants was small for the interview focus group. More participants may provide data that extends beyond this study.
- Conduct a study that would include examining the experiences and confidence levels of students and parents regarding the four components of the Eureka Math program. This could further provide data that supports a different perspective to the studied topic and allow the studied district to determine the effectiveness of Eureka Math more in depth.
- Conduct a study to determine the impact of Eureka Math on student

achievement at each grade level in the elementary setting. This could provide the studied district with additional insights into this topic.

- Conduct a study that would include examining the experiences and confidence levels of middle school teachers in sixth through eighth grade regarding the four components of the Eureka Math. A demographically different population could provide a different insight regarding Eureka Math, and the studied district could compare the experiences of elementary and middle school teachers.
- Conduct a study of the impact of a collaborative school culture on teacher efficacy for teachers in Grades Kindergarten through 5 when teaching the Eureka Math components. This could further provide data on the effectiveness of a collaborative school culture in the school district.

Limitations and Delimitations of Study

The researcher identified the following limitations and delimitations associated with this study. The research and findings in this study include data collected from the participants at 10 elementary schools, all within one district. There were 79 participants who participated in the survey and six participants who participated in the interview group. The researcher had no control of the accuracy or integrity of the responses provided by the participant. The researcher can only assume that the participants answered all questions honestly. A larger sample size would have resulted in more generalizable results. For this reason, results from this study may not be generalized to another district or school.

The survey was distributed during the month of May prior to benchmark testing

and EOG testing in the 10 participating schools. The interview group was conducted after school during the last week of school when EOG retesting was taking place. Due to the time of year when the data were collected, teacher stress level and workload from end of the year pressure for remediating and retesting students could have impacted the study. The researcher acknowledges that the time of the year this research was conducted could allow teachers to respond to the questions with various opinions due to end of year pressure or stress they were encountering during the months of May and June.

The researcher used the chi-square to determine if there was an association between the participants' grade level, years of teaching experience, and years of teaching Eureka Math and the participants' confidence level regarding each component of Eureka Math. The chi-square test indicated some limitations to the significance due to the size of the study. Some of the results indicated that there were more than 20 of the cells that had an expected count less than .5; therefore, the researcher acknowledged there were not enough participants to determine if there was an association between the two variables selected. Some of the cells also had a cell count of 0 or 1, affecting the minimum expected count to gain valid results; therefore, the researcher acknowledges there were not enough participants to determine if the chi-square results were valid.

The researcher used an online survey to collect data from participants. The online survey allowed the researcher to collect data in a timely, accurate manner; but with only 79 participants, it may be evident that some elementary teachers may not check their email frequently or feel comfortable completing an online survey. The responses of each participant involved in the survey serve as a limitation to this study. The researcher had no control of the accuracy or integrity of the responses provided by the teacher

participant. The researcher can only assume that the participants answered any and all questions honestly.

Summary

Previously cited research indicated that instructional shifts are taking place in elementary mathematics classrooms across the United States. Many districts have used the experiences of their teachers to make instructional decisions. Survey and interview data confirmed previous research findings about the mathematics instruction taking place across the United States; therefore, the study's findings indicated that the experiences of elementary teachers delivering Eureka Math components are positive. Comparing the data from these elementary participants, it is evident that teachers within the district regardless of their grade level or years of teaching Eureka Math feel confident to teach, monitor, and provide feedback throughout all components of the Eureka Math program.

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Appendix A

Survey

In an effort to study how elementary teachers experience teaching mathematics using the Eureka Math program in the Rutherford County Schools district, you are invited to participate in a research study entitled, “Elementary Teacher Perceptions of Eureka Math.” This study is being conducted by Lindsay H. Walker (Assistant Principal of East Rutherford Middle School) and my advisor, Dr. Stephen Laws (Gardner-Webb University).

There are on known risks if you decide to participate in this research study. There are no coasts to you for participating in the study. The questionnaire will take approximately ten minutes to complete. The information collected may not benefit you directly, but the information learned should provide more general benefits.

Your participation is voluntary. By completing this survey, you are voluntarily agreeing to participate. You are free to decline to answer any question you do not wish to answer for any reason. I will protect against breach of confidentiality by using a password protected computer to handle participant information and data. All responses will be identified as anonymous and no identifying information will be provided. If you have any questions about the study, please contact Lindsay H. Walker at XXXXXXX

1. What grade level do you currently teach?
   A. Kindergarten
   B. 1st grade
   C. 2nd grade
   D. 3rd grade
   E. 4th grade
   F. 5th grade

2. Years of Teaching Experience
   A. 0-3 years
   B. 4-10 years
   C. 11-20 years
   D. 21- more than 21 years

3. Years of teaching Eureka Math
   A. 1 year
   B. 2 years
   C. 3 years
   D. 4 years
   E. 5- more than 5 years

4. I feel confident to teach Fluency Practice as outlined in the Eureka Math lessons
   A. Agree
   B. Disagree
   C. Strongly Agree
   D. Strongly Disagree

5. I feel confident monitoring students during the Fluency Practice.
   A. Agree
   B. Disagree
   C. Strongly Agree
   D. Strongly Disagree

6. I feel confident in providing feedback to students through the Fluency Practice
   A. Agree
   B. Disagree
   C. Strongly Agree
   D. Strongly Disagree

7. I feel confident to teach Application Problem as outlined in Eureka Math lessons
   A. Agree
   B. Disagree
   C. Strongly Agree
   D. Strongly Disagree

8. I feel confident monitoring students during the Application Problem
   A. Agree
   B. Disagree
   C. Strongly Agree
   D. Strongly Disagree

9. I feel confident in providing feedback to students throughout the Application Problem

A. Agree
B. Disagree
C. Strongly Agree
D. Strongly Disagree

10. I feel confident to teach Concept Development as outlined in Eureka Math lessons
    A. Agree
    B. Disagree
    C. Strongly Agree
    D. Strongly Disagree

11. I feel monitoring students during the Concept Development
    A. Agree
    B. Disagree
    C. Strongly Agree
    D. Strongly Disagree

12. I feel confident in providing feedback to students throughout the Concept Development
    A. Agree
    B. Disagree
    C. Strongly Agree
    D. Strongly Disagree

13. I feel confident to teach Student Debrief as outlined in Eureka Math lessons
    A. Agree
    B. Disagree
    C. Strongly Agree
    D. Strongly Disagree

14. I feel confident monitoring students during the Student Debrief
    A. Agree
    B. Disagree
    C. Strongly Agree
    D. Strongly Disagree

15. I feel confident in providing feedback to students throughout the Student Debrief
    A. Agree
    B. Disagree
    C. Strongly Agree

D. Strongly Disagree

16. Please use this space to describe your experience with Eureka Math.

Appendix B

Teacher Letter for Permission to Study

My name is Lindsay Walker, and I am the Assistant Principal at East Rutherford Middle School. As a doctoral student at Gardner-Webb University, I am required to complete a dissertation study. The topic of my study is Elementary Teacher Perceptions of Eureka Math.

This study will examine kindergarten through fifth grade teachers' experiences while using the Eureka Math program. Therefore, I would like to survey all general education teachers in grades K-5 in the Rutherford County Schools District.

The survey will be sent within the next week and the survey questions are centered around one's confidence level while teaching the components of the Eureka Math lesson plan for K-5 teachers. This survey, through Google Forms, will be sent to your school's email address on Thursday, May 11, 2018. The survey will take less than 10 minutes and I will leave the window open for three weeks, with an ending date of May 11, 2018. I will send a personal email to you as a reminder before the survey window closes.

I will protect against breach of confidentiality by using a password protected computer to handle participant data. Data collected will not be provided to anyone outside of the research team without permission from the Rutherford County Schools District and Gardner-Webb University. There are no known risks to participants and all responses will be identified as anonymous. The principal of each school will receive a permission to study, also. If you have any questions or concerns, please feel free to email me at XXXXXXXXXXXXXXX. I wholeheartedly and sincerely will appreciate your input as well as your taking the time to complete the survey.

Sincerely,

Lindsay H. Walker

Appendix C

Google Form Questions to Participate in Interview Group

Thank you for completing the Eureka Math survey. As part of this research study, I would like to delve deeper into this topic by conducting interview focus groups where teachers can share their experiences regarding Eureka Math. The interview group will meet once and participation in the group will last less than one hour. Your participation in the group is confidential.

1. Would you be willing to participate in an interview focus group and share your experiences regarding Eureka Math?

2. If you answered yes to participate, please provide your name, grade level, and email in the space below.

Appendix D

Email Inviting Teachers to Participate in Interview Group

You have been randomly selected to participate with other kindergarten through fifth grade teachers in an interview group to discuss Eureka Math program and share your thoughts about the Eureka Math program. This interview group is a follow-up to the Eureka Math survey teachers were invited to complete. Information gathered from this interview group will be used as part of a dissertation study. This study seeks to explore elementary teacher experiences of teaching Eureka Math.

The interview group will meet once and participation in the group will last less than one hour. Your participation in the group is confidential. Your name will never be made public or recorded in data.

Please indicate your willingness to participate or your desire not to participate in the group by responding to this email. By indicating your willingness to be a member of this interview focus group, you give your consent to participate in this study. The focus group will meet at RCS Cool Springs Administrative Office Room 212 on June 14, 2018. Thank you in advance for your consideration.

Sincerely,

Lindsay H. Walker