

2018

# Instructional Strategies That Homeschooling Parents Use to Teach Their Children Mathematics

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# Walden University

College of Education

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Lisa Francis

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2018

Abstract

Instructional Strategies That Homeschooling Parents Use to Teach Their Children

Mathematics

by

Lisa Francis

MA, California State University, Hayward, 2001

BS, The Masters College, 1998

Dissertation Submitted in Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education

Walden University

July 2018

## Abstract

Homeschooling has become a viable educational choice for families; however, limited research has been conducted on the instructional strategies homeschooling parents use to instruct their children and whether these reflect a learner-centered teaching approach. The purpose of this qualitative case study was to explore the learner-centered instructional strategies homeschooling parents use to teach their children mathematics. The conceptual framework for this single-case study was based on Weimer's learner-centered teaching model. Participants included 4 parents who homeschooled students in Grades 6–12 in a Western state and who received instructional support from a private school. Data were collected from interviews with homeschooling parents, online reflective journals maintained by homeschooling parents, and documents related to the homeschooling mathematics program. Data analysis included coding and examining emerging themes and patterns and discrepant data. The results indicated that the homeschooling parents aligned only a small amount of their instructional strategies with Weimer's learner-centered teaching model by trying to make mathematics fun, interesting, and relevant to their children's lives. They also differentiated instruction and chose curriculum that included some critical-thinking problems. The homeschooling parents taught using more traditional methods in which they were the primary instructors and made most of the decisions about the instructional content. The results of this study can contribute to positive social change by aiding curriculum designers and educators in their exploration of learner-centered and other instructional strategies they can use to design curriculum and instruct their students.

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## Acknowledgments

I would like to thank all those who helped and supported me through the process of completing my degree. First, my many thanks belong to my committee members, Dr. Charles McElroy, Dr. Deanna Boddie, Dr. Katrina Pann, and Dr. Paula Dawidowicz. Their patience and the hours they spent helping me and guiding me through this process are deeply appreciated. I also want to thank my children, Madeline, Caleb, and Christabel, who put up with my long hours of work to complete this dissertation.

## Table of Contents

Table of Contents.....	i
Chapter 1: Introduction to the Study.....	1
Introduction.....	1
Background.....	2
Problem Statement.....	6
Purpose of the Study.....	9
Research Questions.....	9
Central Research Question.....	9
Related Research Questions.....	10
Conceptual Framework.....	10
Nature of the Study.....	10
Definitions.....	11
Assumptions.....	13
Scope and Delimitations.....	14
Limitations.....	15
Significance.....	16
Summary.....	17
Chapter 2: Literature Review.....	19
Introduction.....	19
Literature Search Strategies.....	21
Conceptual Framework.....	22

Role of the Teacher .....	23
Balance of Power in the Classroom .....	24
Function of Content .....	25
Responsibility for Learning .....	27
Purposes and Processes of Evaluation .....	29
Articulation in Previous Research .....	30
Benefits to This Study.....	33
Literature Review.....	34
Prevalence of Homeschooling .....	34
Reasons Why Parents Decide to Homeschool .....	37
Challenges That Homeschooling Parents Face.....	44
Homeschooling Instruction.....	55
Academic Achievement of Homeschooled Students.....	65
Trends in Mathematics Instruction .....	73
Summary and Conclusions .....	81
Chapter 3: Methodology .....	85
Introduction.....	85
Research Design and Rationale .....	85
Central Research Question.....	86
Related Research Questions.....	86
Role of the Researcher .....	88
Methodology.....	89

Instrumentation .....	89
Interview Protocol.....	90
Reflective Journal .....	90
Procedures for Recruitment, Participation, and Data Collection.....	91
Recruitment.....	91
Participation .....	91
Data Collection .....	92
Data Analysis Plan.....	93
Issues of Trustworthiness.....	93
Credibility .....	94
Dependability.....	94
Transferability.....	95
Confirmability.....	96
Ethical Procedures .....	96
Summary .....	97
Chapter 4: Results.....	99
Introduction.....	99
Setting.....	99
Demographics .....	101
Data Collection .....	102
Data Analysis .....	104
Issues of Trustworthiness.....	105

Credibility .....	105
Dependability .....	105
Transferability.....	106
Confirmability.....	106
Results.....	106
Research Question 1 .....	106
Research Question 2 .....	125
Research Question 3 .....	128
Summary.....	136
Chapter 5: Discussions, Conclusions, and Recommendations .....	138
Introduction.....	138
Interpretation of the Findings.....	139
Limitations of the Study.....	145
Recommendations.....	146
Implications.....	147
Conclusion .....	148
References.....	151
Appendix A: Letters of Cooperation.....	159
Appendix B: Letter of Invitation.....	161
Appendix C: Interview Protocol .....	162
Appendix D: Reflective Journal.....	164
Appendix E: Alignment of Research Questions and Data Sources .....	165

## Chapter 1: Introduction to the Study

### **Introduction**

Homeschooling is becoming more prevalent in the United States. From 1999–2009, the number of homeschooling students rose from 850,000 to 1.5 million (National Center of Research and Statistics, 2009). In 2015, an estimated 2.2 million children were homeschooled in Grades K–12 in the United States; however, this estimate fell short of the actual number, which is unknown (Ray, 2015). Homeschooling began growing rapidly in the 1970s, and the most significant factors leading parents to homeschool their children were their dissatisfaction with the school environment, a concern about a lack of moral values in the public schools, a desire for a more rigorous academic content, concerns about religious or moral instruction, concerns about socialization factors, the special needs of their children, and discipline issues (Mackey, Reese, & Mackey, 2011). Many studies have been conducted on the reasons why homeschooling parents choose to homeschool their children (Anthony, 2009, 2015; Martin-Chang, Gould, & Meuse, 2011; Rothermel, 2011; Taylor-Hough, 2010). However, few studies have been conducted about how homeschooling parents provide instruction to their children (Anthony & Burroughs, 2012). Therefore, I conducted this study to explore the instructional strategies that homeschooling parents used to teach their children mathematics. The results of this study can contribute to positive social change by aiding curriculum designers and educators in their exploration of learner-centered instructional strategies homeschooling parents use to teach their children mathematics. Society may benefit from this deeper understanding about how to provide mathematics instruction in a home

environment because homeschooling parents have the unique opportunity to work individually with their children to meet their specific learning needs.

In this introductory chapter, I will present a summary of the research literature related to the scope of this study. In addition, I will describe the research problem, the purpose of the study, the research questions, and the conceptual framework. I will also describe the methodology of the study, definitions for key terms, assumptions, scope and delimitations, limitations, and the significance of the study.

### **Background**

My review of the extant research literature indicated the scope of homeschooling research. Anthony and Burroughs (2012) examined the day-to-day instructional activities of homeschooling families and found that some parents choose to establish a highly-structured learning environment with organized lessons and schedules. They also found that parents desired a more relaxed, child-centered environment that allowed children to learn naturally from their environment and included spontaneous lessons based on their children's interests in a particular subject. In addition, Anthony and Burroughs found that many homeschooling parents combined the traditional, highly-structured environment with a more child-centered approach.

In a dissertation about homeschooling, Humason (2012) conducted in-depth interviews with four married couples who homeschooled their children to determine how these parents perceived the benefits and values of homeschooling and the deficits they attributed to other educational choices. In relation to the benefits and values of

homeschooling, Humason found that homeschooling parents believed they had the ability to meet their children's individual needs more effectively than classroom teachers.

Humason reported that homeschooling parents believed they knew their children, and therefore, they had opportunities to individualize their children's learning experiences. In addition, Humason found that homeschooling parents believed they were able to utilize a variety of instructional strategies in the home environment and to adjust these strategies to meet the individual learning needs of their children. Even though many parents in the study reported that they lacked training in these instructional strategies, they believed that their children learned through trial and error. The participants also believed that they were able to work closely with their children, understand their learning styles, and discover instructional strategies that help their children learn. In relation to the deficits that homeschooling parents attribute to other educational choices, Humason discovered that homeschooling parents believed that public school education did not match their values. Humason reported that homeschooling parents were often sympathetic toward teachers and administrators in the public schools who they believed were expected to demonstrate moral relativity in relation to their instruction to students. According to Humason, homeschooling parents also believed that it is difficult for teachers in classrooms to provide individual attention for students, and they did not like the emphasis on standardized testing in public schools.

Significant research has also been conducted on the academic achievement of homeschooling students. Ray (2010) examined over 11,000 achievement test scores of

students in Grades K–12 across the United States, including mathematics, reading, science, social studies, and language. Homeschooling students achieved higher scores than students in traditional public schools in all subtests (Ray, 2010). Furthermore, Ray reported that average scores in mathematics for homeschooling students exceeded average scores for students in public schools. In addition, homeschooling students scored, on average, at the 85th percentile in mathematics, while public school students score at the 50th percentile.

In other significant homeschooling research, Martin-Chang et al. (2011) compared the academic achievement of homeschooled students to students who attended public schools in Nova Scotia and New Brunswick. Both the public school group and the homeschooled group included 37 students between the ages of 5–10. Martin-Chang et al. also further divided the group of homeschooled students into two subgroups: structured and unstructured. The structured group in their study experienced a formal curriculum at home with no choice in the activities, and the unstructured group experienced an informal curriculum at home with choice in the activities that happened naturally throughout the day. Martin-Chang et al. administered the Woodcock Johnson Achievement Test, which included seven subtests, to all groups. Their results indicated that structured homeschooled students scored higher than the traditionally-schooled students in public schools, and public school students scored higher than unstructured homeschooled students in all seven subtests.

In related research, Barwegan et al. (2004) examined the academic achievement of homeschooled and public school students as well as student perceptions of parent involvement in their education. Barwegan et al. examined the ACT scores of 127 high school students and found no significant difference between the scores of homeschooled students and public school students who perceived a high level of parent involvement in their education. However, both groups scored significantly higher than public school students who did not perceive a high level of parental involvement in their education.

In a study about the academic outcomes of students at a private university who had previously been homeschooled, Cogan (2010) examined the records of these students in a midsized private university, including grade point average, ACT scores, retention rates, and graduation rates. Cogan compared students who had been homeschooled before coming to the university to students who had attended traditional public schools. Cogan found that homeschooled students have higher retention rates in college, higher graduation rates, and significantly higher grade point averages and ACT scores.

Even though this prior research on homeschooling is valuable, limited research has been conducted on instructional strategies that homeschooling parents use to teach their children (Anthony, 2009; Anthony & Burroughs, 2012; Hannah, 2011; Humason, 2012; Pannone, 2014; Thomas & Pattison, 2013). Few researchers have examined the instructional strategies homeschooling parents use when teaching their children mathematics (Anthony, 2009; Anthony & Burroughs, 2012). I found no current research

that focused solely on instructional strategies that homeschooling families used to teach mathematics to their children.

This study was needed because the results may help educational stakeholders develop a deeper understanding about how homeschooling parents use instructional strategies to teach their children mathematics. This deeper understanding is important because research indicates that the home environment and the school environment are both related to student motivation and achievement (Barwegan et al., 2004; Crow, 2009; Duggan, 2010; Garn & Jolly, 2014). The results of this study may also provide a deeper understanding about how teachers and homeschooling parents could use learner-centered teaching in order to improve student learning in mathematics.

### **Problem Statement**

Homeschooling continues to expand in the United States (Kreager, 2011; Ray, 2011, 2015). However, little is known about the instructional strategies that parents use to teach their children in a home environment (Anthony, 2009; Anthony & Burroughs, 2012; Cardinale, 2013; Gustafson, 2012; Kapitulik, 2011; Martin-Change et al., 2011). Even less is known about how the instructional strategies parents use when homeschooling reflect learner-centered teaching, especially in relation to mathematics instruction.

Significant research has been conducted on learner-centered teaching (Weimer, 2013). In a study that emphasized these learner-centered teaching principles, Mueller, Yankelewitz, and Maher (2011) examined sense making as motivation in learning

mathematics and found that the use of problem solving strategies, where students have to think critically, defend their answers, and communicate with other students in cooperative groups, increased their understanding of mathematical concepts. In a study that emphasized the use of technology as a learner-centered teaching strategy to motivate students, Wei, Hung, Lee, and Chen (2011) focused on a group of Grade 2 students that used a virtual robot in a computer program to learn specific mathematical concepts. Wei et al. found that students who used robots were motivated to learn mathematics because they enjoyed the experience. In another technology study that emphasized student responsibility for learning, Lambic (2011) investigated the effects of incorporating programming into a mathematics program and reported that students developed positive attitudes about mathematics and were motivated to learn mathematics when they were given responsibility for creating a computer math program, a computer game, and a calculator. These hands-on and collaborative activities increased student interest in learning mathematics (Lambic, 2011).

Research has also revealed that homeschooling parents face multiple challenges when providing instruction to their children. In a personal narrative about homeschooling, Raja (2012) observed that homeschooling parents often worry about their teaching abilities. Raja recommended that homeschooling parents learn to put aside any preconceived notions of education and constantly adjust their instruction in order to meet the needs of their children. In other related research, Rothermel (2011) conducted 100 interviews with homeschooling parents in Britain and reported that these parents believed

that meeting the individual learning needs of their homeschooled children involves hard work and preparation and that parents need to be flexible in order to adapt to their children's individual learning needs. These studies indicated that parents face many challenges in homeschooling their children, including meeting the individual learning needs of their children, finding the necessary curricula and materials to increase interest and motivation, and providing their children with a comprehensive education.

Research also revealed that homeschooling parents use a variety of instructional strategies to deliver instruction to their children. Hanna (2011) conducted a comparative study on homeschooling instruction in 1998 and 2008 and found that parents in 2008 used more structured curricula and sought more help from instructional specialists and teachers and other homeschooling families. These parents had more access to instructional materials through the Internet than parents in 1998 (Hanna, 2011). According to Hanna, homeschooling parents in 2008 diversified their instruction to meet the individual learning needs of their children. However, Hanna also concluded that more research needed to be conducted on instructional strategies that homeschooling parents use to motivate their children to learn.

Even though some prior research has been conducted on homeschooling, limited research exists about the instructional strategies homeschooling parents use to meet the individual learning needs of their children and to keep them interested and motivated to learn mathematics. According to current research, Weimer's learner-centered teaching strategies have been used in the classroom setting effectively (Lambic, 2011; Mueller et

al., 2011; Wei et al.; Weimer, 2013). However, not much research has been carried out to determine if learner-centered teaching strategies are used by parents in the homeschooling setting. Research needs to be conducted about the specific instructional strategies that parents use to homeschool their children and how those instructional strategies reflect learner-centered teaching, particularly in mathematics.

### **Purpose of the Study**

The purpose of this qualitative study was to describe how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching. I used the model for learner-centered teaching developed by Weimer (2013) as my conceptual framework. A single case study design was used to describe the beliefs homeschooling parents have about mathematics instruction and determine in what ways learner-centered teaching was reflected in their teaching strategies.

### **Research Questions**

I developed the following research questions in relation to the conceptual framework for this study and a review of the research literature.

#### **Central Research Question**

How do the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching?

### **Related Research Questions**

1. What do homeschooling parents believe about mathematics instruction for their children?
2. What instructional strategies do homeschooling parents use to teach their children mathematics?
3. What do documents reveal about homeschooling instruction in mathematics?

### **Conceptual Framework**

Weimer's (2013) research on learner-centered teaching was the basis for the conceptual framework for this study. According to Weimer, learner-centered teaching focuses on five key changes to instructional practice that teachers make when they change from teacher-centered to learner-centered instruction: (a) the role of the teacher, (b) the balance of power in the instructional environment, (c) the function of content in the instructional environment, (d) the responsibility for learning, and (e) the purpose and processes of evaluation. This conceptual framework was relevant to this study because it provided me with a conceptual lens through which to analyze the instructional strategies that homeschooling parents use to teach mathematics to their children. I will discuss this conceptual framework in more detail in Chapter 2.

### **Nature of the Study**

The nature of this study was qualitative, and the research design was a single case study. The case, or unit of analysis, was a specific homeschooling program supported by Faith Christian Schools, a pseudonym, which is located in the western region of the

United States. Participants included four homeschooling parents of students in Grades 6–12. I collected data from multiple sources, including individual interviews with four homeschooling parents, online reflective journals that homeschooling parents maintained for a week, and documents related to instruction in mathematics that homeschooling organizations provide to parents and their children. Data analysis was conducted at two levels. At the first level, data from each source were coded, using line-by-line coding that Charmaz (2006) recommended for qualitative research, and categorized using the constant comparative method that Merriam and Tisdell (2016) recommended. I used a content analysis to review the documents, which involved describing the purpose, structure, content, and use of each document (see Gall, Gall, & Borg, 2007). At the second level, data across all sources were examined for emerging themes and discrepant data, which formed the key findings for this study. I used Weimer’s learner-centered teaching concepts as the conceptual lens through which to conduct the data analysis and interpretation.

### **Definitions**

*Contemporary teaching methods in mathematics:* As defined by Zorica, Cindric, and Destrovich (2012), these are methods that center on the learner and focus on the process, not the product. Students are given the freedom to explore various methods of attaining specific mathematical goals and solving problems in mathematics. These goals and problems are contemporary and focus on the needs and demands of the current world surrounding the students. This teaching method encourages discussion and collaboration

among students and teachers, real-world problem solving, and using knowledge of mathematical reasoning and processes. Multiple solutions to a problem are accepted and valued.

*Homeschooling:* According to Ray (2015), homeschooling is “parent-led, home-based education” (p. 1). Homeschooling parents are the primary teachers; however, some parents may choose to use homeschooling groups, where parents meet to share ideas, or cooperatives and volunteer to teach some classes to the homeschooling students once a week (Anthony, 2015). Homeschooling parents may also receive help from educators at a traditional school, where they often receive curriculum and their children attend certain classes at the school, such as physical education or art. Homeschooling parents may also provide instruction through online courses that have been designed by independent creators or that schools provide (Anthony, 2015).

*Homeschooling cooperative:* A group of homeschooling families that meet at least once a week, and parents teach various subjects to the students. The purpose of this group is to provide an opportunity for the students to learn in a social environment and to provide help and support for the parents (Anthony, 2015).

*Instructional strategies in mathematics:* These strategies are research-based and considered best practices in terms of improving student learning in mathematics. Examples of these strategies include engaging in problem-solving activities that help students to apply their knowledge of mathematical concepts (Abdullah, Zakaria, & Halim, 2012; Lambic, 2011; Zorica et al., 2012); exploring concepts in-depth to help

students understand mathematics (Zorica et al., 2012); and using technology, hands-on activities, and visual representations to help students understand mathematical concepts (Abdullah et al., 2012; Ardito, Lanzilotti, Costabile, & Desolda, 2013; Ghanbari, Shariatmadari, Ahghar, & Naraghi, 2011).

*Structured homeschooling teaching method:* A method using predetermined curriculum, lesson plans, and schedules to teach the homeschooled children (Martin-Chang et al., 2011).

*Traditional teaching methods in mathematics:* Those methods that rely on rote memorization of algorithms and specific methods in mathematics. The teacher is the center of the learning process and requires students to learn specific processes to solve problems in mathematics without altering the processes (Zorica et al., 2012).

*Unstructured homeschooling teaching method:* According to Martin-Chang et al. (2011), homeschooling parents who select this method allow their children to decide the topics to study and the times during which they learn.

### **Assumptions**

I based the design of this study on several assumptions. One assumption was that the participants had an interest in my study, and therefore, answered the interview questions to the best of their abilities. I assumed that they answered the questions in the interviews and the reflective journals with the intent of providing as much information as possible about their instructional strategies and their chosen curriculum. I also assumed that they remembered as much detail as possible. This assumption was important

because the findings of my study relied on the amount and accuracy of details provided by the participants in the interviews, reflection journals, and the documents they brought to the interviews.

The design of this study was based on my assumption that the participants would respond openly and honestly to the interview and reflective journal questions. This assumption was important for credibility. The credibility of the findings depended on open and honest responses from homeschooling parents about the instructional strategies they believe are effective in improving mathematics learning for their children.

I also assumed that the participants understood the interview and reflection journal questions. Before the interviews, I gave the participants the opportunity to read through the interview questions and to ask for clarification, if needed. My assumption was that the participants would ask for clarification if they did not understand the questions. After the interviews, I had the participants read the reflection journal questions and told them that they could ask for clarification then or contact me through e-mail at a later date. My assumption was that the participants would contact me if they had not asked for any clarification directly after the interview meeting. This assumption was important because the comprehension of the interview and reflection journal questions was imperative to the participants providing me with accurate data.

### **Scope and Delimitations**

A case study is a bounded study (Merriam & Tisdell, 2016) therefore, the scope or boundaries of this single case study included four homeschooling parents from one

homeschooling program supported by a private school, Faith Christian Schools, which is located in the western region of the United States. These four parents chose to receive instructional support from this private school that provides homeschooling curriculum to these parents and can choose to have their children attend certain classes that public schools offer, such as physical education and art.

This study was further delimited by time and resources. Data were collected for several months during the spring of 2017. As a single researcher, I had limited financial resources and time to collect and analyze the data, and therefore, the scope of this study was delimited by those factors.

### **Limitations**

The limitations of this study are related to the nature of qualitative research and to the specific research design. The first limitation was related to the sample or number of participants for this single case study, which included four parents from a homeschooling program located in the western region of the United States. For this single case study, I needed a sufficient number of participants to represent multiple viewpoints about mathematics instruction for homeschooled students. This sample was adequate for this study because, according to Yin (2014), participants in a single case should be limited because data will also be collected from other sources.

A second limitation was related to the role of the researcher in qualitative research. As a single researcher, I was responsible for the collection, analysis, and interpretation of all data, and therefore, the potential for researcher bias existed (see

Creswell, 2007; Merriam & Tisdell, 2016; Yin, 2014). To address this potential bias, I used specific strategies, such as reflexivity (I will further discuss these strategies in Chapter 3). For example, I maintained a researcher's journal in which I reflected on any biases, personal background information, or values I brought to this research that may have influenced my analysis and interpretation of the data for this study.

A third limitation was related to the transferability of findings for this study. Yin (2014) stated that single case studies are limited to literal replication and that four to six cases are needed to provide some theoretical replication. To address this limitation, I developed a theoretical proposition to guide the data collection and analysis for this single case study. The theoretical proposition was that the instructional strategies that homeschooling parents in this study used to teach their children mathematics reflected Weimer's (2013) learner-centered teaching strategies. However, their use of the instructional strategies may have been limited due to a lack of training in effective instructional strategies.

### **Significance**

A significant study contributes to existing research, practice in the field, and positive social change. The results of this study can contribute to advancing knowledge about how homeschooling parents provide instruction in mathematics to their children with the intention of improving their learning in a nurturing home environment. The findings of this study can also contribute to practice in the field by providing some guidance for homeschooling parents who may have concerns about how to effectively

teach their children mathematics in a home environment that is learner centered. In addition, classroom teachers may also develop a deeper understanding of how to assist individual students in learning mathematics through a learner-centered approach to teaching. The results of this study can contribute to positive social change by giving curriculum designers, school educators, and home educators insight into specific instructional strategies homeschooling parents use to teach their children mathematics. When students enjoy learning, they become lifelong learners, which benefits society as a whole because these individuals often make significant contributions to society.

### **Summary**

In this chapter, I presented background information in relation to a summary of the research literature related to homeschooling instruction. The research problem was also described, which was that even though numerous studies had been conducted on the instructional strategies that teachers in traditional schools use in the classroom to improve learning in mathematics, limited studies had been carried out on the learner-centered instructional strategies that homeschooling parents use to teach their children, and even fewer studies were found in relation to homeschooled mathematics instruction. Therefore, the purpose of this study, as reflected in the central research question, was to explore how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching. The conceptual framework was based on Weimer's (2013) learner-centered teaching approach. In this chapter, I also presented the single case study research design and rationale were also presented as well

as the methodology. In addition, terms relevant to this study were also presented. This chapter also included the assumptions, scope, delimitations, and limitations to this study. The significance of this study was also discussed, particularly in terms of contributing to positive social change by helping curriculum designers and educators, both in schools and homes, in their exploration of learner-centered instructional strategies homeschooling parents use to teach their children mathematics.

In Chapter 2, I will present a review of the literature. This will include an analysis and synthesis of current research about the prevalence of homeschooling, reasons why homeschooling parents decide to homeschool, the challenges that parents who decide to homeschool face, instructional strategies that homeschooling parents use, the academic achievement of homeschooling students, and instructional strategies in mathematics that are aligned with Weimer's (2013) learner-centered teaching approach. Chapter 2 will conclude with a discussion of theme and gaps that emerged from the research.

## Chapter 2: Literature Review

### **Introduction**

Even though numerous studies have been conducted on effective instructional strategies in teaching mathematics, limited research has been conducted about learner-centered instructional strategies that homeschooling parents use to teach their children mathematics. Therefore, the purpose of this study was to describe how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching.

A brief summary of the research indicates the relevance of this problem. Concerning the prevalence of homeschooling in the United States, current statistics indicate that the number of homeschooling students in the United States has risen from 15,000 students in the 1970s to over 2 million in 2010 (Ray, 2011). Many reasons exist as to why parents homeschool, including the desire to provide individualized instruction to their children (Gustafson, 2012); dissatisfaction with the public school environment and with academic instruction in these schools; and a lack of religious and moral instruction in schools (Mackey et al., 2011). Homeschooling parents face many challenges, such as time management (Anthony, 2009); providing a comprehensive education for their children (Anthony, 2009; Finch, 2012); choosing appropriate curriculum (Anthony, 2009; Hanna, 2012); taking on the role of a teacher (Finch, 2012); negative attitudes from friends and family members about homeschooling (Haugh, 2014); financial problems (Hanna, 2012); and socialization issues (Haugh, 2014). Researchers

have conducted studies on how homeschooling parents instruct their children (Anthony & Burroughs, 2012; Finch, 2012, Hanna, 2012; Martin-Chang et al., 2011) and found that some parents choose a structured method of teaching their children, which involves a specific curriculum and an emphasis on memorization (Martin-Change et al., 2011), while others select an unstructured teaching method, in which their children choose what and how they want to learn (Finch, 2012; Kapitulik, 2011). Current studies have also shown that homeschooling students perform well on standardized achievement tests (Martin-Chang et al., 2011; Snyder, 2013). In relation to current trends in K–12 mathematics instruction in public schools, research indicates that hands-on activities, discussions, collaborative activities, and critical thinking activities are effective in improving student learning (Zorica et al., 2012). Although significant research has been conducted on these trends in mathematics instruction in public school classrooms, more research needs to be conducted on mathematics instruction in homeschool environments.

In this chapter, I will describe the search strategy used to conduct this review and the conceptual framework that is the foundation for this study. I will analyze and synthesize current literature in relation to the prevalence of homeschooling in the United States and to the reasons parents decide to homeschool their children and the challenges that they face. In addition, research will be analyzed and synthesized about a variety of instructional strategies that homeschooling parents use to teach their children as well as the performance of homeschooling students on standardized achievement tests. This

chapter will conclude with a discussion of the themes and gaps that emerged from the literature review.

### **Literature Search Strategies**

For this study, I used several search strategies to locate current research on homeschooling. I accessed databases, such as ERIC, Academic Research Complete, and SAGE Premier, to find current, peer-reviewed articles about mathematics instruction in public and private schools, instructional strategies used in the homeschooling environment, and current information about the prevalence of homeschooling in the United States and the challenges that homeschooling parents face related to this alternative education choice. In addition, through the use of Google Scholar, I located dissertations about homeschooling instruction and additional peer-reviewed journal articles. Some journal articles were also found on the National Home Education Research Institute website that includes current research on home-based education in the United States.

I used a variety of search terms to find current research about both the instructional strategies homeschooling parents use to teach their children mathematics and the instructional strategies classroom teachers use. I used the search terms *homeschooling*, *mathematics*, *instructional strategies*, *teaching methods*, *achievement*, and *achievement in mathematics* to find current research pertaining to the instructional strategies that homeschooling parents use when teaching mathematics to their children and pertaining to the mathematics achievement of homeschooling students. To find

research on instructional strategies in mathematics that traditional classroom teachers use in their classrooms, I used the search terms *instructional strategies*, *teaching methods*, *motivation in mathematics*, *mathematics*, and *motivation*.

Several challenges emerged during my search for literature. Most of the articles that I found focused on who chooses to homeschool, the academic achievement of homeschooling students, and the reasons why parents choose to homeschool their children. It was difficult to find research on how parents homeschool their children, particularly in relation to learner-centered instructional strategies that parents use in a homeschooling environment to teach mathematics. Locating peer-reviewed research pertaining to these topics was also a challenge because many of the articles were personal narratives and were not peer reviewed.

### **Conceptual Framework**

The conceptual framework for this study is based on Weimer's (2013) learner-centered teaching approach. Weimer opined that learner-centered teaching is reflected in five key changes that teachers make to their instructional practice: (a) the role of the teacher changes from teacher-focused to student-focused, (b) the balance of power shifts from the teacher to the students, (c) the function of content changes from the idea that teachers need to cover certain standards or topics to the idea that teachers need to reveal information to students to help them develop an understanding of the content and related lifelong learning skills, (d) the responsibility for learning is transferred from the teacher to the students, and (e) the purpose and processes of evaluation change from teacher-led

to student-led evaluations. Although teachers are still in charge of grading in this approach, students learn to assess themselves and their peers (Weimer, 2013).

### **Role of the Teacher**

According to Weimer (2013), the role of the teacher is the first key change to instructional practice. The teacher is the facilitator who engages students in learning, Weimer stated. Instead of passively observing instruction, Weimer believed that students should be solving problems, asking and answering questions, studying and reviewing the learning materials, and engaging in discussions. Weimer examined many studies conducted on faculty teaching in colleges and universities and found that faculty used most of class time for lectures and little class time for inquiry-based, active learning techniques. Weimer also examined studies about student perceptions of the instructional strategies that teachers used, finding that students reported that most of the instruction they received was through lectures and that students who were in classes that included active learning and collaboration reported positive perceptions of these methods of teaching.

According to Weimer, the role of teachers does not change from day-to-day, or from hour-to-hour, but is a role that is played out every day. Teachers guide students and support students, but students are the ones who struggle with the learning process. Weimer contended that teachers are coaches who understand the needs of their students, adjusting the learning materials and their instruction to meet their individual needs, strengths, and weaknesses. It is the student's responsibility to master the material, and it

is the teacher's responsibility to support the student as he or she learns (Weimer, 2013). In learner-centered teaching, the focus of teaching changes from what teachers are doing to what students are doing, and teachers adjust their instruction based on what students need to learn in order to move to the next level of learning, Weimer contended. Weimer also presented the following key principles that guide this facilitative teaching:

1. Teachers let students do more learning tasks.
2. Teachers do less telling so that students can do more discovering.
3. Teachers do instructional design work more carefully.
4. Faculty more explicitly model how experts learn.
5. Faculty encourage students to learn from and with each other.
6. Faculty and students work to create climates for learning.
7. Faculty use evaluation to promote learning (pp. 72-84).

Weimer also discussed implementation issues related to this changing role. The implementation issue that is most difficult, Weimer contended, is achieving a balance between telling students what to do and how to do something, and stepping back and allowing them to make their own decisions and mistakes. Weimer concluded that teachers need to step back from their center-stage role and guide students to learn on their own.

### **Balance of Power in the Classroom**

The second key change to instructional practice, Weimer (2013) believed, involves the balance of power in the classroom. Weimer stated, "When teaching is

learner-centered, power is shared with students, not transferred to them wholesale” (p. 94). In a learner-centered classroom, students have some say in what they learn and how to learn it. The goal is to help students become autonomous learners; however, this process takes time, and teachers need to gradually release responsibility for learning to students, Weimer stated. Weimer also argued that when students are given more power in the classroom and can share this power with their teacher, a greater sense of community and collaboration in the classroom develops, which can reduce behavior problems and the desire of students to battle with authority to gain more control. Weimer also presented specific examples of how teachers can redistribute power in the classroom in relation to activities and assignments, course policy decisions, course content decisions, and evaluation activities. In addition, Weimer discussed implementation issues such as the amount of power, decision-making ability, and responsibility teachers should give students. Weimer concluded that both students and teachers can share power, which should be given to each student on an individual basis, and recommended that teachers continually ask questions about these issues when using the learner-centered instructional strategies.

### **Function of Content**

According to Weimer (2013), the third key change to instructional practice involves the function of content in the learning environment. Weimer contended that the way teachers think about content needs to change. Many teachers believe they need to simply cover content; however, covering content means reviewing the content quickly

with students without allowing time for them to develop a deep understanding of that content (Weimer, 2013). Instead, content needs to be taught in depth, which means quality is more important than quantity (Weimer, 2013). Weimer believed that teachers should use content to help students develop their knowledge about a particular subject and to provide students with the learning skills to become lifelong learners. Weimer contended that teachers need to continue to ask the question, “How much content is enough?” (p. 118). Teachers need to focus on teaching content so that students can learn it, internalize it, and apply it in their lives, so the content needs to have meaning for students, and they need to be able to retain it, according to Weimer. Therefore, Weimer argued, teaching methods need to change and teachers should teach lessons that allow students to be active learners. When students use the information they learn, they are able to understand it better, according to Weimer. In addition, Weimer contended that students need to be taught study skills, such as summarizing and synthesizing, so they can apply the information they learn. Teachers need to change the presentation of the content; instead of telling the information to students, Weimer maintained that students should find the information they need to solve a problem or answer a question.

In order to teach content appropriately, teachers also need to consider what learning skills students have and do not have and think about what activities and assignments can help students develop those skills. Then, Weimer (2013) noted, teachers must find time for students to engage in these skill development activities. Some instructional strategies teachers can use to help students learn these skills include

teaching students to write about what they learn, helping students learn from their assessments, and asking students to evaluate their learning processes, Weimer stated. Learner-centered teachers change from caring about the amount of content they teach to using the content to develop knowledge of specific subjects and related learning skills, Weimer said.

### **Responsibility for Learning**

Weimer (2013) believed that the fourth key change to instructional practice involves the responsibility for learning. The major change that teachers need to make in their classroom instruction is in relation to their response to the learning problems of students (Weimer, 2013). According to Weimer, when teachers see a student struggling to learn, they often believe that it is their responsibility to fix the problem. They give students additional instruction to make the concepts clearer, they give extra credit to raise grades, and they give students extrinsic rewards to raise their level of learning. Weimer believed that these practices do not motivate students to become better learners, and instead, teachers need to change their classroom climate to one that promotes learning. A climate is the environment in the classroom, including how students and teacher act (Weimer, 2013). The goal should be for teachers to create a climate that encourages students to be responsible and independent learners, said Weimer. In order to create this climate, Weimer believed that teachers need to build good relationships with their students by providing logical consequences for student behavior and that students need to experience the natural consequences of their decisions. For example, if they do not turn

in their homework, teachers should establish consequences so the work gets done on time.

Teachers need to be consistent in their actions. What a teacher says should be what a teacher does. Teachers should not tell the students that they are going to do something when they do not intend to follow through with that promise. Weimer (2013) also believed that teachers need to have high standards for learning. Work should be rigorous, and therefore, teachers need to set high goals, not unattainable goals, for students. Teachers need to show that they care for students by smiling, talking with students about things that interest them, and taking time to learn about them as individuals. Teachers also need to show a commitment to learning by modeling their own learning. Teachers need to model their thinking and the learning skills that have helped them become lifelong learners. Weimer also contended that students should be involved in creating a positive classroom climate. They can identify qualities of a positive classroom environment and help students take part in improving this environment by maintaining good relationships with their peers and working hard. Weimer believed that teachers should discuss the classroom climate consistently with students so that it remains positive and learner-centered. If a problem with the climate develops, students should fix the problem. Building a positive classroom climate, Weimer noted, can be difficult. Teachers and students must get used to changes that need to happen in the classroom, such as changing from a rules-centered, extrinsically motivated classroom to a place where students have logical consequences for their

actions. Teachers must determine those logical consequences and how they should be differentiated for each student. A classroom climate that encourages student responsibility for learning can be challenging, Weimer noted, but this kind of climate teaches students to be responsible, autonomous, and lifelong learners.

### **Purposes and Processes of Evaluation**

The fifth key change to instructional practice, Weimer (2013) believed, involves the purpose and processes of evaluation. Grading, according to Weimer, is done in classrooms for two reasons. The first reason is to show student mastery of material, and the second reason is to promote learning of the material. The processes of evaluation can involve students, but does not need to be the complete responsibility of students. The purposes and processes of evaluation need to change, Weimer contended, because grades do not always measure all types of learning. They do not always assess higher order thinking skills, or whether or not students can apply what they learned outside the classroom. Weimer argued that students realize the importance of grades and they tend to work for the grade, not toward improving their learning. Students need to turn their focus away from grades and turn their attention to how they can improve their learning. This change, Weimer maintained, involves student self-assessment and peer-assessment. When students are taught to analyze their own work, they are not focused on grades. Instead, they are focused on improving their skills. Teachers need to change the way students look at grades. Instead of being a negative factor, grades can be a motivating

factor in instruction because they assess how much a student has learned and what goals the student needs to make to continue to improve.

Teachers need to make assessments less stressful for students. Weimer (2013) believed that tests should be used to assess learning and to provide formative feedback on what students know and do not know. Weimer suggested that teachers can make assessments into learning experiences by providing review times before the tests, allowing students to use class notes during the tests, and establishing debriefing times after the tests to help students retain what they have learned. Weimer also addressed two implementation issues in relation to evaluation. The first issue is that, no matter how often teachers discuss the importance of learning with students and emphasize the notion that assessments are important for the learning process, students may continue to emphasize grades as most important. Teachers need to be patient and keep telling students that grades are not as important as the learning. The second implementation issue is that teachers need to design ways in which students can be involved in self-evaluation and peer-evaluation. Evaluation must be done, Weimer concluded, but learning, not grades, needs to be emphasized.

### **Articulation in Previous Research**

These five key changes to practice that result in learner-centered teaching have also been described and applied in previous research. In a significant study about student responsibility for learning, Lambic (2011) examined how a teacher motivated students to learn mathematics through the use of a computer program in a study that included 114

students, ages 13-19, who participated in a programming course. The teacher presented nine lessons about how to use a computer program called the C++ Builder to do mathematical computations. Students were allowed to choose their own groups. Teachers taught students how to program the computer to do mathematical computations. Students were given the choice as to what programs they wanted to create. For example, students wanted to design a program to create a calculator on the computer, to find the circumference of a circle, and to solve quadratic equations. From these ideas, the teacher assigned students the tasks of creating a program to find the surface area and perimeter of a square, rectangle, and triangle.

Students also created calculators and a video game. Students designed and executed these computer programs, and the teacher provided information, training, and advice when necessary. Students completed questionnaires before and after the class. Most of the students reported increased enthusiasm and motivation for learning mathematics after the class than before the class. Students also reported that they enjoyed learning mathematics and found mathematics more relevant in everyday life after participating in the class. Students also wanted to learn more about programming computers. The findings are important because they indicate that giving students more control over their learning environment and allowing teachers to become guides and facilitators, as Weimer (2013) contended, motivates students to learn mathematics.

In an experimental study, Ardito et al. (2013) examined the integration of traditional learning and games on large displays in six Grade 5 classes in Italy that

included 107 students who studied ancient Roman history. Teachers provided direct instruction about this history, and students also engaged in hands-on activities, which included a field trip to an archaeology park and museum. In addition, students completed a puzzle game on the computer. Students also collaborated in cooperative groups. Ardito et al. found that students enjoyed the learning process because the educational games were engaging, supported group work, and favored inclusion. This study is significant because findings indicate instructional strategies that emphasize hands-on and collaborative activities are important components of learner-centered teaching.

In another study related to learner-centered teaching, Garn and Jolly (2014) examined intrinsic motivation to learn. This qualitative study included 15 gifted students, ages 8-12. During their interviews, students reported that the ability to choose what they want to learn and allowing them to take responsibility for their learning was important to them and increased their motivation to learn. Students appreciated teachers who got to know them personally and who matched the lessons to their interests and goals. Students also reported that they were most motivated when the lessons supported their interests outside of school. Many students reported that they enjoyed learning about subjects that matched their future career goals. Most of the students also acknowledged that grades and external rewards did not motivate them. These findings are relevant because they indicate that learner-centered teaching methods, which emphasize student choice, student interests, and student responsibility for learning, increase students' intrinsic motivation to learn.

In a study about improving student motivation to learn using a situated learning program, Hossainy (2012) divided the population sample of 34 college students into two groups. One group was taught using a traditional lecture method, and the other group was taught using situated learning methods, which included scaffolding, authentic learning situations and assessment, collaboration among students, and reflections about their learning. Using a pre- and a posttest assessment and questionnaire to assess student motivation, Hossainy found that the situated learning group increased their scores on the post-test more than the lecture group. In addition, a significant difference between the pre- and post-test questionnaire concerning intrinsic motivation and school motivation was found in the situated learning group, but no difference was found in external motivation. This study is important because it revealed that situated-learning methods emphasizing a learning-centered teaching approach motivate students to learn.

### **Benefits to This Study**

This study benefits from this conceptual framework. A review of current research has found that the five changes to instructional practice that Weimer (2013) discussed in relation to learner-centered teaching are often effective in improving student learning (Ardito, et al., 2013; Garn & Jolly, 2014; Hossainy, 2012; Lambic, 2011). Therefore, the purpose of this study is to describe how the instructional strategies that homeschooling parents use to help their children learn mathematics reflect learner-centered teaching. These five changes to instructional practice will also form the conceptual lens by which the findings for this study will be analyzed and interpreted.

## **Literature Review**

The literature review includes an analysis and synthesis of current studies related to the following topics: the prevalence of homeschooling, the reasons why parents decide to homeschool, challenges that homeschooling parents face, homeschooling instruction, the academic achievement of homeschooled students, and current trends in mathematics instruction. I also analyze research about the instructional strategies that homeschooling parents and public school teachers use to motivate students to learn mathematics in order to develop a deeper understanding of the impact of learner-centered teaching on student motivation and achievement in mathematics. These topics were chosen to provide a deeper understanding of the phenomenon of homeschooling instruction.

### **Prevalence of Homeschooling**

Homeschooling has existed in the United States since the country began (Anthony & Burroughs, 2012; Wilhelm & Firmin, 2009). Children were homeschooled, attended private schools, or became apprentices to a trade in the United States before 1852, when compulsory attendance laws began to exist in some states, requiring students to attend public schools. Massachusetts was the first state to pass a compulsory attendance law requiring all students to attend public schools in 1852, and Mississippi was the last state to pass this law in 1918 (Davis, 2011; Taylor-Hough, 2010). Homeschooling became a distinct methodology of education for some parents who did not want their children to attend public schools (Safran, 2010). However, homeschooling did not become legal in the United States until 1993. In 1962 and 1962, Supreme Court rulings removed prayer

and Bible reading from public school education (Gustafson, 2012; Wilhelm & Firmin, 2009). These rulings caused some parents to remove their children from public schools and to enroll them in private Christian schools. Legal groups, such as the National Homeschool Defense Fund and the Association of Christian Schools International, fought to make this form of alternative schooling legal, and in 1993, through federal legislation, homeschooling became legal in all states (Taylor-Hough, 2010; Wilhelm & Firmin, 2009).

The modern homeschooling movement occurred between the 1960s and 1970s (Anthony & Burroughs, 2012; Ray, 2010; Wilhelm & Firmin, 2009). Homeschooling became particularly popular in 1964 when John Holt wrote a book called *How Children Fail*. In this nationally recognized book, Holt discussed how public schools hampered the learning process for many students, which caused some parents to homeschool their children (Davis, 2011; Safran, 2010; Taylor-Hough, 2010). Holt believed that children should learn in a natural environment and that public school educators were too focused on the successes and failures of students. Holt wanted “educational decentralization and greater parental autonomy” (as cited in Wilhelm & Firmin, 2009, p. 307). Holt believed that public schools were classifying children into winners and losers and that public schools “disrupted the natural process of learning” (as cited in Davis, 2011, p. 30). Holt believed that children needed to be saved from these methods of teaching, and he encouraged parents to take control of their children’s education by pulling their children

out of public schools and homeschooling them. Holt's ideas caused many families to begin homeschooling their children.

The number of homeschooling families in the United States has rapidly increased since 1970. In 1970, the number of homeschooling students was estimated to be 15,000 (Wilhelm & Firmin, 2009). Fifteen years later, in 1985, the number of homeschooling students jumped to an estimated 50,000, and in 1992 to 300,000 students (Wilhelm & Firmin, 2009). Since that time, the number of homeschooling students has grown to 1.5 million students in 1996 and over 2 million students in 2010 (Ray, 2010; Ray, 2011; Wilhelm & Firmin, 2009).

In a more recent study, Ray (2011) used data from previous federal government studies, surveys of various homeschooling organizations, and information about homeschooling families from 13 states to determine the number of homeschooling families in the United States. From this data, Ray determined the number of homeschooled students in the United States in 2010 to be 2.2 million. In other research, Hanna (2012) conducted a longitudinal study from 1998 to 2008 of 250 homeschooling families and also found an increase in the number of homeschooling families during that period. The National Center for Education Statistics (NCES) also reported the number of homeschooled students to be about 850,000 in 1999, and in 2007, the NCES reported that this number had risen to about 1.5 million (as cited in Snyder, 2013). However, in all of these studies, the number of homeschooled students is approximate because researchers used survey data, and some homeschooling families did not respond to these surveys.

From these estimates, however, it is clear that homeschooling has become a significant method of alternative education.

### **Reasons Why Parents Decide to Homeschool**

Parents elect to homeschool for a variety of reasons. In a demographic picture of homeschooling families in South Carolina, Gustafson (2012) administered a 22-question survey to 751 homeschooling families and found that most of the families had both a mother and a father living in the home, an average of three children in the household, and the mothers were usually the primary teachers in the home. Gustafson also found that the most prevalent reason why parents in South Carolina chose to homeschool their children was to provide more individualized instruction to their children. Other reasons included having more control over the curriculum, spending more time with family, upholding their spiritual beliefs, and providing a quality education for their children. These homeschooling families were positive in their reasons for homeschooling and did not focus on negative reasons related to their experiences in public schools.

In similar research, Kapitulik (2011) examined the gender and politics of homeschooling in a dissertation study that included 45 homeschooling parents, half of whom identified themselves as religious and half as secular. The purpose of this dissertation was to understand the phenomenon of homeschooling within the context of broad social trends. Kapitulik examined a variety of social trends, including instruction in public schools, safety in public schools, the modern family structure, the economy, and the impact of feminism on families. This study was based on the following four research

questions: (a) How do the parents justify homeschooling and how do these justifications relate to family structure and gender? (b) How do parents homeschool their children and how are these [teaching methods] related to ideas about family life, the parents' childhood, and motherhood? (c) How do homeschooling families see themselves as a whole and how do they look at themselves in relationship to non-homeschooling families? and (d) What do the results of this study reveal about current thoughts about the gender roles in families and feminism?

In relation to the first research question, Kapitulik (2011) found that parents thought about homeschooling through three cultural frameworks. First, they thought about childhood and mothering, believing that childhood is an important time and that public schools take children away from their most important teachers, their mothers. The second framework through which parents viewed homeschooling is the decline of the family. Homeschooling parents believed that families are breaking down, as evidenced by increasing numbers of divorces and single parents. These homeschooling parents believed that homes should be a safe place for children, where they can express their thoughts and feelings in a safe environment. They were also concerned that family time is declining because work and school takes up too much time. The third framework is moral decline. Homeschooling parents believed that their moral views contradicted the views of those individuals in the world around them. For these reasons, the parents in Kapitulik's study decided to homeschool their children. Concerning the second research question, Kapitulik found a difference in how secular homeschooling parents taught their

children and how religious homeschooling parents taught their children. Secular homeschooling parents taught their children in a less structured way than religious homeschooling parents. Secular homeschooling parents provided instruction using real-world, hands-on activities that they encountered in their daily lives. Their first concern was for their children to develop a strong sense of self and build confidence. Learning reading, writing, and arithmetic were their second priorities. Their approach was to allow the children to learn at their own pace through daily activities, rather than forcing them to learn content and skills they did not want to learn. Religious homeschooling parents opted to do the school-at-home approach, where parents are the teachers and they teach from a structured curriculum with an emphasis on achievement. In relation to the third research question, Kapitulik found that secular homeschooling parents discovered their identity through homeschooling, becoming a part of who they were. Religious homeschooling parents, however, thought of homeschooling simply as something they do.

Concerning the fourth research question about gender roles in families and feminism, homeschooling mothers believed that women can choose to have careers outside of the home, but they chose to devote their lives to being mothers. Some homeschooling mothers reported having aspirations for careers later in life, but they believed they were feminists by choosing to be mothers. Homeschooling fathers in this study believed that their jobs were to be the breadwinners, and both parents followed a traditional way of looking at gender roles in the family. Kapitulik (2011) concluded that

homeschooling families are unique in the way they see the world and that the homeschooling movement will most likely not result in social change because homeschooling families choose to solve problems in the world by removing their children from public schools.

In a comprehensive study of homeschooling, Hanna (2012) conducted a longitudinal study from 1998 to 2008 that included 250 homeschooling families in urban, rural, and suburban areas of the Pennsylvania. Hanna examined homeschooling instruction and curricular materials and found significant changes in the instructional programs that families used during this time period. One of these changes was that many of the homeschooling parents bought computers, which they used to help their children understand concepts, to communicate with other homeschooling families, to take classes, to purchase curriculum and materials, and to complete online courses. Another change was that homeschooling families began to network with each other through the internet, cooperatives, and other homeschooling groups. Hanna also found that homeschooling families share materials and instruction responsibilities. In relation to reasons why parents homeschool their children, Hanna found that some homeschooling parents were concerned with the safety of their children after the terrorist attack on the United States on September 11, 2001, and school shootings that happened across the country at this time. Homeschooling parents also reported other reasons they began homeschooling, including perceptions about increased bullying in public schools, an increase in standardized testing in public schools, a perceived decline in moral standards in the

public schools, and overcrowded classrooms. In addition, homeschooling parents cited the flexibility and plethora of resources available to them from homeschooling organizations. This longitudinal study is important because it provides a longitudinal examination of changes that occurred in homeschooling in the United States and an in-depth look into the reasons parents decide to homeschool their children.

In a regional analysis of homeschooling demographics, Mackey et al.(2011) included 130 homeschooling families in a regional homeschool association as participants in their study. Mackey et al. compared the results of questionnaires completed by these regional homeschooling families with results collected from a national sample of homeschooling families and a national sample of non-homeschooled students. Results indicated that the top three reasons homeschooling parents in the regional sample chose to homeschool was concern over moral values, academic content, and religion. The top three reasons in the national sample were concerns over the school environment, religious or moral instruction, and academic instruction. Mackey et al. concluded that homeschooling students in this study did not represent the general population of students, in that they were mainly white and Christian, had families with two parents living in the home, and were highly educated. This limitation, according to Mackey et al., needs to be taken into account when examining the results of their study.

In other related research, Rothermel (2011) interviewed 100 British families and found a number of reasons why parents choose to homeschool. Rothermel reported that many of the families homeschooled their children because an older sibling had difficulty

in school. Some families did not like the learning and social environment in public schools and were concerned about bullying. Some homeschooling parents did not want strangers teaching their children. Others had children with special needs. These parents made a decision to homeschool their children after significant consideration. It was not a rash decision. This study is important because Rothermel interviewed many homeschooling families from many different cultures, types of family structures, and socioeconomic groups, which provided a strong sampling of the population of British homeschooling families. This study also provided a broad perspective about the reasons why parents choose to homeschool.

In a dissertation study, Anthony (2009) examined the motivations, instructional approaches, curriculum choices, and challenges of four homeschooling families. Anthony found that the main reasons these families chose to homeschool was because of their conflicts with the instructional strategies and religious beliefs of public school teachers. In addition, the social lives of their children were a key factor. These families did not approve of the social environment in the school. These families also reported academic difficulties with some of their children, and they believed that these difficulties could be addressed through differentiated and individualized instruction. Homeschooling parents believed that they could differentiate curriculum and instruction more effectively in the home environment to meet the individual needs of their children.

This study is significant because homeschooling parents reported that they choose to homeschool their children for two reasons. The first reason was for religious beliefs

and the second reason was that they want differentiate curriculum and instruction in order to meet their children's individual academic needs. Anthony (2009) concluded that these four homeschooling families chose to homeschool because of their religious beliefs. In addition, because they desired more control over their children's education, they used many means, including a cooperative, other teachers, university classes, and the Internet to teach their children. These homeschooling families also used both traditional and alternative methods to teach their children, particularly concerning reading, which they believed was the most important subject they taught. Anthony recommended that more research be conducted on non-religious homeschooling families to test the universality of these results. This study is important because it provides a description of the daily choices that homeschooling families make about their children's education and provides insight into the instructional strategies that these families use to teach their children.

Finch (2012), who explored the experiences of six homeschooling mothers, found that their reasons to homeschool their children differed. One mother encouraged her children to love learning and believed that traditional schooling would not motivate her children. Other mothers chose to homeschool because they wanted flexibility in scheduling and more time spent with family. One mother reported that her child wanted to be homeschooled because she did not feel socially accepted in the public school. Overall, these mothers chose to homeschool because they did not think the public schools met their children's social and academic needs, they wanted to spend more time with their families, and some of the children asked to be homeschooled. This study is

particularly relevant because some children ask to be homeschooled in order to avoid the social and academic environment of public schools.

Thus, research indicates that parents report a variety of reasons why they choose to homeschool their children, such as the desire for more family time, conflicts with the subject matter and morality taught in the public schools, the desire to help their children by differentiating instruction to meet their individual needs, and a dislike of the social environment in the public schools. However, the most significant reason parents chose to homeschool was to provide a safe, supportive, morally-focused environment for their children to learn. Homeschooling parents believed that this environment is not provided in traditional schools, and they were willing to take on the responsibility of developing this environment at home.

### **Challenges That Homeschooling Parents Face**

Homeschooling is a daunting undertaking because parents must learn to be both teachers and parents (Anthony, 2009). Many of the challenges that homeschooling parents face are unique to the homeschooling environment because they must determine how to function in these various roles and learn how to balance these roles. These challenges include learning to manage time, providing a comprehensive education to their children, choosing appropriate curriculum, assuming the role of a teacher, addressing negative attitudes of others about homeschooling, facing financial difficulties, and resolving socialization issues.

**Time management.** Parents are often concerned about homeschooling challenges related to time management. In a study about the motivations, instructional approaches, curriculum choices, and challenges of four homeschooling families, Anthony (2009) found that mothers who were homeschooling reported that they had to manage and balance the time they devoted to homeschooling and other commitments throughout each day. They also had to make sure their children were using their time wisely and completing the assignments the homeschooling cooperative required. They also had to find time for their other commitments outside the home. Most of the families reported they were worried that their children did not complete enough schoolwork because there were many interruptions to their instruction. The majority of homeschooling families also reported difficulties with scheduling and organizing the instructional day. They also reported difficulty keeping up with all of the household work they needed to do. In Rothermel's study (2011) of 100 British homeschooling families, parents also reported time management challenges, including time needed to plan lessons, choose curriculum, provide instruction to meet their children's individual learning needs, and sustain daily parental duties, such as housework and cooking.

**Comprehensive education.** Another challenge for homeschooling parents is to provide a comprehensive education for their children so that colleges and universities would accept them (Anthony, 2009; Finch, 2012; Rothermel, 2011). In a study on the academic achievement of homeschooling students, Cogan (2010) noted that the National Education Association reported that homeschooling students do not receive a

comprehensive education, which helps students to develop English language skills, critical thinking skills, citizenship, skills in the arts, healthy habits, caring for the environment, an appreciation for moral and aesthetic things, an appreciation for cultural and religious differences in others, and computational skills (p. 201). According to Cogan, this report led to the support of comprehensive education for homeschooling students by many homeschooling organizations. However, Cogan concluded that more research needs to be done on homeschooling student achievement and retention in colleges and universities in order to determine the effectiveness of this comprehensive education.

In a study of the experiences of homeschooling mothers, Finch (2012) noted that one of the mothers used an “unschooling” method. This meant her daughter was allowed to choose the direction of her learning throughout all of the grades. However, as her daughter completed college entry applications and examinations, this homeschooling mother used specific curricula to make sure her daughter received a comprehensive education that would support her acceptance into college.

In a dissertation case study of four homeschooling families, Anthony (2009) found that these parents were also concerned that their children might not have enough credits for college acceptance. These homeschooling parents expressed concern that their children were also missing out on opportunities, such as sports and foreign languages, that they would have experienced in public schools. They also worried that their children did not have the same social or classroom experiences of other high school students that

prepared them for college. Anthony found that families who were concerned about preparation for college and who wanted to make sure their children received a comprehensive education used a homeschooling cooperative. The cooperative helped them by providing an integrated curricula related to reading, writing, science, and social studies with reading as the primary focus. In addition, much of the curricula integrated content from the Bible. The cooperative also provided support for homeschooling parents by offering classes in reading, writing, science, and social studies. The cooperative, however, did not provide any instruction in mathematics. Homeschooling parents selected the curricula and classes they wanted their children to take and filled in the gaps by either teaching their children at home through self-selected curricula, online courses, or outside tutors or classes.

In a study of 100 British homeschooling families, Rothermel (2011) interviewed a mother and a father who could not agree on how to prepare their children for college. The father believed that they could not provide their children with a homeschooling education that would match the comprehensive education they would receive by completing advanced high school courses and their children would not receive enough credits to be accepted at a college or university. The mother, however, believed that she could provide their children with a comprehensive education. Rothermel concluded that homeschooling parents often differ on how to homeschool their children in terms of a comprehensive education.

**Curriculum choices.** An additional challenge that homeschooling families face is choosing appropriate curricula for homeschooling their children (Anthony, 2009; Hanna, 2012). In Anthony's (2009) study of four homeschooling families, parents desired curricula that provided a comprehensive and a liberal education for their children. Some homeschooling parents also wanted curricula that upheld their religious beliefs. Some families, however, were willing to use curricula that opposed their religious beliefs because they believed these materials provided a teaching opportunity to defend their faith and to help their children think critically. Homeschooling parents were also concerned about the plethora of choices they faced in selecting homeschooling curricula and whether or not they were choosing the best curricula to meet their children's individual needs. Therefore, they often turned to a homeschooling cooperative for help. Some parents turned to online classes for help.

In a related 10-year study of 250 homeschooling families in urban, rural, and suburban Pennsylvania, Hanna (2011) examined parents' choices of curricula, instruction, and materials. Hanna found that homeschooling parents face many choices when selecting curricula to meet the needs of their children, including Internet options. Hanna also noted that the cost of curricula and materials is a concern for many parents, and sometimes curricula is not available to homeschooling students because they are only published for schools. Hanna found many parents had a difficult time choosing appropriate mathematics and science curriculum to meet their children's needs in order to provide a comprehensive education in these content areas. Therefore, many parents

chose to borrow science and mathematics textbooks from neighboring school districts. Many parents, however, believed these public school textbooks were inadequate, and they were also afraid that the public school would gain too much control over their children's education through required district monitoring. Hanna's study is significant because it provides a deeper understanding of the challenges that homeschooling parents face in finding effective curricula. Homeschooling parents have access to numerous resources and curriculum. Homeschooling parents are often faced with difficult decisions when choosing the best curricula to meet each child's individual needs.

**Role of the teacher.** Another challenge that homeschooling parents believe they face is assuming the role of teachers for their children. In a study of four homeschooling families, Anthony (2009) found that parents reported that they often became frustrated with their children because they had to deal with teaching children of different ages, and they were responsible for motivating their children to work. Cynthia and Rachel, two homeschooling mothers in Anthony's study, often became frustrated because their children would distract each other from learning. Another mother in this study, Mary, had difficulty getting her son to follow a set schedule. Mary realized that her son was an independent learner who completed his work at his own pace and allowed him have more responsibility for his own learning. One of the children in the Smith family reported that the hardest thing about homeschooling was that his mother was his teacher. His parents also echoed that concern. The mother sometimes became frustrated when her children

were not working at the pace she wanted or doing what she wanted them to do.

Sometimes a power struggle erupted between the parents and the children.

Another family, the Harbor family, experienced some difficulty with their child, Matt. Matt did not want to abide by a set schedule that his mother had set up. Eventually the mother gave in and allowed him to work at his own pace. Matt's mother had previously been a teacher, and she admitted that it was hard for her to give up control of his schedule. Anthony (2009) concluded that being a parent-teacher is difficult. When a parent becomes frustrated with behavior or with the instructional process, there is no one to step in and take the place of the parent. This difficulty, according to Anthony, was prevalent among all of the four families he studied. Anthony concluded that, although homeschooling families faced many challenges, including conflict between parents and children, they still believed that homeschooling provided the best education for their children.

In Finch's (2012) study about the experiences of homeschooling mothers, these mothers found it difficult to balance the roles of a teacher and a parent. They discussed the frustrations of doing housework, disciplining their children, teaching their children, and making sure they completed their work. Instead of worrying about parenting, these mothers now worried about whether or not their children were learning everything they needed to know. These mothers reported that they had to learn to make time for themselves because their lives were consumed by parenting and teaching their children

all day. Finch concluded that balancing the roles of parenting and teaching is a challenge.

**Negative attitudes about homeschooling.** An additional challenge that homeschooling parents face is negative attitudes about homeschooling from family and friends. In an individual homeschooling narrative, Haugh (2014) believed that people were concerned that her child would look abnormal to others if he was homeschooled. However, Haugh did not let the perceived negative opinions of others affect her decision to homeschool. In a case study about the experiences of homeschooling mothers, Finch (2012) reported that one mother found it difficult to find friends who shared her experiences. She felt isolated because her friends were working. It took her a while to find other stay-at-home mothers like her. Another mother also felt isolated because community members were involved in public school activities, and she was not. Another mother felt isolated until her children became involved in local sports teams and church activities. Even though these mothers experienced social isolation and had to work hard to develop a sense of community, Finch found that many homeschooling families often feel isolated because their friends and family members do not support their decision to homeschool their children. Some of the mothers maintained a distant relationship with some of their family members because of their decision to homeschool. Some mothers did not receive support from their husbands. Two women stated that their husbands did not want them to homeschool at all, but they made the decision to homeschool against their husband's wishes.

In a discussion about the evolution of homeschooling, Davis (2011) stated that many homeschooling families have had to face family members, friends, and the members of their communities who disagreed with their decision to homeschool and who believed they were harming their children. These people believed that homeschooling was not the best way to teach children and that children learn best in a public school system with trained teachers. Davis added,

Homeschooling requires a great deal of work in deciding and developing curriculum, learning how to manage time, learning how to organize requirements and document everything, understanding the laws and regulations for homeschooling, ability to apply curriculum to the state standards, and designing curriculum that is both effective and engaging. For parents who do not have teaching backgrounds, homeschooling can be a daunting endeavor (p. 33).

Thus, Davis concluded that homeschooling parents often believe that family and friends do not understand how daunting an endeavor of homeschooling can be and are not supportive.

In other related research, Rothermel (2011) conducted interviews with 100 British homeschooling families and found that many parents of homeschooled British students felt disconnected from their communities because they had different religious beliefs and used different methods for instructing their children. Finch (2012) also found that a lack of support from family members was a particular challenge that homeschooling mothers reported. These mothers reported limited support from extended family members who

did not approve of their decision to homeschool. They also reported that some of their spouses were supportive of the notion of homeschooling, but did not help with the process of homeschooling. Half of the mothers reported feelings of isolation. The other half did not feel isolated because they were able to find homeschooling support groups or friends who homeschooled. Finch concluded that becoming involved in homeschooling support groups and having other homeschooling mothers as friends and confidants was an antidote for their feelings of isolation.

**Financial problems.** Financial issues are also a concern for some homeschooling parents. Some families were challenged to live on only one income. One mother in Kapitulik's (2011) study reported that she had to work part-time while homeschooling, and her husband worked two jobs to make ends meet. Hanna (2012) contended that purchasing homeschooling curricula could be very expensive and added, "For homeschoolers on limited budgets, the cost of materials and programs may appear cost prohibitive" (p. 613). In a study of 751 homeschooling families in South Carolina, Gustafson (2012) found that homeschooling families who completed the survey reported an above-average income for South Carolina. This finding was surprising, Gustafson noted, because homeschooling families rely on one income yet still continue to homeschool. Thus, these studies indicate that financial difficulties for homeschooling families often arise because most of these families only have one employed parent, but they still need to buy curricula materials, which public schools often provided free of charge.

**Socialization issues.** Another major challenge that homeschooling parents face concerns the social experiences of their children. In a homeschooling narrative of her own experiences with homeschooling her child, Haugh (2014) stated that she was worried about socialization. Haugh wondered if the playdates and meetings with other homeschooling families were enough to effectively socialize her child. In a study about historical and contemporary developments in home school education, Wilhelm and Firmin (2009) found that a common worry among homeschooling parents was the socialization of their children. In a study about the motivations, instructional and curriculum choices, and challenges of four homeschooling families, Anthony (2009) found that parents used homeschooling cooperatives to socialize their children, and they also engaged their children in sports activities and church activities. Their children attended classes in the homeschooling cooperatives, which allowed them to study and learn with other homeschooling children. Finch (2012), who studied the perspectives of six homeschooling mothers, found that three of them felt isolated from the community because their children did not attend the public school, and their children did not know or hear about many of the school-sponsored events. Mothers who did not feel isolated involved their children in homeschooling groups, local sports teams, and church activities. They also were involved in cooperatives, which helped socialize their children through participation in classes, field trips, and other organized events. These mothers reported that their children made friends, and their children also felt supported by other mothers in the cooperative. These studies indicate that socialization in homeschooling

communities occurs mainly through participation in groups, such as sports teams, cooperatives, homeschooling groups, classes outside of the home, and church groups.

Thus, homeschooling parents face a number of challenges. These challenges include managing their time, providing their children with a comprehensive homeschooled education, and making difficult curriculum choices. They also must assume the role of the teacher, address negative attitudes about homeschooling from friends and neighbors, resolve financial difficulties related to homeschooling expenses, and consider socialization issues for their children.

### **Homeschooling Instruction**

The studies on homeschooling instruction are limited. As Thomas and Pattison (2012) stated, “There is, however, a dearth of research about how parents actually go about home education on a day-to-day basis” (p. 142). Some current research about curricula and instruction for homeschooling students exists, but additional research needs to be conducted on specific instructional strategies that homeschooling parents use to teach the core academic subjects to their children, particularly in relation to reading and mathematics.

In significant research, Thomas and Pattison (2012) conducted three different studies about home education. The first study was conducted in 1992, when Thomas spent 1 week living with one homeschooling family in order to investigate individualized teaching in a home environment. Thomas found that the family taught their children using informal methods, such as discussion, which was often spontaneous. The second

study was conducted in 1994, when Thomas extended his research into a broader study of homeschooling instruction by examining 100 homeschooling families in Australia and the United Kingdom. Thomas found that parents used a wide variety of instructional strategies from highly structured to highly informal. One mother, who used unstructured methods, kept a journal of her child's day-to-day activities to show that her child learned in unplanned ways. Her daughter learned on a need-to-know basis, and her learning happened through everyday experiences. This mother reported that her child was able to understand mathematical concepts and performed at the same level as her peers. The third study was conducted in 2008 when Thomas and Pattison examined 27 homeschooling families who only used informal homeschooling methods, and they found that the children learned through discussion and inquiry. Parents reported that their children were curious about the world and how it works, and therefore, instruction was based on ordinary events that happened in their lives. Thomas and Pattison added,

Certainly home education covers a very wide range of styles from structured school type education through degrees of informality to a style of education which has no obvious shape at all [which includes] education without a timetable, a curriculum, written exercises, marking, testing or even explicit learning aims (p. 142).

Thomas and Pattison concluded that informal instruction is more effective for homeschooled students than formal instruction which relies on predetermined curricula and set schedules. Thomas and Pattison recommended that teachers provide more

opportunities for students to make decisions about what and how they learn. They also recommended that public school educators consider informal instruction as an effective method for improving student learning. Thomas and Pattison concluded that educators and researchers have often overlooked homeschooling instruction because it emphasizes the idea that learning happens effectively in many different ways. This study is significant because it indicates that informal home education often includes principles of learner-centered teaching, which allows students more choices in what and how they learn.

In an individual home schooling narrative, Haugh (2014) described the instructional strategies that she used to teach her son at home. At first, Haugh chose instructional methods that teachers in public schools used. Haugh also determined what her son would learn and when. However, Haugh quickly stopped this method when she saw that his desire to do the work waned, and he became frustrated. Haugh decided to allow her son to choose what he wanted to learn from then on. Haugh concluded that granting children independence in learning is a gift. This study is relevant because Weimer's (2013) research on learner-centered teaching also stresses the importance of allowing students freedom to choose what and how they want to learn.

In a study about the experiences of homeschooling mothers, Finch (2012) also found that homeschooling mothers allowed their children to choose what they wanted to learn and how they wanted to learn. These mothers considered themselves to be facilitators for their children's learning. If their children wanted to learn using a

workbook, they would help them use it. If their children wanted to learn through real-life experiences, such as going to the store or balancing a checkbook, these homeschooling mothers taught them using authentic situations. These mothers believed their children were more motivated to learn when they had some responsibility for how they learned. One mother stated,

I am not particularly hung up on labels and I am not particularly hung up on format. I am more going by my gut instincts and trying to attend to who each of my children is as a learner and whatever I find that nurtures them and sustains them that is where we will go. (pp. 119-120)

Some of the homeschooling mothers changed the curriculum if it was not working for their children. Some mothers did not use any curriculum, but waited for their children to express an interest in learning a particular subject and then they obtained the necessary materials. This study is important because these homeschooling mothers believed in their teaching role was to be facilitators in helping their children choose their learning experiences, which is also one of the premises of learner-centered teaching.

In a dissertation study about the gender and politics of homeschooling, Kapitulik (2011) examined religious and secular homeschooling families in the broader context of several social trends, including the economy, the safety and academic success of public school students, and the roles of women in the family structure. The first research question addressed how homeschooling families framed their commitment to homeschooling. Kapitulik found that homeschooling families framed their commitment

to homeschooling in relation to the following: (a) *precious childhood/intensive mothering*, which means that homeschooling mothers want to spend as much time as possible with their children, (b) *decline of the family*, which means that homeschooling families believe that homeschooling provides more time for families to be together, and (c) *moral decline*, which means that homeschooling parents believe that public schools cannot provide the moral education that homeschooling families can provide. The second research question concerned how homeschooling families see themselves in relation to other families. Religious homeschooling families in Kapitulik's study viewed homeschooling as something that they do, whereas secular homeschooling families viewed homeschooling as a part of their identity and who they are. The third research question was about the specific methods that homeschooling parents used to provide instruction to their children. Both religious and secular homeschooling families believed that mothers were the primary instructors in the home. Religious homeschooling families focused on structure, adult authority, and academics, while secular homeschooling families were more relaxed and child-centered in their teaching styles. Kapitulik found that religious homeschooling families used a high level of structure in their instruction. They focused on schedules and taught their children reading, writing, and mathematic skills through direct instruction. They wanted their children to learn the skills necessary to prepare them for life. Secular homeschooling families were more relaxed in their teaching style. These parents did not force their children to learn anything before their children were ready. One child did not learn to read until she was 9 years old, which the

parents believed was normal. The focus of the secular homeschooling families was on their children's love of learning and the development of self-esteem. Kapitulik added,

Interestingly, we have two groups of parents who adhere to a similar, but certainly not identical, model of childhood. They agree that schools are not a good option for their children, yet the religious parents think their kids need more structure and guidance, while the secular parents think they need less (p. 56).

Kapitulik concluded that secular homeschooling parents and religious homeschooling parents differed in how they used instructional strategies to teach their children. Secular homeschooling parents allowed their children more autonomy in their learning, while religious homeschooling parents did not believe that their children should determine what and how they learned. Instead, these parents organized and created their children's learning experiences. A fourth research question was about the possible outcomes of the homeschooling movement. Kapitulik believed that the homeschooling movement will not lead to social change because homeschooling parents chose to solve social problems by making a personal choice. Instead of fighting for the changes they believe should occur in public schools, they withdraw their children. This study is significant because gender and politics of homeschooling were found to impact instruction.

In a longitudinal study about homeschooling teaching methods, materials, and curricula, Hanna (2011) found that significant changes occurred in the instruction of homeschooling parents over a ten-year period from 1998 to 2008. Hanna found that homeschooling families increased their use of prepared curricula and textbooks and other

materials that they borrowed from their local public school districts. Some of the homeschooling families also increased their use of public libraries and their use of technology and the Internet to supplement their instruction, as well as their use of outside teachers or experts to help their children learn. They also increased their use of networking with other homeschooling parents in their communities in order to share materials and expertise. In addition, Hanna found that some homeschooling parents used a cooperative, where parent volunteers helped teach children in a school-like environment a few days a week. Students completed homework assigned through the cooperative, and parents supplemented this instruction by teaching other subjects at home. This study is relevant because it is one of the few studies that specifically examined how homeschooling parents used curricula, methods, and materials over a 10-year period.

In another significant study about homeschooling instruction, Anthony and Burroughs (2012) examined the daily operations of four homeschooling families who were involved in a homeschool cooperative, including their instructional activities. Anthony and Burroughs found that parents in the cooperative provided direct instruction to students through lecture and related discussion. These parents also required students to complete assignments at home. Some of these assignments involved hands-on activities, and some were written assignments. At home, parents helped their children with these assignments and also taught them additional subjects. Anthony and Burroughs also found that homeschooling parents provided explicit instruction in reading and writing. They read aloud to their children and then asked questions to check for comprehension. They

also required their children to learn content through memorization and provided one-on-one tutoring in subjects such as mathematics and English language arts. One family integrated the subjects together. For example, they taught a lesson in history and incorporated reading, mathematics, and science into the lesson. Some of the families supplemented their instruction with computer programs that the cooperative provided. The goal of these families was to teach their children responsibility for their learning. This research is significant because it provides an in-depth examination into the instructional strategies that a small sample of homeschooling parents who belonged to a cooperative used to instruct their children. These parents considered themselves as facilitators for their children's learning, which supports Weimer's (2013) learner-centered teaching model.

In another study related to homeschooling instruction, Anthony (2009) examined the motivations, instructional approaches, curriculum choices, and challenges that four homeschooling families face. These families were members of a homeschooling cooperative. Anthony found that the main instructional strategies that homeschooling families used were related to reading instruction and included tutoring, direct instruction, memorization, and questioning techniques. These families also used the resources of a homeschooling cooperative, other teachers outside of the cooperative, and videos to supplement their instruction. For example, one mother enlisted the services of a microbiologist to teach science to her children. These mothers also constantly changed curriculum and instruction to meet their children's individual learning needs.

In this same study, Anthony (2009) also described some of the instructional strategies and materials that homeschooling families used to teach their children mathematics. The Smith family included a daughter who attended middle school and an older son who attended high school. Mrs. Smith reported that she used workbooks, CDs, and the Internet to help her children learn mathematics. The instructional strategies were aligned to the mathematics curriculum that Mrs. Smith selected, which was chosen to meet the specific needs of her children. Her two children, therefore, used different mathematics curricular materials. Mrs. Smith also reported that she often changed the mathematics curriculum and instruction to maintain her children's interests in mathematics, which, she contended, was an important factor in effective homeschooling.

Another family, the Johnsons, reported using similar instructional strategies to teach mathematics. The Johnsons, who homeschooled four of their children, ages 16, 13, 8, and 6, first determined the mathematics objectives they wanted their children to learn, and they used workbooks, the Internet, educational corporations, and a homeschooling cooperative to teach their children. Their children learned mathematics through memorization, reading assignments, and one-on-one tutoring. One child attended a private educational corporation for additional help in mathematics. The Harbor family, who homeschooled two of their children, ages 10 and 16, taught mathematics to their children using a computer program. Their ten-year-old son learned prealgebra on his own using CD-ROM discs. His mother helped him with mathematical problems with which he had difficulty. He took quizzes after the tutorials on the CDs, and his mother

graded the quizzes. They also reviewed the problems he was unable to solve. The older son used CDs to learn geometry. The Harbors, like all of the homeschooling families in this study, wanted their children to be independent learners. The children in the Harbor family often completed their own work independently, and their mother helped them when needed. Another family, the Rileys, who homeschooled only their youngest child, age 15, did not provide formal instruction in mathematics at home. They allowed their child to learn mathematics on his own and helped him, if needed. Their child also received direct instruction in mathematics from other parents in a homeschooling cooperative and from a local private educational institution that offered mathematics instruction.

All of the families chose curricula to provide a broad, liberal education for their children that they believed was grounded in their religious beliefs. They taught their children specific skills to become independent learners. This study is particularly important because many of the instructional strategies that these homeschooling parents used to teach their children mathematics support learner-centered teaching, particularly in relation to student choice and helping their children to become independent, lifelong learners.

Thus, even though research on the instruction that homeschooling parents provide for their children is limited, researchers have found that homeschooling parents use a variety of instructional strategies from highly structured to highly unstructured to teach their children. Many of these instructional strategies are learner-centered because parents

allow their children to make decisions about how and what they learn, use hands-on and critical thinking activities to teach their children, differentiate instruction, and use formative assessments to meet their individual needs. Many homeschooling parents also use outside support, such as cooperatives that offer formal classes, prepared curricula, and online materials and instruction. However, additional research needs to be conducted on the effectiveness of these instructional strategies.

### **Academic Achievement of Homeschooled Students**

Homeschooling students often score high on standardized achievement tests. In this section, several significant studies will be analyzed that have been conducted on the academic achievement of homeschooling students in comparison to the academic achievement of students in traditional schools. This research is important to this study because it presents a picture, although somewhat limited, of the academic achievement of homeschooling students in the United States in relation to standardized achievement tests in mathematics and English language arts, which includes reading.

In an investigation into the academic achievement of homeschooled and traditionally-schooled students, Martin-Chang et al. (2011) conducted an experimental study that included two groups of students, 37 homeschooling students and 37 public school students, all between the ages of 5 and 10, who lived in either Nova Scotia or New Brunswick, Canada. The homeschooled group was further divided into two subgroups. The first subgroup included 25 students who were homeschooled using structured methods, which was a school-at-home approach that included a formal curriculum. The

second sub-group included 12 students who were homeschooled using an unstructured method, in which the parents rarely used formal curriculum and learning happened naturally throughout the day. Martin-Chang et al. compared the scores of these two groups of homeschooled students on the Woodcock-Johnson Test of Achievement with the scores of the 37 elementary school students enrolled in a public school. Martin-Chang et al. found that the structured homeschooled students scored higher than public school students on this achievement test, with unstructured homeschool students scoring the lowest of the three groups. Martin-Chang et al. concluded that structured homeschooling benefits their academic achievement because they receive differentiated instruction, smaller class size, and instruction based on reading and writing. Martin-Chang et al. suggested that homeschooling children be taught by a teacher who knows the material, instead of allowing learning to just happen throughout the day. This research is important because it shows that teacher guidance makes a difference in the homeschooling environment.

In other research about the achievement of homeschooled students, Snyder (2013) examined the SAT and ACT scores and the grade point averages of 408 students attending a Catholic university who had attended public schools, Catholic schools, or had been homeschooled. Snyder found that homeschooled students scored significantly higher on the SAT and ACT tests and had higher grade point averages than students in the public schools and the Catholic schools. Homeschooled juniors and seniors attending this Catholic university also scored significantly higher in their overall GPAs than the

juniors and seniors in the public and Catholic schools. Snyder concluded that homeschooling students are a valuable addition to universities and recommended that universities acknowledge that the preparation students receive at home is as viable as the preparation students receive in public schools.

In an analysis of the demographics of homeschooled students, Mackey et al. (2011) compared the scores of a regional sample of 130 homeschooled students to a national sample of non-homeschooled students. Mackey et al. found that the homeschooled students in Grades 1-12 outperformed non-homeschooled students in Grades 1-12 on the composite score as well as in reading, English language arts, mathematics, social studies, and science. Mackey et al. concluded that homeschooling families who participated in their study tended to be Caucasian, Christian, had both parents living in the home, and both parents were highly educated. These qualities match the Department of Education's list of factors that lead to academic success for students. Mackey et al. suggested that homeschooled students performed higher on standardized achievement tests than public school students for the same reasons. This study is important because it suggests that other reasons besides teaching practices could contribute to the academic success of homeschooled students.

In other earlier research, Barwegen et al. (2004) conducted a study to investigate the academic achievement of homeschooled and public school students and their perceptions of parent involvement. A total of 127 public school seniors in a suburban high school completed a survey about their perceptions of their parents' involvement in

their education. Barwegan et al. also sent a similar survey to the parents of these students and 23 parents completed the survey. Parent involvement included attending parent/teacher conferences, volunteering at the school, becoming members of the PTA, asking their children about school, and attending Back-to-School Night. Barwegan et al. then compared the ACT scores of students who had high perceptions of parent involvement with the ACT scores of homeschooled students. In addition, Barwegan et al. compared the ACT scores of students who had high perceptions of parent involvement with the ACT scores of students who had low perceptions of parent involvement. They also examined the academic achievement of students in the public school to the academic achievement of public school and homeschooled students at the national level. Barwegan et al. found no significant difference between the ACT scores of public school students who had a high perception of parental involvement and the ACT scores of homeschooled students. Students in public schools with a low perception of parental involvement scored the lowest on the ACT test. Barwegan et al. concluded that children whose parents are involved in their schooling have higher academic achievement, as evidenced by the ACT scores of children with perceived high parental involvement and homeschooled students. Barwegan et al. recommended that educators provide more opportunities for parent involvement and that parents should become as involved as possible in their children's education so their children are aware that they are concerned about their schooling. This study is important because findings demonstrate that parental

involvement is important in the academic achievement of both public school and homeschooled students.

In other related research about the achievement of homeschooled students, Cardinale (2013) conducted a multiple case dissertation study to determine the factors that contributed to the success of mathematically proficient homeschool graduates. Cardinale found that male students scored in the 700s on their SATs, and female students scored in the 600s, with the exception of one female student who scored in the 700s. All of the students had a positive attitude about their homeschooling experiences in mathematics. Cardinale reported that homeschooling parents focused on using a specific curriculum, such as Saxon, ABeka, Math-U-See, and the University of Chicago Student Math Project, to help their children achieve mastery of mathematical concepts. Some students used Chalk Dust, an online website that teaches mathematics using videos. Some parents used additional resources, such as outside tutors or teachers to help their children learn these concepts. When their children were younger, homeschooling parents reported that they taught their children mathematics using direct instruction, which often involved reading directly from the textbooks and working through the problems with their children. As their children grew older, parents reported that they taught them to become independent learners, and many students taught themselves mathematics. Some of the students stated that they enjoyed using the Saxon curriculum because it repeated mathematical concepts until mastery was achieved.

Students also reported that they enjoyed using the Math-U-See curriculum because it connected mathematics to real-world situations. Homeschooling parents also reported discussing with their children how mathematics connected to their lives in budgeting money, paying taxes, and selecting engineering as a career. Most of the student participants reported that mathematics was difficult and stressful to learn, but they felt confident when they scored high on standardized achievement tests and when they completed college courses after graduating from high school. Cardinale (2013) concluded that these homeschooling families used many effective instructional strategies, such as implementing challenging curriculum, teaching students to become autonomous, lifelong learners, providing direct instruction when needed, motivating their children to learn mathematics by encouraging mastery and maintaining positive attitudes toward mathematics, and engaging their children in conversations about mathematics. Cardinale recommended that researchers explore how homeschooled students learn and take ownership of their learning. This study is important because homeschooling parents used many learner-centered teaching strategies to help their children become lifelong learners and to develop positive attitudes toward mathematics.

In another similar study about the academic outcomes of homeschooled students, Cogan (2010) examined the ACT scores and the first and fourth year grade point average of 76 students enrolled at a university who had been homeschooled and compared these data to the ACT scores and the grade point average of non-homeschooled students at the same university. Cogan found that the homeschooled students had significantly higher

ACT scores and grade point average scores than students who had not been homeschooled. The four-year graduation rates and retention were similar for both groups. Cogan concluded that, because the number of homeschooling students has increased significantly in recent years, more research needs to be conducted on the academic achievement of homeschooling students.

In a homeschool progress report that examined academic achievement and demographics, Ray (2009) included over 11,000 homeschooled students from the United States, Puerto Rico, and Guam. Ray found that average scores of homeschooled students on the California Achievement Test, Iowa Tests of Basic Skills, and the Stanford Achievement Test for the 2007–2008 academic year was in the 80th percentile range in social studies, reading, English language arts, and mathematics, which was 34%-39% higher than the national norm. Ray also examined differences in scores among homeschooled students with varying backgrounds, including parent marital status, economic status, how long the students had been homeschooled, the types of curricula used, and student gender. Ray found that differences in scores of students with different backgrounds were slight, and all of the homeschooling students, no matter their background, scored above the national percentile. Ray (2009) concluded, “As the evidence accumulates, it only serves to further establish homeschooling as a valid and truly effective educational option” (p. 6). Ray suggested that because the number of homeschooling children continues to increase and the academic achievement of

homeschooling children is high, homeschooling needs to be a continually-researched topic.

In an earlier investigation into the academic achievements of homeschooled students in higher education, Wichers (2001) examined research that the Ohio Department of Education conducted about the academic achievement of homeschooled students in that state. Wichers found that homeschooling students in Ohio performed the same or better academically than traditionally-schooled students. Wichers also found that over 150 colleges in the United States were actively looking for homeschooled students to attend their schools because they believed that these students value learning, demonstrate a high level of reading comprehension, and are able to do research tasks. Wichers concluded that homeschooling students are not at a disadvantage concerning college entrance in relation to traditionally-schooled students. At first, Wicher believed that homeschooling students were at a disadvantage because their parents were not trained to be teachers. However, after examining the research, Wichers concluded that homeschooling students are academically proficient because there are many support groups to help homeschooling families and homeschooled students develop the learning skills necessary to be prepared for higher education.

Thus, these studies indicate that homeschooled students in the United States score consistently high on standardized achievement tests. They also tend to score higher than their counterparts in public schools or private religious schools. Many homeschooled students have also experienced success in their applications for entrance to college. This

research is relevant because it is important to understand the achievement of both public school students and homeschooled students. More research needs to be conducted about the achievement of homeschooling students by using measures other than standardized assessments.

### **Trends in Mathematics Instruction**

Trends in mathematics instruction in traditional classrooms in public schools sometimes influence the type of mathematics instruction that homeschooling parents provide for their children (Taylor-Hough, 2010). Therefore, this section includes an analysis of research about current trends in mathematics instruction that have moved away from lectures and rote memorization and incorporated hands-on activities, discussion, collaborative activities, and critical thinking activities to help students learn mathematical concepts. These contemporary approaches often mirror Weimer's (2013) research on learner-centered teaching.

In an examination of traditional and contemporary approaches to teaching mathematics to students, Zorica et al. (2012) conducted a review of current research about these two approaches to teaching mathematics. Zorica et al. found that, in the traditional approach, teachers use direct instruction, particularly lectures. The focus is on memorization and learning mathematical procedures, which includes repetition of concepts and working alone. Contemporary approaches encourage students to take responsibility for their own learning, collaborate with peers, engage in problem solving,

think deeply about mathematics, understand how mathematics applies to real-life situations, and work toward meeting goals in mathematics.

Zorica et al. (2012) also discussed the importance of developing mathematical literacy, which occurs when students know mathematical concepts and can use them in a variety of different situations to solve problems (p. 882). Zorica et al. concluded that traditional approaches are not effective and do not develop mathematical literacy. This study is significant because the contemporary approach to mathematics instruction supports a learner-centered teaching approach in which students are asked to take responsibility in their own learning, collaborate with others, think critically, and reach their goals.

In another study about current mathematics trends in instruction, Krawec, Huang, Montague, Kressler, and Melia de Alba (2012) examined the impact of cognitive strategy instruction on mathematical problem solving processes for middle school students with disabilities. Krawec et al. described a program called *Solve It!* that involves direct instruction about problem solving processes that students with disabilities use to solve problems in mathematics. Students with disabilities are taught seven cognitive processes to use when encountering mathematics problems. The seven processes include (a) to read for understanding, (b) paraphrase the mathematics problem in their own words, (c) visualize a picture or a diagram, (d) hypothesize a plan to solve the problem, (e) estimate to predict the answer, (f) compute the answer, and (g) check the answer. Teachers require students to ask themselves questions, instruct themselves, evaluate their

performance, and self-correct. Teachers provide time to practice, so students will learn to solve problems independently. Krawec, et al. collected data over a 2-year period. Forty schools in Florida were paired based on state assessment scores and the socioeconomic status of the students, as determined by free or reduced-priced lunches at the schools. The paired schools were randomly assigned to treatment and control groups. The first year of the study included a group of 24 Grade 8 teachers and 89 students, and the second year of the study included a group of 36 Grade 7 teachers and 111 students. Teachers attended a 3-day training session about a program called *Solve It!*, which was designed to help students identified with learning disabilities solve mathematics problems. Students were taught to read the mathematics problem, paraphrase the problem in their own words, visualize the problem, hypothesize about ways to solve the problem, and check their answers. Teachers taught this method to all students, but only the achievement of students who returned signed consent forms were analyzed. Students completed the Math Problem-Solving Assessment before and after the study.

Students in the treatment group performed better on the post-test assessment than students in the control group and used more problem solving strategies than the control group. Furthermore, the treatment group performed better on the post-test, regardless of ability level. Krawec et al. also compared achievement test results of students identified with learning disabilities with average-performing students in the schools and found that the *Solve It!* program worked equally well for both groups because all students improved their problem-solving skills on the posttest. Krawec et al. concluded that explicitly

teaching students how and when to use problem solving strategies in mathematics is an effective way of helping all students, regardless of ability level, to achieve success in mathematics.

In another study about current trends in mathematics instruction, Martin et al. (2015) examined the questioning strategies and mathematical tasks that teachers use to increase students' understanding of mathematics. Martin et al. observed mathematics instruction for two teachers from each grade level in one elementary school (K-5) in each of two school districts in the southeastern region of the United States in order to describe the questioning strategies and mathematical tasks that they used in the classroom. Teachers used a mathematics curriculum named Investigations. The questioning strategies that Martin et al. observed included asking open-ended questions to spur discussions, encouraging the use of problem solving strategies through discussions and modeling, allowing student-led discussions, asking higher level cognitive questions, and allowing students to justify their answers. The mathematical tasks that Martin et al. observed included solving difficult and complex problems, using manipulatives, drawing conclusions about mathematics, and developing an understanding of concepts. Martin et al. observed mathematics instruction for each teacher two times to determine if there was an increase in teachers' use of specific mathematical tasks and higher-level questioning strategies. Martin et al. found a slight increase in the second observations, but it was not statistically significant. Martin et al. concluded that students become more engaged in mathematics through discussions because they are able to think deeply about the content.

In these discussions, students also shared their ideas, questions, strategies to solve problems, procedures, and solutions. Teachers challenged students to explain and justify their answers, which also encouraged students to think deeply about the content. Martin et al. also concluded that teachers should use questioning techniques and mathematical tasks to teach mathematics. This study is important because Weimer's (2013) research on learner-centered teaching supports teacher use of instructional strategies such as higher-level thinking questions.

In an investigation into the influence of play on learning mathematical concepts, Ghanbari et al. (2011) included 50 female students in Grade 1 from Iran as participants. In this quasi-experimental study, students were divided into a control group and an experimental group. Students in both groups were administered a pre-test to determine students' understanding of addition and subtraction. The experimental group was taught mathematics using a fishing game to learn addition concepts and a basket game to learn subtraction concepts, and the control group was taught mathematics without the games. Ghanbari et al. found that students in the experimental group performed better on the posttest than students in the control group. Ghanbari et al. concluded that games can be an effective strategy for teaching mathematics concepts. This study is important because games are a part of the current trends in mathematical instruction that are used to increase student enjoyment in learning mathematics through play. The use of games can also develop thinking skills and creativity in students and are a visual way for students to learn mathematics.

In an investigation into using critical thinking and visualization strategies to solve word problems in mathematics, Abdullah et al. (2012) conducted a study in Malaysia that included 193 primary school students. In this quasi-experimental study, the experimental group was taught to use critical thinking processes, methodological problem-solving strategies, and visualization to solve word problems, while the control group was taught to memorize mathematical facts and formulas. All of the students were asked to complete pre- and post-tests, using a standardized achievement test and a mathematics test, which were revised and adapted from the *NWREL Mathematics Problem Solving Scoring Guide* (2000) and based on the research of Schommer-Aikins, Duell, and Hutter (2005). Abdullah et al. found a significant difference between the performance of the control group and the experimental group. Students in the experimental group performed higher on both of the tests than students in the control group. Abdullah et al. concluded that encouraging students to be actively involved in their learning by teaching them to visualize problems in mathematics and to think critically to solve problems is more effective than rote learning. This study is significant because learner-centered teaching focuses on critical thinking and teaching students to solve problems independently. By teaching students to visualize word problems, teachers give students a strategy to use that can help them to become independent learners.

In an investigation about the effects of constructivist instructional strategies on mathematics Grady, Watkins, and Montalvo (2012) conducted a study that included three groups of Grade 6 students in three different schools in Illinois. One group was taught

for 7 years using traditional instruction, which included learning a set of skills and practicing these skills over and over until proficiency was achieved. One group was taught for 7 years using traditional instruction, but through a supplemental program called Mountain Math, which included cyclical practice of mathematics skills. A third group was taught for 7 years using contemporary instruction, which included using a program called Everyday Mathematics, which was a computer program that allowed teachers to differentiate instruction to match students' individual learning needs. Grady et al. found no significant difference in the performance of the three groups on the Illinois Standards Achievement Test and concluded that traditional instruction which includes supplemental practice, advanced content, and ability grouping can be as effective as a constructivist approach. This study is important because homeschooling parents use a variety of instructional strategies and Grady et al. found that traditional, highly structured approaches may be as effective as a less structured, constructivist approach.

In another study about current trends in mathematics instruction, Lambic (2011) examined the effects of using software called the C++ builder to help students learn programming on a computer. The study included students ages 13-19. In their mathematics classes, students were taught to use a computer program to develop games, to find the circumference and surface of geometric shapes, and a computer calculator. At the end of the course, Lambic found that students enjoyed learning mathematics and were more motivated to learn mathematics. They also saw benefits to learning mathematics and the relevance of mathematics in daily life. When they worked in cooperative groups,

students were motivated to create games and use calculators on the computer. Teachers encouraged students to think critically and to ask questions about their mathematics problems, which helped students comprehend mathematical concepts. According to results of a pre-and post-study questionnaire, students reported more enthusiasm for learning mathematics after participating in the study. This research is significant because learner-centered teaching also supports the use of questions that engage students in thinking critically.

In an experimental study, Abbas (2016) examined the use of a developmental mathematics approach to improve higher-order thinking skills in primary school students. A total of 53 students participated in this study. These students were in fifth grade and attended the same elementary school. Abbas divided these students into a control group and an experimental group. Abbas designed a developmental mathematics program for the teacher in the experimental group to use. Students in both the control and the experimental groups were given pre- and post-tests, which included a problem-solving test, a creative thinking test, and a mathematics appreciation scale; however, only the experimental group was taught using the developmental mathematics program. This program, which lasted for 8 weeks, emphasized using problem-solving strategies, communicating with each other by using appropriate mathematical vocabulary and language, and learning about mathematics in real-world situations. The teacher's responsibility was to guide students in building upon their prior knowledge to learn new mathematical concepts independently. The posttest was administered to both the

experimental group and the control group. Abbas found that the experimental group scored significantly higher than the control group on the problem-solving test and the creative thinking test. In relation to the mathematics appreciation scale, Abbas found that students in the experimental group reported that they liked mathematics better than students in the control group and believed that they might pursue a specialization in mathematics in their future education and careers. Abbas concluded that developmental mathematics programs are effective in increasing student knowledge and understanding of mathematics and helping students understand the importance of mathematics in the world. This study is important because it supports the instructional practices of learner-centered teaching, including engaging students in real-world situations and meaningful discussions about mathematics. The role of the teacher as a guide who encourages students to become more independent learners also supports learner-centered teaching.

In summary, this research indicates some important trends in mathematics instruction that reflect Weimer's (2013) instructional practices related to learner-centered teaching. These instructional practices included engaging in hands-on activities, discussion, critical thinking, real-world activities, rigorous problem solving, playing games, and asking good questions. Teachers who use these learner-centered instructional practices help students to improve their understanding of mathematics.

### **Summary and Conclusions**

This chapter was a review of the research literature relevant to this study. This chapter included a description of the search strategies that I used to conduct the review

and a detailed explanation of the conceptual framework, which is based on Weimer's (2013) learner-centered teaching approach. The literature review included an analysis and synthesis of current research pertaining to the prevalence of homeschooling, reasons why parents choose to homeschool their children, the challenges that parents who decide to homeschool face, homeschooling instruction, the academic achievement of homeschooled students, and current trends in mathematics instruction in public schools that may influence homeschooling instruction in mathematics.

Several themes emerged from this literature review. The first theme is that parents choose to homeschool their children for religious and academic reasons. They desire to provide their children with a comprehensive education. They believe that this comprehensive education can be provided in the home environment, where the individual needs of their children can be met and where they can choose curricula and outside teachers and resources that meet these needs and that match the religious or secular beliefs and values of the family.

The second theme is that homeschooling parents face many challenges when they choose to educate their children at home. These challenges included managing time, providing a comprehensive education, making curriculum choices, assuming the role of a teacher, facing negative attitudes of family and friends about homeschooling, addressing financial difficulties, and resolving socialization issues for them and their children. However, homeschooling parents also reported that homeschooling cooperatives helped them tackle some of these challenges.

The third theme that emerged from the literature review is that homeschooling families used a wide range of instructional strategies, from highly structured to highly unstructured, to teach their children. In a structured approach, parents often use similar instructional strategies that teachers use in the public schools. They buy prepared curricula and present structured lessons during set schedules. In an unstructured approach, homeschooling parents give their children the freedom to learn by allowing them to choose the topics they are most interested in learning. Instead of providing direct instruction, parents act as facilitators to guide them in their learning. There are no set schedules and no formal lessons. Children learn throughout the day as they encounter new ideas. Both approaches can be effective in improving student learning, especially when used together.

The fourth theme is that current trends in mathematics instruction include the use of instructional strategies that are learner-centered, including project-based learning, problem-solving activities, cooperative learning, and direct instruction. The use of these strategies often results in improved test scores and motivation to learn mathematics. Both homeschooling parents and public school teachers use learner-centered teaching strategies to improve student learning. More research needs to be done, however, on how homeschooling parents used learner-centered strategies to teach their children mathematics and whether or not these instructional strategies are effective in improving their learning.

Several research gaps also emerged from this literature review. Little research was found about specific instructional strategies that homeschooling parents use to teach mathematics to their children. Little research was also found about the effectiveness of specific mathematics curricula that parents use to homeschool their children. In addition, little research was found about how power or control between the teacher and students in the homeschooling environment is balanced. In addition, little research was found about how homeschooled students learn mathematics in either a highly structured or a highly unstructured environment.

In Chapter 3, I will describe the research method that will be used to conduct this study. The research design and rationale, my role as the researcher, and the methodology in relation to participant selection, instrumentation, and procedures for data collection and data analysis will be presented. In addition, issues related to the trustworthiness of this research and ethical procedures used to conduct this study will be described.

## Chapter 3: Methodology

### **Introduction**

The purpose of this study was to explore how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching. The major concepts of learner-centered teaching include (a) the role of the teacher, (b) the balance of power in the instructional environment, (c) the function of content in the instructional environment, (d) the responsibility for learning, and (e) the purpose and processes of evaluation (Weimer, 2013). To accomplish that purpose, I collected data on the beliefs of homeschooling parents about mathematics instruction for their children and the instructional strategies that they used to teach their children mathematics. In addition, I reviewed documents related to homeschooling instruction.

Chapter 3 will include a description of the research method that I used to conduct this study. In this chapter, I will describe the research design and rationale; my role as the researcher; and the methodology, including participant selection, instrumentation, and procedures for data collection and analysis. In addition, I will describe issues of trustworthiness for this qualitative research and the ethical procedures that I followed while conducting this study.

### **Research Design and Rationale**

I developed the following research questions in relation to the conceptual framework and the literature review for this study.

### **Central Research Question**

How do the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching?

### **Related Research Questions**

1. What do homeschooling parents believe about mathematics instruction for their children?
2. What instructional strategies do homeschooling parents use to teach their children mathematics?
3. What do documents reveal about homeschool instruction in mathematics?

In this qualitative study, I used a single case study design. Yin (2014) defined a case study in two parts. First, Yin noted that a case study is an empirical inquiry that “investigates a contemporary phenomenon (the ‘case’) in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident” (p. 16). Second, Yin wrote that a case study inquiry

cope with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion, and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis. (p. 17)

Based on Yin’s definition, I chose a single case study design for several reasons. This design allows qualitative researchers to present a rich picture of the phenomenon or the

case, which for this study was mathematics instruction for K–12 students in a homeschool program affiliated with Faith Christian Schools, which is a private school located in a western state. Homeschooling parents provide this mathematics instruction in the real-world context of the home environment. In addition, because the boundaries between the phenomenon of mathematics instruction in this specific homeschool program and the context of the home environment are not clear, case study research provided me with an opportunity to explore these boundaries in-depth through the triangulation of multiple data sources.

I considered other qualitative research designs for this study, including phenomenology, grounded theory, and ethnography. Phenomenology is defined as a method of inquiry that focuses on the lived experiences of the participants in relation to a particular phenomenon (Creswell, 2009). The purpose of this study was not to examine the lived experiences of homeschooling parents or their children but to describe the instructional strategies that homeschooling parents use to teach their children mathematics and how that instruction reflects learner-centered teaching, so phenomenology was not appropriate for this study. Grounded theory is defined as using categories and themes that emerge from the data to develop a theory (Creswell, 2009). Since the purpose of this study was not to develop a theory about learner-centered teaching, grounded theory was not suitable. Ethnography is defined as a study that examines a cultural group in their natural setting over a long period of time (Creswell, 2009). The goal of this study was not to describe the culture of homeschooling families

over a long period of time though; consequently, ethnography was not a suitable research design.

Case study research was an appropriate qualitative research design for this study because it is “a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one or more individuals” (see Creswell, 2009, p. 13). Cases are also “bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time” (Creswell, 2009, p. 13). In this study, I explored the instructional strategies that homeschooling parents use to teach their children students mathematics and how the use of those strategies reflect Weimer’s learner-centered teaching model using multiple data collection procedures. This study was also bounded by time because I collected data over the time period of several months in the spring of 2017.

### **Role of the Researcher**

As a single researcher for this qualitative study, I assumed many roles. I was responsible for selecting the research design and method, determining how data were collected, selecting the participants, collecting the data, and analyzing and interpreting the data. In addition, I designed the instruments for data collection.

Because I was the only person responsible for all data collection and analysis in this study, the potential for bias existed. Even though I am a Grade 4 and 5 combination classroom teacher at the private school associated with this homeschool program, I am not a part of the homeschool program. I do not homeschool my own children, and I did

not have a personal or professional relationship with the participants in this study. I will address this potential for bias later in this chapter by describing strategies, such as reflexivity, that I used to improve the trustworthiness of this qualitative study.

## **Methodology**

### **Participant Selection**

The participants for this study included four homeschooling parents. I selected participants according to the following inclusion criteria: (a) participants must have had children enrolled in one of the four tracks of the homeschool program for students in Grades K–12 at Faith Christian Schools and (b) participants must have been parents who homeschooled their children in mathematics.

I selected participants using a purposeful sampling technique in order to obtain the richest data possible (see Merriam & Tisdell, 2016). The superintendent of Faith Christian Schools sent an invitational letter I created and a consent form to all qualifying parents inviting them to participate in this study. The first participants who returned a signed consent form to me in the enclosed stamped and self-addressed envelope were chosen to participate.

### **Instrumentation**

For data collection purposes in this study, I designed two instruments aligned with the research questions for this study (see Appendix G). In addition, I asked an expert panel of several colleagues with advanced degrees in education to review the instruments.

The expert panel checked for alignment with the research questions in order to improve the trustworthiness of this study.

### **Interview Protocol**

The first instrument that I designed was the interview protocol (see Appendix D). According to Merriam and Tisdell (2016), interviews for qualitative studies are less structured, include more open-ended questions, are exploratory, and allow the interviewees to “define the world in unique ways” (p. 110). I chose to use a semistructured format for these reasons. I created nine interview questions that were aligned with the research questions and used the same interview questions for all of the participants. I also asked probing questions when needed to obtain more in-depth responses from participants. I chose to include some background questions to gain more information about the homeschooling experiences of the parents, behavior questions to get an understanding of how homeschooling parents teach mathematics to their children, and opinion questions about the beliefs that homeschooling parents have about mathematics instruction for their children.

### **Reflective Journal**

The second instrument I used was an online reflective journal (see Appendix F). I designed this instrument to allow homeschooling parents to reflect about the five changes of instruction in learner-centered teaching, which include (a) the role of the teacher, (b) the balance of power in the instructional environment, (c) the function of content in the instructional environment, (d) the responsibility for learning, and (e) the purpose and

processes of evaluation (see Weimer, 2013). I sent these questions to parents via e-mail, and they were asked to respond by writing a paragraph response for each question.

### **Procedures for Recruitment, Participation, and Data Collection**

To conduct this single case study, I followed strict procedures for recruitment, participation, and collection of data. I also followed a data analysis plan. I will describe these procedures in the following subsections.

#### **Recruitment**

To begin the recruitment process, I first contacted the superintendent of Faith Christian Schools and the director of the homeschool program at this site to explain the purpose of my study. I obtained signed letters of cooperation from these individuals, indicating the willingness of Faith Christian Schools and the homeschool program to be my research partner (see Appendix A). I asked the director of the homeschool program to provide of a list of potential participants who met the inclusion criteria that I have presented. The superintendent of the Faith Christian Schools sent a letter of invitation and a consent form in a self-addressed, stamped envelope to each of the potential participants, inviting them to participate in this study.

#### **Participation**

For this study, I selected the first four homeschooling parents who returned signed consent forms to me in a self-addressed, stamped envelope. I contacted each participant by telephone to schedule the interviews in a public place in order to minimize

interruptions. At the end of each interview, I explained the data collection procedures for the reflective journal.

### **Data Collection**

I collected data from several sources. The first source was the individual interviews with homeschooling parents. At the beginning of the interviews, I provided homeschooling parents with a copy of the interview questions and gave them time to read the questions and think about their answers. The interviews were audio recorded and lasted approximately 30 to 45 minutes. At the end of the interview, I discussed the data collection procedure for the reflective journals and the completion time period for the reflective journals.

The second data source was the online reflective journal. After I explained the protocol for collecting this data with the participants, I sent an e-mail to them with the five reflective journal questions attached. I asked participants to complete their written reflective journal responses within 2 weeks and e-mail them to me.

The third data source was documents related to the homeschooling program that I collected from the homeschooling director. These documents included publications from Faith Christian Schools that described the four tracks and related homeschooling fees. In addition, I collected the most recent K–12 mathematics standards document for the region in the western United States because homeschooling parents follow these standards and may use curricula based on these standards. I also collected documents

from homeschooling parents related to the mathematics curricula, instructional strategies, and assessments that they use to teach their children mathematics.

### **Data Analysis Plan**

For this single case study, I analyzed data at two levels. At the first level, I analyzed the data from the interviews and reflective journals by using line-by-line coding that Charmaz (2006) recommended for qualitative research. The coded data were then categorized using the constant comparative method that Merriam and Tisdell (2016) recommended for qualitative research. I used content analysis to describe the purpose, structure, content, and use for each type of document (see Merriam & Tisdell, 2016). At the second level, I analyzed the data by examining all of the data sources to determine themes and the discrepant data that emerged. These themes formed the key findings or results of this study, and they were analyzed in relation to the research questions for this study and interpreted in relation to the literature review and the conceptual framework.

### **Issues of Trustworthiness**

The concept of trustworthiness, which is referred to as validity and reliability in quantitative research, is critical to qualitative research. Merriam and Tisdell (2016) stated,

Regardless of the type of research, validity and reliability are concerns that can be approached through careful attention to a study's conceptualization and the way in which the data are collected, analyzed, and interpreted, and the way in which the findings are presented (p. 238).

In other words, trustworthiness is important to qualitative research because it provides credibility, transferability, dependability, and confirmability for the findings. These four constructs are discussed in the following sections in relation to specific strategies that I used to improve the trustworthiness of this study.

### **Credibility**

Credibility is defined as how closely the research findings match the real world (Merriam & Tisdell, 2016). Qualitative researchers should use the following strategies to improve the credibility of a study: triangulation, member checks, adequate engagement in data collection, clarification of the researcher's position, and peer review (Merriam & Tisdell, 2016). For this study, I used the strategy of triangulation by comparing and contrasting multiple data sources, including interviews, and online reflective journals. I also used member checks to improve the credibility of this study by asking participants to review the tentative findings for their plausibility.

### **Dependability**

Dependability is the extent to which the findings of the study can be replicated (Merriam & Tisdell, 2016). It also refers to the consistency of the results and whether or not the same results can be repeated again (Merriam & Tisdell, 2016). Dependability is difficult to attain because human behavior changes constantly. Merriam and Tisdell (2016) noted,

That fact, however, does not discredit the results of the original or subsequent studies. Several interpretations of the same data can be made, and all stand until

directly contradicted by new evidence. So if the findings of a study are consistent with the data presented, the study can be considered dependable. (p. 252)

To ensure dependability, the following strategies should be considered: triangulation, member checks, and adequate engagement in data collection (Merriam & Tisdell, 2016).

I used the strategy of triangulation by collecting and analyzing multiple sources of data, including interviews and online reflective journals. I used the strategy of member checks by asking participants to review the tentative findings for their credibility. In addition, I collected data over several months in order to experience adequate engagement in the data collection process.

### **Transferability**

Transferability, or external validity, according to Merriam and Tisdell (2016), “is concerned with the extent to which the findings of one study can be applied to other situations” (p. 253). Merriam and Tisdell contended that transferability in qualitative studies occurs when a researcher makes sure there is enough descriptive data to allow another researcher to apply the same data in another situation. Strategies that qualitative researchers use to improve the transferability of qualitative research include highly, detailed, thick descriptions and variation or typicality in the sample. To improve the transferability of this single case study, I provided rich, detailed descriptions of the setting, the data collection process, and the data analysis process. In terms of the sample, I chose a sample of homeschooling parents that is representative of homeschooling parents in this western region of the United States.

### **Confirmability**

Confirmability is the objectivity of qualitative research. Merriam and Tisdell (2016) recommended that qualitative researchers use the strategy of reflexivity to improve the objectivity of their research. Merriam and Tisdell defined reflexivity as the ways in which the research processes affect the researcher and the ways in which the researcher affects the research processes (p. 249). To improve the objectivity of this study, I used the strategy of reflexivity by maintaining a researcher's journal during the data collection and analysis process. In that journal, I described my assumptions, biases, and dispositions about the study, as well as the research decisions that I made, so readers can understand how I reached my findings and conclusions.

### **Ethical Procedures**

The trustworthiness of qualitative research depends in large part on the ethics of the researcher. Both before and during the study, researchers need to support participants' right to privacy, informed consent, and their honest responses. The trustworthiness of a study also depends on how data is collected, analyzed, interpreted, and presented so that potential bias is reduced (Merriam & Tisdell, 2016).

To conduct this study, I followed specific ethical procedures. First, I sought approval to conduct this study from the Institutional Review Board (IRB) at Walden University. The IRB number is # 02-09-17-0064001. I also used pseudonyms to protect the privacy of each participant as well as the identity of the homeschool program, the school, and the state. In addition, I asked participants to sign consent forms, indicating

their willingness to participate in this study. I also scheduled interviews at times that fit the schedules of participants. All interviews were conducted in an office near the district office at Faith Christian School, which is a quiet place, to ensure fewer distractions and greater privacy.

I also used several strategies to properly collect and store the data. I audiotaped the interviews and used these audio tapes to transcribe and code the data. I printed the online journal reflections from the computer in order to code the data. All of these data were kept in a secure location in my home. Participants do not have access to data from the other participants in this study and are only granted access to their own data. After the dissertation is approved, I will maintain the data for 5 years as required by the university.

### **Summary**

In this chapter, I discussed the research method, including the research design, which is a single case study, and the rationale for this design as well as my role as the researcher. I based the central research question on the conceptual framework and the literature review for this study: How do the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching? In relation to the methodology, I aligned all of the data sources to the central and related research questions. Concerning data collection, I interviewed four homeschooling parents and collected online reflective journals, in which these homeschooling parents answered questions about their use of learner-centered instructional strategies in

mathematics. I also collected documents related to the K-12 homeschool program that is the single case for this study. In this chapter, I described the data analysis plan, issues of trustworthiness, and ethical procedures.

I included the results of this study in Chapter 4. This chapter will also include a description of the setting, the participants, and the data collection process that I used. I will describe the data analysis procedures that I used and the results of the study. In addition, I will discuss evidence of trustworthiness.

## Chapter 4: Results

### **Introduction**

The purpose of this study was to explore the instructional strategies of homeschooling parents and how they reflect learner-centered teaching. Learner-centered teaching includes (a) the role of the teacher, (b) the balance of power in the instructional environment, (c) the function of content in the instructional environment, (d) the responsibility for learning, and (e) the purpose and processes of evaluation (Weimer, 2013). I explored the relationship between the instructional strategies of homeschooling parents and learner-centered teaching by gathering data on the beliefs of homeschooling parents about mathematics instruction for their children and the instructional strategies that they use to teach their children mathematics. I also reviewed documents related to homeschooling instruction.

In this chapter, I will describe the results of my study. I will also provide the setting and demographics of my study, the data collection process, the data analysis, the trustworthiness of the study, and the results of the study. In addition, I will summarize the answers to my research questions.

### **Setting**

The homeschool program for this study is affiliated with the Faith Christian Schools, which is located in the western part of the United States. Tuition and donations from supporters fund this private school, which has been in existence for 46 years. Faith

Christian Schools enrolled 678 students in Grades K–12 for the 2016–2017 academic year.

The homeschool program employs a part-time homeschool director. In this program, families choose from four tracks based on how they want to homeschool their children. Homeschooling parents can choose one or more tracks, depending on the needs of their children. The first track is the Private Satellite Program, designed for homeschooled students in Grades K–8, in which parents teach their children at home using self-selected curricula. Homeschooling parents in this program attend five support meetings with the homeschooling director to discuss the students' work progress and monthly goals. In addition, for a fee, their children are allowed to take standardized tests at the school, which include the Terra Nova Test that is administered in the spring to students in Grades 1–5, the UC Berkeley Math Diagnostic Test that is administered in the fall and spring to students in Grade 5, the UC Berkeley Math Diagnostic Test that is administered in the fall and spring to students in Grades 6–8, and the Stanford Writing Assessment that is administered to students in Grades 6–8.

The second track allows homeschooled students in Grades K–5 to take classes at Faith Christian Schools for a fee. The third track is designed for high school students in Grades 9–12. In this track, homeschooling parents are asked to attend five support meetings and must meet with the homeschool director throughout the year to discuss curricular choices, course participation, goals, attendance records, and work portfolios. Homeschooling parents and their high school children are also allowed to select courses

at community colleges or other postsecondary options in this track, but these choices must be approved by the homeschool director and the program director in order to meet graduation requirements. This track also includes an opportunity for students in Grade 9–12 to take standardized tests for a fee, such as the UC Berkeley Math Diagnostic Test and the Stanford Writing Assessment. The director of the homeschool program maintains educational records for these students and provide resources to assist homeschooling parents. The fourth track is designed for homeschooled students in Grades 6–12 and allows them to attend classes at Faith Christian Middle School and Faith Christian High School for a fee.

My study consisted of three parts: interviews, reflective journals, and reviewing documents pertaining to mathematics instruction. I interviewed four participants in an office next to the district office of Faith Christian Schools. I chose this location because the office was vacant after 3:30 p.m. and, since the participants all used the homeschooling program through Faith Christian Schools, they already knew the office location. I conducted all of the interviews at 4:00 p.m., after school had ended. There were no personal or organizational conditions that influenced the participants or their experience at the time of the study.

### **Demographics**

I interviewed a total of four participants who all homeschooled their children using the homeschooling program through Faith Christian Schools. The first participant, who was called Jill (a pseudonym), was homeschooling one of her sons, who was in 12th

grade. The second participant, who was called Marie (a pseudonym), was homeschooling her son, a 10th grader. The third participant, who was called Betty (a pseudonym), was homeschooling three of her granddaughters in mathematics. Betty helped her daughter homeschool by teaching only the subject of mathematics. Her granddaughters were in 11th grade, 10th grade, and eighth grade. The fourth participant, who was called Cindy (a pseudonym), homeschooled her daughter, a sixth grader.

### **Data Collection**

Four participants participated in this study. I interviewed the four participants for 30–45 minutes in an office near the district office of Faith Christian Schools. I conducted the interviews in that office because it was a quiet place after school is dismissed, and it is near the district office, so the location could be easily located by the participants.

The participants also provided me with documents pertaining to their mathematics instruction. Before the interview, I asked them through an e-mail to bring any curricula, worksheets, assessments, or any other documents related to their instruction in mathematics. They each brought the textbooks they used, and some brought copies of assessments and worksheets they used.

Each participant also completed an online reflective journal. I asked them to complete the online reflective journal within 2 weeks of the interview, and I e-mailed them the link to the reflective journal, which was housed in Google Forms. After each participant completed the reflective journal, their responses were automatically recorded within Google Forms, where I accessed them from. I did not receive responses from two

participants within the original 2 week timeline, so I e-mailed the link to the reflective journal again and they responded immediately.

I conducted the interviews first. As each participant arrived in the office, we took a few minutes to formally introduce ourselves because we had previously solely communicated through phone conversations and/or e-mail. After that, I went through the introduction with them, as outlined in the Interview Guide (see Appendix D). Then, I allowed the participants time to read the interview questions to make sure they understood them. All of them stated that they understood the questions after reading them. Next, I turned on the recording device, which was a handheld voice recorder. The first interview with Jill lasted approximately 40 minutes, and the second interview with Marie lasted approximately 35 minutes. The third interview with Betty lasted approximately 20 minutes as did the fourth interview with Cindy. During the interviews, I asked the interview questions as laid out in the Interview Guide (see Appendix D) as well as additional follow-up questions pertaining to interview questions, if needed, to guide the interviewee to go deeper into detail.

I closed the interviews as outlined in the Interview Guide (see Appendix D). Then, I made copies of the documents provided by the participants at a copier machine in the office. One thing that did not go according to plan is that one of the participants, Jill, discussed the entire history of her homeschooling experience teaching mathematics with both of her children, instead of only focusing on the son that was currently in school. This gave a comprehensive viewpoint into her teaching experiences in mathematics.

One unusual circumstance I encountered in the data collection was that the superintendent of Faith Christian Schools sent a consent form to a homeschooling mother who then contacted me by e-mail to tell me that her mother actually taught her daughters mathematics. After a discussion with my committee about the proper way to proceed and with permission from the mother, I contacted the grandmother, Betty, and she agreed to participate in my study and signed the consent form.

### **Data Analysis**

After collecting the data, I transcribed the interviews and then labeled each line with a code, using line-by-line coding (see Charmaz, 2006). I then categorized the coded data using the constant comparative method (see Merriam & Tisdell, 2016). Finally, I organized the categories according to my research questions. The questions on the online reflective journal were related to the five key changes of instruction for learner-centered teaching (Weimer, 2013). I grouped the responses to the questions from all the participants together and separated them into the five key changes of instruction. The documents were analyzed according to the documents' purpose, structure, content, and use (see Merriam & Tisdell, 2016). I explained the content and structure of the documents and how the participants used the documents to instruct their children in mathematics. The responses to the interviews and reflective journals as well as the analysis of the documents were organized into major themes and analyzed according to the five key changes of instruction for learner-centered teaching (see Weimer, 2013).

Discrepant findings were analyzed and relayed within the context of the major themes and Weimer's five key changes of instruction for learner-centered teaching.

### **Issues of Trustworthiness**

Trustworthiness is important in qualitative research. In order for the findings in my study to be accurate my study must provide credibility, transferability, dependability, and confirmability for the findings. In the following subsections, I will discuss the steps I took to ensure the credibility, transferability, dependability, and confirmability of the findings of my study.

#### **Credibility**

I used the strategy of triangulation by comparing and contrasting multiple data sources. I interviewed the participants, collected online reflective journals, and collected documents pertaining to homeschooling instruction. I also used member checks and asked the participants to review the tentative findings of my study to examine their plausibility. I e-mailed the transcripts of the interview to each participant, respectively, to read. I asked them to only respond if they found any discrepancies between what they said and the transcripts. I received one response from Cindy stating that she believed everything was correct. The rest of the participants did not respond.

#### **Dependability**

I took many steps to increase the dependability of my findings. I used the strategy of triangulation by collecting and analyzing interviews, online reflective journals, and documents. I also used the strategy of member checks by asking the participants to

review the findings of my study. Finally, I experienced adequate engagement in the process of collecting data because I collected data over several months.

### **Transferability**

In order to ensure transferability, I ensured there were enough descriptive data so other researchers could apply my data to another situation. I improved the transferability of my research by including detailed, thick descriptions. I also had a little variation or typicality in the sample. Some of the homeschooling parents taught high school students, others taught middle school students, and they were all a representation of homeschooling parents in this western region of the United States. I also provided rich, thick descriptions of the setting, the data collection process, and the data analysis process.

### **Confirmability**

I took some steps to increase the confirmability of my study. To improve the objectivity of this study, I used the strategy of reflexivity. I maintained a researcher's journal and wrote notes about my thoughts during the data collection and data analysis process. I described my assumptions, biases, and dispositions about the study. I also wrote about my research decisions, so readers can understand how I came to my conclusions and findings.

## **Results**

### **Research Question 1**

With Research Question 1 I asked: What do homeschooling parents believe about mathematics instruction for their children? The participants shared similar beliefs about

how to teach their children mathematics. Most believed that mathematics instruction should be fun and interesting, relevant to their children's lives, based on curriculum, differentiated, include memorization, include both formal and informal assessments, motivate students, require mastery of the material, and include critical-thinking activities. The participants also believed that their children should have limited choice and that instruction should be teacher-driven. Although most of the beliefs and practices of the participants were similar, there were a few differences.

**Fun and interesting.** Some of the parents believed that curriculum and instruction should be fun and match the interests of the students. Jill stated that the curriculum she chose needed to be fun, or otherwise her children would not have liked it. When she began teaching her children mathematics, she taught using a curriculum called Math-U-See, which contained manipulatives like place value blocks and bricks that resembled Lego. Jill's two boys loved the Legos and played with them even when they were not doing math lessons. Then, as the boys became older, they told Jill that they were getting tired of Math-U-See and it was too childish. She looked at a variety of curricula, including Saxon. However, her sons thought it was too dry. Jill wrote in her reflective journal, "It had to be something engaging for my boys, hands on or something visual." Jill found an online curricula called Teaching Textbooks and her sons agreed that they wanted to use this curriculum. For their math lessons, the boys go on the computer and watch the lessons. Then they do the mathematics practice online. When they pass the mathematics practice and tests, they move on to the next level. The boys

loved the program because they were able to use technology and they also loved the graphics on the program. There are little characters that pop up when the children get the answers right or wrong. Jill often heard the boys laughing from the other room as they were doing their lessons and they would tell Jill to come see the new characters that popped up. She recalled,

I wasn't always in there, but I could hear them giggling and laughing because of what the little thing would do when they got the problem right or wrong and they would be like, 'Mom, come and look at this one!' I'd be like, 'Ok, Ok.' So they would have fun doing it. I mean, they would do it wrong, just so they could see what it did. Actually, a couple of times they would do all of it to see what the little thing would pop up, to see what the little thing would be.

Her sons both loved the online curriculum because it matched their interests.

Both Jill and Cindy also used games and activities to teach their children. Jill bought educational games for her sons to use to learn mathematics. Cindy used games to help her daughter memorize math facts. Her daughter also had a mathematics app she played.

Cindy stated that her daughter liked that the curriculum Cindy chose. They used a curriculum named Purposeful Design. The curriculum had colorful pictures. She also said her daughter liked that the information and problems were spread out on each page. It does not have an overwhelming amount of text on each page.

Cindy also believed that mathematics becomes fun when it is connected to real-world situations. She contended, “I think it does help when you find real-world situations that it’s going to apply to and show them that it’s not just a bunch of memorizing facts but that it does matter and it can be fun.” She tried to connect mathematics to real-world situations whenever she could, as did Marie. Marie and Cindy made sure the word problems, especially, were personal. They changed the word problems to match their child’s interests and activities. Marie often connected mathematics to soccer because her child loved soccer. Cindy changed the names and situations of the characters in the word problems to names and situations her daughter encountered in real life.

Betty believed learning should be fun. However she believed that her granddaughters loved mathematics because they got to go to their grandmother’s house to learn it. She stated, “...I just teach one-to-one, so it can be really personal. I like that and they like that. As far as I can tell, they have all enjoyed going to Grandma’s house for math.” While she does not connect mathematics to her grandchildren’s interests, the girls are all interested in learning mathematics because they get to spend some quality time with their grandmother.

**Relevant.** Marie, Jill, and Cindy tried to make mathematics relevant to their children’s lives. Marie’s son enjoys soccer and, since he is learning geometry this year, she tied in the mathematic problems to soccer. For example, he might tackle problems in which he has to measure the field or calculate how high the ball goes. Marie also mentioned that she wants to take her son to an amusement park to look at the way roller

coasters work and study mathematical concepts, such as velocity. The high schoolers at Faith Christian Schools go on a field trip to a local amusement park, but Marie and her son were not able to join them because they were out of town. She wants to take her son there when she gets the chance. She also talked a bit about how she motivated her son to learn by telling him that mathematics is important to learn so that he can play soccer in the future. She stated,

I have told my son, he would love to become a professional soccer player...he's good. I tell him that in order for him to fulfill that dream, aside from God opening doors for him, he needs to be good in math and English. Those are core subjects that he must be good at. And if he doesn't he will not be able to get into college. It doesn't matter how good of a student you are, I'm sorry, of an athlete you are because you don't have the skills to move forward. God has given you the ability to move forward, but if you're not good in communicating and you're not good in math, you won't be able to pass the exams. So, that's the motivation for him.

She tries to keep him motivated to do math by connecting it to his interest, which is soccer.

Jill and Cindy tried to connect mathematics to their children's lives by creating meaningful experiences for their children. Both Jill and Cindy used real-world experiences to help their children further understand mathematics. Jill took her children to the grocery store and they practiced adding and subtracting in a real-world situation.

Cindy cooked with her child and they learned about fractions. Cindy also would change names and situations in word problems to match her daughter's life.

**Curriculum-based.** The curriculum was the key component to the mathematic programs in all of the families. When her children were younger, Jill taught from the curriculum and used the Lego-like manipulative blocks provided in the curriculum. She did not use any supplemental materials, except games to teach memorization of math facts. When her kids became older and she switched the curriculum to the online curriculum, her sons learned through the computer without any supplemental materials.

Betty taught solely from the curriculum. She went through the textbook with all of her granddaughters and used the assessments included in the curriculum. She also used the videos that were included in the curriculum to help teach the lessons. She stated that she did not use any supplemental games or manipulatives, although she did use some manipulatives when her grandchildren were younger that resembled Cuisenaire Rods. Betty, however, did adjust the curriculum sometimes. She said, "Well, I have adjusted a number of things in this curriculum that he (the author) teaches that I think are unnecessary, or he teaches something too long or that I just don't like or am not comfortable with. And so I just do it my own way." She contended that the author of the curriculum includes things that are "interesting from a mathematical point of view, but are not terribly helpful if you're trying to learn the process." She changed the lessons to what she believed helped her grandchildren learn mathematical processes the easiest.

Cindy also followed the curriculum exactly, except she would sometimes skip a unit if she thought her daughter was not ready for it. She would return to it at a later time. She said that she did not use any of the manipulatives provided with the curriculum and supplemented only with a few games to learn multiplication facts and one app that her daughter used for a little while. She taught from the curriculum, but did not teach word-for-word from the scripted lessons. She stated,

I use the book as more as a prompt, as I need it, but I don't go word-for-word unless I don't understand it myself. And she (Cindy's daughter) does not often understand it if I just read it. I have to explain it more and she likes diagrams, so I have to draw it out and then she understands it better."

Cindy used the curriculum, but added diagrams and drawings, if her child didn't understand the material contained in the textbook.

Marie was the only one who frequently used supplemental textbooks and a website to help her child. She was teaching geometry and she had two supplemental books to help her son further understand the concepts. She also utilized Khan Academy, which is a website that provides lesson videos to teach various concepts. She used the curriculum, but she included a lot of supplemental materials to help her son understand geometry.

**Differentiated.** Some of the participants differentiated their instruction to meet their children's needs. Jill and Betty both stated that children all learn differently. Jill

allowed her sons to drive the decision to change the curriculum and they had choice about the type of curriculum Jill ultimately chose. Jill stated,

See that's what's so good about homeschooling and I've done it with other curriculum, not math, but it didn't work for them so we dropped it, sold it, and started another one. In the middle of the school year. That's what was so cool being able to do that for them.

Betty realized that all of her grandchildren learned differently and she did state that she did listen to input from her grandchildren about the instruction of mathematics. She did not, however, did not reveal that she differentiated her instruction much for her grandchildren. One of her grandchildren was bored with the mathematics videos that came with the curriculum. Betty still had her granddaughter watch the videos. She did not change the lessons or the length of the lessons. She said she simply motivated her grandchildren to learn by her own enthusiasm for the subject of mathematics. She did change the amount of videos she showed to each consecutive grandchild because she learned after the oldest granddaughter that she did not like all the videos so she lessened the videos for the next grandchildren. Also, when one of her granddaughters did not understand a concept, she went back and retaught the concept. She said that she went back and taught either a little slower or taught the concept a little differently. When deciding how to help each of her granddaughters, she stated, "...I just do it by feel." She taught her granddaughters slightly differently, if they did not understand a concept.

Marie, when she began to homeschool, took a seven-week course about how to determine her child's learning style.

I would say that when I first begun to homeschool, I took a seven-week course that taught me to analyze my child. There are different ways of teaching and I have to decipher, I have to learn through watching him perform, what is the best way to teach him? So, having done that, I realized his skills are audio.

She found through this course and through watching her son that he learned primarily through auditory means. When asked what she believes about adjusting mathematics instruction to meet the individual learning needs of K-12 students, she stated,

I think it's essential. It's worthless to just keep on presenting them with material that they do not understand. So I would rather see my son just finish two years of high school math, but it's something that he understood. Having three years, four years and you didn't really comprehend it, it's worthless. So, less is more, in that regard. So, definitely adjust it what they need to have.

Marie believed that homeschooling is wonderful because she can meet her child's individual needs. Cindy knew that her daughter is a visual learner and so she uses a lot of diagrams and pictures to explain mathematics concepts. She agreed that it is important to teach to her daughter's ability and learning style. Also, if her daughter did not understand a concept or, if she believed that she was not ready to learn a concept, she would skip that particular chapter and return to it when she felt her daughter was ready.

The participants moved at the pace of their children. When their children did not understand, they would slow down the instruction or skip a section and come back to it later. If their children did not pass an assessment, the participants would reteach and retest. The participants enjoyed homeschooling because they can teach exactly the way their children learn. Marie said, “So, for me homeschooling beautiful because I will move at the pace my son is at. I know that will be very difficult in a public setting because you want everyone to learn.” When Jill realized her sons were too old for the old curriculum she decided to change curriculum. Cindy, when her daughter doesn’t understand something, she sometimes skips it and moves on. Then, she comes back to it. She stated,

Yes, we usually go back and do the chapter unit again and I go back and reteach anything that I see she didn’t do well. So, if she gets below a C on the unit test, I usually, we redo whatever she didn’t understand and then I retest her since they (the curricula) have a second test.

Cindy and Marie both used other teachers to help teach their children. Cindy sometimes asked her husband or one of her older sons to teach the mathematics lesson to her daughter. She stated, “...or sometimes I let her dad teach it because he has a different way of doing it or one of her brothers. That’s helpful. Sometimes a different teacher makes a difference.” Cindy believed that other teachers could provide a new set of eyes and mouths to see a different way her daughter can learn and teach it in a different way than Cindy. Marie believed that Khan Academy was a good resource because another

teacher taught the same lesson in a different way than Marie or showed her son how to work out the problem in a different way than Marie could. By having another teacher, Cindy and Marie were better able to differentiate the lessons to meet their children's needs.

**Include memorization.** The participants believed that some memorization in mathematics is important. Marie stated,

So I believe that even though it (math) may not be something that you might use in life, it is a core subject that you must learn. Having said that, I believe math is almost like a language that you must memorize the fundamentals in order to build. It's like building blocks. There are things you must memorize in order to do the sequence that math requires you to do.

The participants made sure that their children memorized their math facts through a variety of games. Cindy and Jill bought games to help their children memorize math facts. Betty believed mathematics should be fun, but there should also be memorization. She said,

Well, I believe it should be fun. I think hands-on is really important in the younger ages. We used counting rods and hands-on stuff. But I think one has to memorize the mathematical facts and that is pretty much by rote, the adding, subtracting, multiplication, division, and then a lot of techniques one has to memorize.”

Betty contended that math facts, as well as algorithms and rules of mathematics, should be memorized.

**Include formal and informal assessments.** The participants believed in utilizing both formal and informal assessments to check for understanding. Betty used both formal and informal assessments. She stated,

Well, there are paper tests at the end of each chapter, but I find by sitting with them, I can tell whether they are getting it or not and if they don't seem to be getting it, then we go over something.

She gave the tests in the curriculum, along with quizzes to check for memorization. She also checked her grandchildren's assignments daily and sat with them daily while they did these assignments so that she could check constantly for understanding. Jill gave paper and pencil tests when her children were younger. These were included in the Math-U-See curriculum or Jill typed the tests. When they changed to the Teaching Textbooks curriculum, her sons had to pass a test to move to the next lesson and the tests were online. In the curriculum called Purposeful Design, Cindy said that there were chapter reviews in the book and online tests. She had her daughter do both the chapter reviews and the online tests and then averages the grades together. She said that she also used the daily assignments. Marie's son completed the quizzes and tests in the textbook. She also had her son take the Berkeley Diagnostic Test. He took the math and English standardized assessments through Faith Christian Schools. She, like the other participants, also checked for understanding during the daily assignments. She wrote in

her reflective journal, “The instructional strategies I used are as follows: visual representation (through Khan Academy), thinking aloud, understanding the problem, and frequently analyzing his learning abilities.” Marie made sure she was constantly checking for her son’s understanding through all of these methods, along with quizzes and tests.

**Motivate students.** The participants believed that their children should be motivated to appreciate mathematics and should have a positive attitude about learning mathematics. Betty believed that her love of math helped increase her grandchildren’s motivation and helped improve their attitudes about mathematics. She stated,

Well, for me, I love mathematics. I think it’s a lot of fun. I have a favorite quote by Pascal. ‘Mathematics is...’ You’ve probably heard of it. ‘Mathematics is the language that God wrote the universe in.’ So, I think my interest in it and my delight in it comes across and they pick it up.

Betty loved teaching her grandchildren and she considered math time a fun time to be together and spend time with her grandchildren. Betty mentioned that one of her grandchildren was a little distant sometimes while Betty was teaching her. She thought that it was because she was more of a perfectionist and got a little upset when she did not get all of the answers correct. Betty just kept on encouraging her and telling her that she could do it.

Jill believed that her children were motivated to do mathematics when it was fun. Her boys were attracted to Math-U-See because they loved the Lego-like bricks. Her

sons played with the Legos even when they were not learning math. When her children grew out of Math-U-See and began Teaching Textbooks, they liked it because they got to use technology and they also liked the little characters that popped out when they got the answers right or wrong.

Cindy motivated her child to do her mathematics by using real-world problems and adjusting her daughter's workload. She stated, "I think it does help when you find real-world situations that it's (mathematics) going to apply to and show them that it's not just a bunch of memorizing facts but that it does matter and it can be fun." She desired to motivate her daughter by including real-world problems in her daughter's mathematics assignments and by making mathematics apply to her daughter's life. She also adjusted the amount of problems her daughter had to complete in her math lessons. For example, Cindy may say that if she gets the first three right, she will only have to do every other problem on the rest of the page.

Marie believed in motivating her child to learn mathematics by providing incentives and reminding him how important learning mathematics is. She said,

I have told my son, he would love to become a professional soccer player...he's good. I tell him that in order for him to fulfill that dream, aside from God opening doors for him, he needs to be good in math and English. Those are core subjects that he must be good at. And if he doesn't he will not be able to get into college. It doesn't matter how good of a student you are, I'm sorry, of an athlete you are because you don't have the skills to move forward. God has given you

the ability to move forward, but if you're not good in communicating and you're not good in math, you won't be able to pass the exams. So, that's the motivation for him.

Marie also talked to her son about the importance of attending college in order to fulfill his dream to be a soccer player. She recently took him to visit a college. Her son got to stay in the dorms and he really liked the college. She told her son that if he really wants to go to the college, he can if he gets good grades. In addition, she motivated him by taking him on trips as rewards for maintaining good grades. She will be taking him to see a soccer team called Manchester United play and she also will be taking him to Mexico for 2 weeks. Further, she motivated her son by giving her son some choice. He has to do mathematics every day, but he can choose when during the day he does it. She also taught mathematics during everyday activities.

**Require mastery.** All of the participants encouraged their children to master certain concepts in the units before moving on to the next unit. In Teaching Textbooks, Jill's children had to pass the assignments and assessments, mastering the concepts, before they could move to the next lessons. If Jill was not satisfied with her boys' scores on assessments, she reviewed the material and had them retake the assessments. Marie, who taught a geometry curriculum from Bob Jones University, stated,

...one of the things I liked about the book is that it tells you this is what you must know now in order to move to the next lesson. It is like a prerequisite. You must

know this to move to this...Having said that, when you master this, you should be able to go to that.

Marie also said, "...we don't always have the luxury to teach at the pace the student will learn, but it's more important for them to fully comprehend before we move forward."

Marie made sure her son thoroughly understood each mathematics concept before moving to the next one. Khan Academy, in order to pass a section, students must pass either three or four lessons consecutively, according to Marie. Marie will not move to the next topic until her son has mastered the past topics. She also made sure her son corrected any mistakes on assessments so he can learn from his mistakes. She would go back to a lesson and reteach it. Cindy and Betty, if the children did not understand the material, as evidenced on the assessments and the daily assignments, went back and retaught the material until mastery. Betty, if she saw one of her grandchildren was struggling to understand a concept, printed out extra worksheets from the curriculum. She said it didn't happen often, but she gave the girls extra work, if needed.

Cindy differed from the other participants a bit. Cindy sometimes went back and retaught the lesson. Other times, if she decided that her daughter was not developmentally ready to understand a concept, skipped the lesson or unit and returned to it later. None of the other participants stated that they skipped lessons. They followed the lessons in the textbooks as they were laid out.

**Include critical thinking activities.** Some of the participants mentioned the importance of critical-thinking activities. Marie wrote in her reflective journal, "My role

as a mathematics teacher to (my son) is to nurture his critical-thinking abilities by fully understanding math concepts and to prepare him for SATs and college entrance exams.” Marie believed that math helped her son expand his critical thinking abilities. Cindy said that her curriculum includes critical-thinking, real-world mathematics problems. She said that when her daughter was younger, it was difficult for her to find the answers to these problems, but she is getting older and she can now think more abstractly. Sometimes, her daughter got the correct answers on these problems, but she could not explain how she came to that conclusion or why that particular answer was correct. The other participants’ curricula did have word problems, which required their children to think critically about mathematics, however, Marie and Cindy specifically discussed that they saw critical-thinking activities as an important component to include when teaching mathematics.

**Allow limited student choice.** Some of the participants revealed that they allowed their children to make choices in their learning. Marie and Jill allowed their sons to help choose the curriculum. While all participants tried to do mathematics every day, Marie allowed her son to choose the time at which he wanted to complete mathematics. Jill, if she realized her son was frustrated by math for the day, allowed her son to take a break for a while and come back to it when he was ready. Cindy also gave her daughter a break when needed, and sometimes she stopped the lesson altogether and came back when her child was ready. While the participants allowed some choice, all of the participants required their children to complete mathematics every day and the teachers

made the decisions about the lessons their children did. Betty made hardly any adjustments to her teaching for her granddaughters and she did not allow her granddaughters any choice in what they learned. The other participants allowed very limited choice.

**Have teacher-driven instruction.** The participants all believed that the balance of power in the teaching of mathematics should be in favor of the teacher. All of the participants believed the teacher is in charge of the learning experience. While some of the children had choice over when they did mathematics in the day, the children did not have any choice over what they learned. The teacher made all the decisions. Jill allowed her children to help choose the curriculum, but she ultimately made the final decision about the curriculum that was chosen. The rest of the participants chose the curriculum for the students. The participants chose the lessons the students needed to learn each day. The parents also made the decisions about whether the students needed to retake any assessments and the pacing when moving through the lessons and units. When the students became frustrated or did not understand a concept, the teachers decided the course of action to take, whether to take a break and resume again another time, whether to skip a particular unit, or whether to reteach the content.

All of the participants took an active role in their children's learning. Some of the participants sat with their children every day while they did their assignments, while others did that when they were younger, but gradually allowed their children more autonomy as they aged. Jill wrote in her reflective journal,

When they were younger, I went over the lessons with them individually. As they got older and more responsible, I just assigned them the lessons they had to get done each day/week. I would check over their work each night to see how they did and if they did not do a good job on the lessons, they had to do it again the next day, and this time with me.

Jill also wrote that she kept control over her children's learning, no matter their age. She allowed them some input into the curriculum they used, but she had the final say. Marie wrote in her reflective journal, "I share leadership in the classroom with my son and I encourage autonomy. In this manner, (he) is responsible to learn on his own." Marie taught her son the lessons, but he was responsible for reviewing the lessons the night before. She also used Khan Academy to help with the teaching of the lessons.

Cindy described herself as the primary teacher. In her Reflective journal, she saw herself as "A teacher of new concepts and as a manager of making sure practice is given to master what is taught." She also described herself as her daughter's encourager as she is learning mathematics. Further, she wrote, "I am directing what is being taught, but I am observing if she is ready to learn a concept and adjusting to her feedback and needs."

Cindy saw herself as a guide, as well. She stated,

I would say it more leads towards me guiding it, but we do end up doing a lot of lessons kind of together. She will tell me. She will say, 'I can do this on my own,' and other times she wants to talk it through with me."

Cindy teaches the lesson each day, and then her daughter completes practice problems on her own, for the most part. Betty also saw herself as the primary teacher. She wrote in her reflective journal,

My role is to teach the basic facts and tools of mathematics and to impart a love for mathematics to my grandchildren. I am in charge of the lesson and content, but I am open to special interests and questions of my students. We take as long as necessary to cover the lesson for the day. There are lots of smiles and laughter as we work together.

Like Cindy, Betty sat with her granddaughters while doing the lesson and some of the practice, but she also allowed them to solve problems with no help. She also assigned homework for independent work.

### **Research Question 2**

With Research Question 2 I asked: What instructional strategies do homeschooling parents use to teach their children mathematics? The participants used a variety of instructional strategies to teach their children mathematics. They used instructional materials, such as textbooks and online computer programs, they used both formal and informal assessments, and they used many teacher-directed activities. These strategies helped their children understand the mathematical concepts and stay motivated to learn mathematics.

**Heavy use of instructional materials.** All of the participants relied heavily on the curriculum. They used the resources provided in the curriculum. They all

administered the assessments from the curriculum. Marie was the only one who provided supplemental books to her child and she also used Khan Academy. She still used the curriculum for the daily lessons and assessments. She stated that she did not use the assessments in Khan Academy because she didn't want to "veer away from the curriculum." The rest of the participants used few or no supplemental materials. Games were only used to memorize math facts. Cindy used cooking activities to show her daughter fractions and Jill took her sons to the store to help them practice concepts like addition and subtraction. Betty, Cindy, and Jill used manipulatives, drawings, and charts to help their children learn mathematics. While Marie believed that going on field trips and learning how to apply mathematics in real-world situations is important, she expressed the desire to take her son to the amusement park to learn about geometry, but she has not yet taken him. Marie and Jill utilized a lot of technology to help teach their children mathematics. Marie used it at a supplement. She taught the lessons and then used Khan Academy if her son needed another explanation of the concepts or to add extra practice. Jill used Teaching Textbooks, which is a mathematics curriculum that is completed on the computer. The computer program taught the children mathematics and Jill just helped when necessary.

The participants also used other teachers to help their children learn. With Teaching Textbooks, Jill's sons were taught online by another teacher. Jill, also, if her younger son struggled with a concept, had his older brother try to teach it to the younger son. Betty often showed her granddaughters videos of the author of the curriculum

teaching the mathematics content. Marie used Khan Academy and, previously, YouTube videos. She believed that another person teaching her child sometimes helped her son. She said that if her son didn't understand the material after she explained it, she went to a video on Khan Academy to teach the concept another way. She stated, "There were certain people, the way they spoke and communicated, it was 'bang.'" Sometimes her son understood it when another person taught it to him. Cindy sometimes had her husband teach her daughter because he could explain the concept differently to her daughter.

**Constant formal and informal assessments.** All of the participants administered assessments. They gave the assessments after they taught a unit in the curriculum. They also informally assessed their children by watching and checking them while they were completing the daily assignments in the textbook. All of the participants, except Jill, contended that they sat by their children and worked with them individually. Jill allowed her children to complete the lessons and the assignments on the computer independently. The participants used the assessments as a checkpoint to determine if their children understand the material. If their children did not understand, they reviewed the material with their children and had them retake the test. Sometimes, the participants would create another test themselves or use the same test. Betty also created quizzes if her grandchildren needed more practice in a certain area. The participants considered mastery of the material to be of utmost importance and would not move on to the next unit until their children mastered the material and could pass the unit test.

**Teacher-directed activities.** The participants all taught mathematics in about the same way. The math block contained a lesson and independent work. Marie, Betty, and Cindy taught their children the lesson from the book. In Jill's household, the computer program taught the children. The children did independent practice. Betty and Cindy stated that they sat with their children while they did the practice problems and watched their progress. Jill did not sit with her children while they completed their work on Teaching Textbooks. She just made sure they were completing the lessons and passing the tests. Betty, Cindy, and Marie used pictures, diagrams, and manipulatives to help their children understand the concepts in mathematics. Marie used supplemental books and Khan Academy to help her son, as well. Marie did something a little different than the other participants. She had her son read over the lesson for the next day the night before to help prepare him. The participants retaught the lesson, if their children did not understand the concepts or failed the assessments.

### **Research Question 3**

With Research Question 3 I asked, What do documents reveal about homeschooling instruction in mathematics? In this section, I will compare and contrast the main curricula and the supplemental materials used by each participant. I will also discuss how the documents were used by the participants and what this reveals about the instruction of the homeschooling participants.

**Reliance on the main curriculum.** The participants varied in the curriculum they used, but all of the participants relied heavily on the curriculum to help them teach their

children. The curricula chosen by all participants were similar in many ways. The curricula included a description of the lesson, followed by practice problems. Some of the practice problems were cyclical, in that they reviewed past concepts, but most of them focused on the current lesson or unit. All of the curricula included assessments after each main concept or unit. Some of the assessments were cyclical. The participants followed the curricula and rarely veered from the lessons in the curricula.

Jill used a computer program called Teaching Textbooks. She did not provide documents of the program because the program is on the computer. I conducted a search on the Teaching Textbooks website. The curriculum can be accessed on a PC or Mac. The lessons are on CDs and in physical textbooks. Parents can choose to buy both the CDs and the textbooks, or just buy either the textbooks or the CDs. These purchases could be made online on [teachingtextbooks.com](http://teachingtextbooks.com). I completed a sample lesson that was included on the Algebra 1 CD. It took 15 minutes. During the lesson, a man's voice was teaching while notes were typed by the computer program on the screen. The lesson stopped periodically for the students to complete practice questions. If the students got the answer right, the instructor's voice praised them. If the students got the answer wrong, the instructor showed the correct way of solving the problem. After completing the lessons, students could complete practice questions. For each question, if students got the right answer, a cartoon character praised them. If the students did not get the answer correct, they could try again or there was a button to press to allow the program to reteach the topic. There were also true and false questions about the concepts taught and other

questions that did not require mathematical calculations. The website provided placement tests to help parents decide proper placement in the variety of computer textbooks. The curriculum also had a gradebook that keeps the grades on the computer for each practice set and test.

Marie taught primarily from a geometry textbook published by Bob Jones University. The main textbook by Bob Jones University follows the same format for each unit. Each lesson in each unit has a written description of the lesson, including definitions of key terms and a lot of examples. There are diagrams and pictures to aid in understanding. The textbook makes connections to real-world examples. There is a section about the history of geometry. For example, in Lesson 4 of Unit 10, when discussing geometric translations, the textbook has a picture of the Air Force Academy chapel in Colorado that shows repeated translations in the building structure. Then, there are exercises of practice problems. At the end of the exercises, there is a short cumulative review of about 10 questions. At the end of the unit, there is a review test.

Betty used Math-U-See to teach her grandchildren mathematics. Math-U-See has units. The lessons were scripted for the teacher. There were lesson practices and cumulative reviews at the end of the units. Betty had the option of using the DVDs provided to have the author of the curriculum teach the lesson. She used the DVDs sometimes, but not always. I went online and saw some examples of the videos. The videos show a man standing next to a whiteboard and demonstrating how to do the various mathematics problems.

Cindy used the sixth grade mathematics curriculum published by the Association of Christian Schools International. Each unit has lessons with practice exercises and there is an application section that requires students to think about how mathematics applies to real-world situations. The lessons also have sections of cumulative review and cumulative review assessments. There are study guides for each test and a unit test at the end of each unit. The curriculum contains extra worksheets with pictures and diagrams to help students comprehend the mathematics concepts better.

Although the curricula were varied and no two were the same curricula, there were numerous similarities among them. All of the curricula was organized by units, included student practice, and periodic assessments throughout each unit and at the end of each unit. Some of the assessments were cumulative. Each lesson in all of the curricula included a description of the new concepts and student practice problems. The curricula did have some real-world application examples and word problems, which can motivate students by connecting math to their own lives. The curricula also included some pictures and diagrams that can draw student attention.

Two of the curricula included a technology component. Technology can help motivate students to learn mathematics. With the Math-U-See curriculum Betty had the option of having the grandchildren watch the videos of the author teaching the lessons. While Betty used technology as a supplement to her own teaching, Jill's curriculum was solely based on technology. The children learned by watching the videos on the computer. Jill used a computer program that taught all the lessons for her. This

curriculum was useful for a number of reasons. First, since a computer program taught the students, this could allow students to work more independently and at their own pace. Second, whether or not a student progresses is dependent on whether or not the student passes the quizzes and assessments. Therefore, the program required understanding and mastery before moving on to the next concept. Third, the program made it easy for parents to see the child's progress because there was an online gradebook and online assessments. Fourth, the program retaught any concept the student did not understand until the student reached mastery. Fifth, according to Jill, the parent could override the program by throwing out any assessments with which the parent was not happy. The parent could require the student to repeat a lesson to the parent's satisfaction. Sixth, this curricula is very motivational to students because it utilizes technology and has interesting characters that pop out to provide immediate feedback for the students. All of these features were included in the program and required no work of the teacher.

The curricula revealed much about how the participants chose to instruct their children. They all chose curricula with scripted lessons or with lessons that took the place of the teacher and taught through technology. This revealed that the participants believed that the teacher should be the leader during the lessons, not the student. The participants' lessons matched the curriculum and the lessons were teacher-driven. The participants chose what would be taught and how to teach it to help their child to learn the material. It also revealed that the parents trusted the curriculum to teach their children correctly and to motivate their children to learn. The parents revealed that they

did not use extra activities outside the textbook to motivate their children. Therefore, they relied on the lessons in the curriculum to help their child learn the material and to keep their child motivated. However, some, if they found the lessons in the curriculum did not adequately meet their child's needs, did supplement with charts and pictures, as well as another person presenting the lesson. Finally, the participants used the assessments provided in the curriculum to monitor progress. This revealed that the participants trusted the assessments to be an accurate representation of what the students should know after learning the material in each unit. The participants did not create their own assessments, unless their children had to retake an assessment. In this case, the participants sometimes created a test like the one in the curriculum that their child had already taken.

**Rejection of supplemental materials.** The curricula that the participants chose all included supplemental materials. However, most of the participants chose not to use the supplemental materials supplied in the curriculum. Cindy did not use supplemental materials provided in the curriculum. Although the curriculum provided manipulatives, downloadable reinforcement papers, charts, and skill review sheets, she does not use any other materials but the book. She had used some additional supplemental materials not provided by the curriculum. She used Unifix Cubes, games for memorizing math facts, and a mathematics app. She also drew pictures and diagrams, and created her own mathematics manipulatives.

Marie supplemented with two other textbooks called *School Mathematics Geometry*, published by Houghton Mifflin, and *Geometry*, published by Ginn and Company. Marie stated that the main curriculum she used, published by Bob Jones University, is sometimes too complex for her son. Therefore, she supplements the other books because they are more hands-on. The supplemental textbooks also follow this same format. Marie also used Khan Academy to supplement the curriculum. Khan Academy, found at [Khanacademy.org](http://Khanacademy.org), is an online place to learn. I went on Khan Academy and watched a lesson. The instructor used diagrams and notes to teach the mathematical concepts. The lessons last, on average, about 8 minutes. There are exercise problems and tests on each unit, as well. She stated that she does not use manipulatives but she does have her son draw geometric shapes and diagrams. Sometimes she and her son refer to online drawings through Khan Academy. She sometimes uses worksheets that she prints online from Khan Academy.

Jill used supplemental materials when her children were younger. She used Lego-like bricks and mathematics board games to help her children memorize their mathematics facts. Now that she uses the computer program to teach her children, she does not use supplemental materials.

Betty did not use any supplemental materials. She did use the DVDs with the author of the curriculum teaching the lessons. She also drew diagrams and pictures if her grandchildren need it.

The rejection of supplemental materials revealed many things about the way the participants chose to teach mathematics to their children. The participants did not believe that supplementation was necessary, especially as their children got older. They taught the lessons from the curriculum and believed that the curriculum was enough to adequately help their children learn the mathematical processes. The participants did draw pictures and use some manipulatives, if their children needed it. The lessons taught with technology included diagrams, as well, to illustrate the concepts. Another overall belief the rejection of supplemental materials indicated was the participants thought their children did not need hands-on activities or manipulatives to understand mathematics as much as when their children were younger. Jill and Betty both stated that they used to have more manipulatives when the children were younger. Cindy was different from the others. She did not buy any manipulatives, but she did make her own, if her daughter needed them. A third belief is the participants used technology solely as another teacher to instruct their children, not as extra reinforcing games. The participants did not have their children play mathematics games on technology. Cindy, at one point, allowed her child to download an app a while back. However, her daughter no longer used it at the time of the interviews. Marie specifically stated that it was helpful to have another teacher instruct her child in a different way because he may explain the mathematical processes differently. For the participants that chose to use technology, they believed that it was effective to teach the students in a different or better way than the participants could teach the material.

### Summary

In this section, I discussed my study. I talked about the processes utilized to gather, organize, and code the data for my study. I also discussed the findings of my study. I talked about what the homeschooling parents believed about teaching their children mathematics, the instructional strategies they used to teach mathematics, and the documents they used to teach mathematics. The central research question of this study was, how do the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching? The beliefs, instructional strategies, and the documents they used to teach mathematics revealed that the participants did not closely follow the instructional strategies of learner-centered teaching. They believed that mathematics instruction should be teacher led and that curriculum should be used as the primary instructional resource. They used minimum supplemental activities, manipulatives, and visuals to teach mathematics. They also believed in one-on-one instruction and most sat with their children while they completed their daily mathematics assignments. The participants all required mastery before moving on to the subsequent concepts.

In the following chapter, I will delve deeper into comparing and contrasting the beliefs, the instructional strategies, and the documents the participants chose to use with learner-centered instructional strategies. I will discuss the findings of my study. I will interpret the findings of my study in light of the four key changes to instruction of Weimer's (2013) learner-centered teaching ). I will also discuss the limitations of my

study, recommendations for further research, implications for social change, and my conclusions.

## Chapter 5: Discussions, Conclusions, and Recommendations

### **Introduction**

The purpose of this study was to explore how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching. The results of this study extended the limited knowledge of the instructional strategies homeschooling parents use to instruct their children. The first related research question was: What do homeschooling parents believe about mathematics instruction? In this study, I found that homeschooling parents believed mathematics instruction should be fun and interesting, relevant to students' lives, curriculum-based, differentiated to meet children's learning needs, include memorization, include formal and informal assessments, motivate students, require mastery, include critical-thinking activities, allow limited student choice, and have teacher-driven instruction. The second related research question was: What instructional strategies do homeschooling parents use to teach their children mathematics? I found the homeschooling parents in my study heavily used instructional materials, constantly formally and informally assessed the students, and had many teacher-directed activities. The third related research question was: What do documents reveal about homeschooling instruction in mathematics? The documents revealed a heavy reliance on main curriculum and a rejection of supplemental materials.

In this chapter, I will discuss my analyzation, categorization, and evaluation of the instructional strategies chosen by the homeschooling parents. I will also describe how I analyzed the instructional strategies and categorized the instructional strategies to match

the traditional instructional methodology or the learner-centered methodology. Further, I will provide my evaluation of the instructional strategies of the participants in light of the effectiveness of the same instructional strategies seen as effective in current research studies.

### **Interpretation of the Findings**

The purpose of this study was to examine the instructional strategies of homeschooling parents and how the instructional strategies reflect the instructional strategies in learner-centered teaching (see Weimer, 2013). The overall findings of my study indicated that the instructional strategies of the homeschooling parents were a mixture of the traditional instructional methodology and the learner-centered instructional methodology. However, the homeschooling parents primarily used the traditional instructional methodology.

The participants believed that mathematics should be fun and interesting, relevant to their children's lives, motivating, differentiated, and include critical-thinking activities, and these instructional strategies are a part of learner-centered teaching (see Weimer, 2013). Further, these instructional strategies have been researched in multiple studies and found to be effective in both homeschooling and in regular classrooms (Anthony & Burroughs, 2012; Finch, 2012; Haugh, 2014; Martin et al., 2015; Thomas & Pattison, 2012; Zorica et al., 2012) While the participants believed that some of these instructional strategies were important for a quality education in mathematics and the participants tried

to incorporate these instructional strategies, they did not utilize them to the extent that Weimer (2013) intended in learner-centered teaching.

According to Weimer (2013), learner-centered teaching requires a change from the traditional methods of instruction. In the traditional instructional strategies, the teacher is in charge of the learning processes, and the students learning of mathematics is highly structured, using memorization and rote activities (Zorica et al., 2012). In learner-centered teaching, Weimer contended that there needs to be five key changes from the traditional instruction methodology. The first change is in the role of the teacher (Weimer, 2013). In learner-centered teaching, the teacher is not the center of the learning process; instead, the students are involved in active learning activities and the teachers support the students' learning experiences (Weimer, 2013). The second change is in the balance of power in the classroom (Weimer, 2013). The balance of power shifts from being solely teacher-driven to a balance in power between the students and the teacher, allowing students to make some decisions in the learning process (Weimer, 2013). The third change is in the function of content (Weimer, 2013). Instead of teachers seeing content as just something to be covered, the content is taught in depth and students are expected to deeply understand the concepts being taught (Weimer, 2013). The fourth change is in the responsibility for learning (Weimer, 2013). Students become more responsible for their own learning and they are able to experience the natural consequences for their actions (Weimer, 2013). Teachers model critical thinking and correct ways of learning and, through scaffolding, students learn to apply these methods

to a variety of learning situations (Weimer, 2013). The fifth change is in the purposes and processes of evaluation (Weimer, 2013). The purpose of grading should be to show student mastery of the material (Weimer, 2013). Instead of a focus on grades, students should be working toward accomplishing goals and learning new concepts (Weimer, 2013).

Although their instructional strategies were mainly traditional, the participants made four changes to traditional instruction. The first was that the homeschooling parents often searched for what their individual children needed to learn mathematics. They found curriculum that matched their students' needs, and much of their teaching was catered to their students' needs. Weimer's (2013) second change to instruction stated that the balance of power in the learning environment needs to be shared by the student and the teacher. The parents in my study looked for ways to better teach to their children's needs, and they endeavored to move toward giving their children more power in the learning environment.

The next change to traditional instruction the participants made was working closely with their children and giving them individual attention. This strategy is like Weimer's (2013) first change to instruction, where students complete the work while teachers facilitate. Many of the participants sat next to their children as they were completing their assignments and helped, if needed. If their children student did not understand the concepts, then the parents facilitated the learning by bringing in manipulatives, videos, visuals, or other books to help them learn.

The third change was that all of the participants required student mastery of the material before moving on. If their children did not understand a concept, they slowed down and retaught the material. This strategy matched Weimer's (2013) third change in instruction. The function of content, according to Weimer, should be for deep understanding. By requiring mastery, the participants required full understanding of the material.

The final change to traditional instruction made was the participants used both formal and informal assessments to analyze the progress of their children. They looked at the work in their children's daily assignments as well as all of the assessments in the curriculum, and the results drove their instruction. In the last change in instruction, Weimer (2013) contended that students should be evaluated in numerous ways, not just through pencil-and-paper assessments.

The participants used some of the learner-centered instructional strategies, but the instructional strategies they used did not follow Weimer's (2013) methodology to the full extent. The participants desired to use more learner-centered instructional strategies, however, their everyday instruction often fell short of their desired methodologies to instruct their children. Thomas and Pattison (2012), Finch (2012), Hossainy (2012), and Haugh (2014) all found in their studies that students learn well in authentic, real-world situations. The participants spoke of making mathematics fun, interesting, and relevant. Some stated that they desired to have more hands-on and real-world activities to make learning mathematics even more fun and relevant. When the participants described their

activities in the interviews and the reflective journals, they revealed that they did not use many supplemental materials, they did not do many hands-on real-world activities, and they did not go on many field trips pertaining to mathematics.

Some of the participants believed that critical-thinking skills were important. Martin et al. (2015) found it to be effective when students answer open-ended questions, participate in student-led discussions, ask higher-level questions, justify their answers, solve difficult problems, think deeply, use manipulatives, and draw conclusions. In a study conducted by Abdullah et al. (2012), the students were taught critical-thinking skills, problem-solving strategies, and visualization to solve word problems and outperformed the control group who was taught to memorize mathematical facts and formulas. The participants in my study had their children complete critical-thinking word problems in the curriculum; however, they did not create supplemental activities or projects to encourage critical thinking.

The participants did differentiate their instruction. The differentiation included taking a course to discover a child's learning style; reteaching material, if necessary; and adjusting the curriculum to meet the students' needs. However, this type of differentiation is not extensive in the way Weimer (2013) intended. Weimer believed that differentiation occurs when students are doing projects and have some choice in the way they complete them.

The participants did not state that they encouraged a deep understanding of mathematics. None of the participants discussed any projects that they had their children

complete to aid in a deeper understanding of mathematics. They also did not reveal that they had in-depth discussions with their children about concepts in mathematics or allowed their children to self-assess their progress in mathematics. All of these activities, Weimer (2013) contended, can lead to a deeper understanding of concepts in mathematics.

The participants more closely adhered to traditional instructional strategies, but they included some learner-centered instructional strategies. Their instruction was curriculum-based, included memorization of math facts and algorithms, allowed limited student choice, had teacher-driven activities, and did not include many supplemental materials or activities. These instructional strategies proved just as effective as the constructivist or learner-centered instructional strategies in Grady et al.'s (2012) study. In other studies, these instructional strategies were effective when combined with some learner-centered strategies (Anthony, 2009; Anthony & Burroughs, 2012; Ardito et al., 2013).

Although the participants made only a few of the changes to instruction that Weimer (2013) presented, the instructional strategies the participants chose to use did seem to be effective for their individual children. The participants in my study combined traditional methods with only a few of the learner-centered methods to instruct their children, and the results of this study extend the knowledge of this type of instruction. In their study of the instructional strategies of homeschooling families, Anthony and Burroughs (2012) discovered that some parents combined traditional methods, where

students learned through highly-structured lessons and schedules, with contemporary methods, where the parents taught according to the students' needs. Anthony (2009) also found that many homeschooling families combined traditional and contemporary methods of instruction. The participants in my study used these same instructional strategies. Ardito et al. (2013) found that combining traditional and contemporary methods was an effective strategy for teaching fifth grade students history. Grady et al. (2012), who conducted a study on how students in sixth grade best learned mathematics, found traditional instructional methods, which in their study included supplemental and advanced practice, cyclical review, and ability grouping, were as effective as the contemporary instructional strategies. All of the participants in my study stated that their children did not struggle with mathematics too much and did fairly well on the assessments. They said that their children did not have to retake assessments often. The participants in my study seemed to be satisfied using instructional strategies that mixed the traditional and learner-centered methodologies.

### **Limitations of the Study**

There were some limitations to my study. The first limitation to this study was that only four parents were included in this single case study. According to Yin (2014), participants in a single case study can include four to six participants. The number of participants in my study was on the low end of the spectrum, but according to Yin, was sufficient for a single case study. The second limitation was the participants in my study included parents and a grandparent who taught in only Grades 6–12. Homeschooling

instructors in K–5 did not respond to the invitation to participate in my study. This is a limitation because I was unable to study the instructional strategies of homeschooling parents of students in grades K-5, which could have further extended the knowledge of instructional strategies in mathematics. Another limitation was that, being a single researcher conducting this study, the potential for researcher bias existed (see Creswell, 2007; Merriam & Tisdell, 2016; Yin, 2014). To prevent this, I kept a researcher’s journal to reflect on any biases or values I brought to the research that may have influenced my interpretation of the data and my analysis of the data. The final limitation was the transferability of the findings of my study. To prevent this, I included rich, thick descriptions of the data provided in the interviews, the reflective journals, and the documents. I also described the setting, the data collection process, and the data analysis process in great detail.

### **Recommendations**

Much research still needs to be done on the instructional strategies homeschooling parents use and the effectiveness of these strategies. In this study, I focused on four families, all with students in high school or middle school in a Christian school. Further research needs to be done on homeschooling students in elementary school as well as students in secular homeschooling families. Kapitlulik (2011) found many differences in the methodology of instruction between the religious and secular homeschooling families. Further research can be conducted on the instructional strategies of secular homeschooling families.

In my study, the focus was solely on the instructional strategies used by the homeschooling families. However, further research can focus on the motivations and feelings behind the use of the particular instructional strategies chosen, along with the feelings of the students who are taught the particular instructional strategies. When finishing this study, I found myself asking whether the students were motivated by these instructional strategies and the feelings the students had about the instructional strategies their parents used. Jill mentioned that her children did not particularly enjoy mathematics. This may have changed if she had chosen instructional strategies that more closely matched learner-centered teaching.

Further study can be done on the reasons behind the choices the homeschooling parents decided to make. More research can explore why they chose not to use some of the learner-centered instructional strategies, why they chose not to use the supplemental materials in the curriculum, such as manipulatives, and why they stopped using manipulatives as their children became older. These topics need to be explored further.

Finally, further study can be conducted on instructional strategies used by homeschooling families in other subjects, not just mathematics. Further research can show the instructional strategies used when teaching other subjects. The participants may use more learner-centered instructional strategies when teaching other subjects.

### **Implications**

This study has contributed to existing research and can help improve current teaching practices. It can lead to positive social change. Little research exists on the

teaching practices of homeschooling families (Pattison, 2012). My study helped to extend the limited research on instructional strategies homeschooling parents use to instruct their children in mathematics. My study also can help increase knowledge of both homeschooling parents and school instructors of effective instructional strategies to teach children mathematics. Homeschooling parents who have concerns about how to effectively instruct their children can see the instructional strategies that are working with the families in my study. Instructors in schools can also see the instructional strategies the participants in my study found to be effective. They can develop a deeper understanding of effective instructional strategies in mathematics. Effective instructional strategies help children to learn. As a result, students can be motivated to learn mathematics and become lifelong learners. When students are lifelong learners, they can contribute to social change.

### **Conclusion**

The purpose of this study was to describe how the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching (see Weimer, 2013). In this study, I examined the responses of the participants in interviews and reflective journals. I also examined documents pertaining to the homeschooling of the participants. I discovered that the instruction of the participants did not closely abide by Weimer's (2013) methodology in learner-centered teaching. In Weimer's learner-centered teaching, the teacher gradually releases responsibility to the students. Teachers teach the students how to think critically, solve problems, and speak

using mathematical language. The students, in turn, take more control over their learning and use the skills their teachers taught them to think critically, solve problems, and speak using mathematical language to work cooperatively and engage in projects and discussions. Teachers also teach content deeply and students learn to assess themselves and their peers. In the homeschooling environments of the participants in my study, the parents held most of the responsibility for their children's learning. Like in learner-centered teaching, the parents taught lessons. The parents followed the curriculum and rarely did extra activities. The parents covered the curriculum, but not very deeply. The students completed word problems and critical-thinking activities included in the curriculum.

These methods seemed to work for their children, as far as learning the content. The participants stated that their children almost always passed the assessments the first time. However, some factors still need to be considered. If the participants did integrate more learner-centered instructional strategies into their lessons, this may have increased their ability to learn, not only the concepts in mathematics, but to appreciate mathematics. They may have enjoyed learning mathematics more and they may have been able to better apply the concepts of mathematics to everyday experiences in their lives. They may better remember the concepts in mathematics for the rest of their lives, instead of just for the duration of the mathematics unit, and become lifelong learners of mathematics. These concepts need to be examined more closely by all educators, including homeschooling educators as well as future researchers on the subject.

All of the participants indicated that they enjoyed homeschooling. They stated they enjoyed homeschooling because they had the privilege of working closely with their children and discovering the methods of learning mathematics that work best for their children. Their children were taught as individuals. Finding the instructional strategies that work for individual children as much as possible is an important consideration when determining the most appropriate and effective instructional strategies for mathematics.

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## Appendix A: Letters of Cooperation

Lisa Francis  
[REDACTED]

September, 2016

Dear Lisa Francis,

Based on my review of your research proposal, I give permission for you to conduct the study titled Instructional Strategies That Homeschooling Parents Use to Teach their Children Mathematics for the [REDACTED] School's Home School Program affiliated with [REDACTED] Schools in [REDACTED]. As part of this study, I authorize you to recruit and select six homeschooling parents who sign a consent form and return it to you in a self-addressed, stamped envelope. I authorize you to interview these homeschooling parents and to collect online reflective journal entries from these parents. I understand that individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include providing documents describing the homeschool program affiliated with Faith Christian Schools. We reserve the right to withdraw from the study at any time if our circumstances change.

I understand that the data you collect will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty without permission from the Walden University Institutional Review Board (IRB).

Sincerely,

[REDACTED], Superintendent  
[REDACTED]

Lisa Francis  
[REDACTED]

September, 2016

Dear Lisa,

Based on my review of your research proposal, I give permission for you to conduct the study titled *Instructional Strategies That Homeschooling Parents Use to Teach their Children Mathematics* for the homeschool program affiliated with [REDACTED] Schools in [REDACTED]. As part of this study, I authorize you to recruit and select four to six homeschooling parents who sign a consent form and return it to you in a self-addressed, stamped envelope. I also authorize you to interview these homeschooling parents and to collect online reflective journal entries from these parents. I understand that individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include providing documents describing the homeschooling program affiliated with [REDACTED] Schools. We reserve the right to withdraw from the study at any time if our circumstances change.

I understand that the data you collect will remain entirely confidential and may not be provided to anyone outside of the student's supervising faculty without permission from the Walden University Institutional Review Board (IRB).

Sincerely,

[REDACTED], Homeschooling Director  
[REDACTED]

## Appendix B: Letter of Invitation

Hello,

My name is Lisa Francis. I am a PhD candidate at Walden University, which is an accredited institution of higher education. I am also an elementary school teacher at [REDACTED] Schools.

The purpose of my study is to describe how homeschooling parents use instructional strategies to teach their children mathematics. You have been invited to participate in this study because you are a homeschooling parent in the K-12 program associated with [REDACTED] Schools.

Please read the attached consent form, which will describe your responsibilities for participating in this study. If you are interested in participating in this study, please sign the enclosed consent form and return it to me in the self-addressed, stamped envelope within one week.

If you have any questions about this study, please contact me at [REDACTED] or at [REDACTED].

Thank you for your consideration.

Sincerely,

Lisa Francis  
[REDACTED]

## Appendix C: Interview Protocol

### Introduction:

My name is Lisa Francis. I am an elementary teacher at [REDACTED] Schools. I am meeting with you because you are a homeschooling parent in the K-12 program affiliated with [REDACTED] Schools, and you have agreed to participate in this study. I want to ask you some questions about how you teach mathematics to your children in your home. I will first provide you with the questions to review before I begin audiotaping the interview as you agreed in the consent form. Please respond to each question with as much detail as possible so I can attain a better understanding of your homeschooling experiences in mathematics. Thank you for your participation.

### Interview Questions:

1. What is the name and age of the child (or children) you homeschool?
2. Please describe the mathematics curriculum you use.
3. Why did you select this mathematics curriculum?
4. What supplemental materials (e.g. manipulatives, technology) do you use when teaching mathematics and why?
5. What instructional strategies (e.g. hands-on activities using manipulatives or games, problem solving) do you use in your mathematics lessons?
6. How do you adjust the mathematics curriculum to meet your child's individual learning needs?

7. When your child does not understand the mathematics concepts that you are teaching, what do you do?
8. When your child seems unmotivated to learn mathematics, what do you do?
9. How do you assess your child's mathematical learning?
10. Please describe instructional strategies that you used in the past to help your child learn mathematics.

Closure:

Thank you for your participation. When I have analyzed the results of this study, I will send you a draft of the tentative results by email. Please take a few minutes to review the findings for their credibility and send me your comments.

### Appendix D: Reflective Journal

Directions: Please answer these questions and return your responses no later than 2 weeks after our interview to Lisa Francis at [REDACTED].

1. How would you describe your role as a mathematics teacher for your child?
2. How would you describe the balance of power between you and your child concerning the teaching and learning of mathematics in your home?
3. How do you, or your child, select the mathematics content (i.e. curricula and/or standards) that they learn each year?
4. What instructional strategies do you use to help your child take responsibility for learning mathematics?
5. How would you describe the purpose and processes of evaluation in relation to your mathematics instruction?

## Appendix E: Alignment of Research Questions and Data Sources

### **Central Research Question**

How do the instructional strategies that homeschooling parents use to teach their children mathematics reflect learner-centered teaching?

### *Interview Questions*

1. What is the name and age of the child (or children) you homeschool?
2. Please describe the mathematics curriculum you use.
3. Why did you select this mathematics curriculum?
4. What supplemental materials (e.g. manipulatives, technology) do you use when teaching mathematics?
5. What instructional strategies (e.g. hands-on activities using manipulatives or games, problem solving) do you use in your mathematics lessons?
6. How do you adjust the mathematics curriculum to meet your child's individual learning needs?
7. When your child does not understand the mathematics concepts that you are teaching, what do you do?
8. When your child seems unmotivated to learn mathematics, what do you do?
9. How do you assess your child's mathematical learning?
10. Please describe instructional strategies in mathematics that you used in the past to help your child learn mathematics?

*Reflective Journal Questions*

1. How would you describe your role as a mathematics teacher for your child?
2. How would you describe the balance of power between you and your child concerning the teaching and learning of mathematics in your home?
3. How do you, or your child, select the content (i.e. curricula and/or standards) that your child learns each year?
4. What instructional strategies do you use to help your child take responsibility for learning mathematics?
5. How would you describe the purpose and processes of evaluation in relation to your mathematics instruction?

*Types of Documents*

1. State mathematics standards for K-12 students
2. Written documents related to the homeschooling program, including publications that describe the four tracks and homeschooling fees
3. Documents from homeschooling parents related to the mathematics curricula, instructional strategies, and assessments that they use to teach their children mathematics

**Related Research Questions**

What do homeschooling parents believe about mathematics instruction for their children?

*Interview Questions*

1. What is the name and age of the child (or children) you homeschool?
2. Please describe the mathematics curriculum you use.
3. Why did you select this mathematics curriculum?
4. What supplemental materials (e.g. manipulatives, technology) do you use when teaching mathematics?
5. What instructional strategies (e.g. hands-on activities using manipulatives or games, problem solving) do you use in your mathematics lessons?
6. How do you adjust the mathematics curriculum to meet your child's individual learning needs?
7. When your child does not understand the mathematics concepts that you are teaching, what do you do?
8. When your child seems unmotivated to learn mathematics, what do you do?
9. How do you assess your child's mathematical learning?
10. Please describe instructional strategies that you used in the past to help your child learn mathematics?

*Reflective Journal Questions*

1. How would you describe your role as a mathematics teacher for your child?
2. How would you describe the balance of power between you and your child concerning the teaching and learning of mathematics in your home?

3. How do you, or your child, select the content (i.e. curricula and/or standards) your child learns each year?
4. What instructional strategies do you use to help your child take responsibility for learning mathematics?
5. How would you describe the purpose and processes of evaluation in relation to your mathematics instruction?
6. What instructional strategies do homeschooling parents use to teach their children mathematics?

*Interview Questions*

1. What is the name and age of the child (or children) you homeschool?
2. Please describe the mathematics curriculum you use.
3. Why did you select this mathematics curriculum?
4. What supplemental materials (e.g. manipulatives, technology) do you use when teaching mathematics?
5. What instructional strategies (e.g. hands-on activities using manipulatives or games, problem solving) do you use in your mathematics lessons?
6. How do you adjust the mathematics curriculum to meet your child's individual learning needs?
7. When your child does not understand the mathematics concepts that you are teaching, what do you do?
8. When your child seems unmotivated to learn mathematics, what do you do?

9. How do you assess your child's mathematical learning?
10. Please describe instructional strategies that you used in the past to help your child learn mathematics?

*Reflective Journal Questions*

1. How would you describe your role as a mathematics teacher for your child?
2. How would you describe the balance of power between you and your child concerning the teaching and learning of mathematics in your home?
3. How do you, or your child, select the content (i.e. curricula and/or standards) your child learns each year?
4. What instructional strategies do you use to help your child take responsibility for learning mathematics?
5. How would you describe the purpose and processes of evaluation in relation to your mathematics instruction?
6. What do documents provided in homeschooling programs reveal about homeschooling instruction in mathematics?

*Documents*

1. State mathematics standards for K-12 students
2. Written documents related to the homeschooling program, including publications that describe the four tracks and homeschooling fees

3. Documents from homeschooling parents related to the mathematics curricula, instructional strategies, and assessments that they use to teach their children mathematics