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Grade K-5 Teachers' Perceptions of Professional Development That Supports Mathematics Instruction

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This is to certify that the doctoral study by

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Walden University
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Abstract

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by

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MA, Texas A&M University-Commerce, 2010

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Many Grade K-5 teachers in the United States do not receive the mathematics support they need from the professional development (PD) activities offered by their school districts. The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they received from their school district to support mathematics instruction. The conceptual framework that supported this study was andragogy, an adult learning theory that takes the learner's needs into account and values the connection to real-world situations. The research question addressed how Grade K-5 teachers perceive the PD that they were offered by their school district that was intended to support mathematics instruction. A basic qualitative research approach was used in which semistructured interviews were conducted with eight Grade K-5 teachers from throughout the United States. The four themes that emerged from data analysis showed that teachers have valuable insight into PD, PD is most effective when it is hands-on and can be implemented right away, teachers receive limited PD in mathematics, and teachers do not believe their PD needs are fully met. Overall, the findings indicate a perception that district leaders do not take teachers' views into consideration when designing PD, which hampers its effectiveness. Furthermore, participants viewed PD as being limited in the area of mathematics. It is recommended that district leaders routinely integrate teacher input into PD decisions and find innovative ways to provide PD that is tailored to teachers' professional and classroom needs. This study has the potential to foster positive social change by providing an understanding of the ways in which educators learn best and encouraging the use of best practices in teacher PD. More effective PD may improve mathematics instruction and student learning outcomes.

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Dedication

I dedicate this work to my family. Without them I would not have been able to complete this degree. They were my cheerleaders and source of motivation through this journey. Thank you for celebrating the milestones with me. To my son, Caleb, who had to share my attention with this study, may you always know the value of hard work and perseverance. I hope you dream big and achieve your ambitions. I know you will accomplish amazing things. To my nephew, Kade, may you reap the rewards of continued determination while setting out to reach your goals. Don't give up even when things get tough. To my niece, Kinsley, I hope you always have a strong love for learning. May it be the catalyst for all your hopes and dreams.

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Thank you, Jesus, for giving me the persistence and motivation to complete this journey. This is by far the most challenging endeavor I have undertaken. I would not have made it without the support of friends and family who encouraged me to keep working even when things seemed impossible. I want to also thank my chair, Dr. Richard Penny, for being a constant source of motivation for me. Thank you for always keeping me on track, pushing me to succeed, and helping me to navigate this study. Another thank you to Dr. Michelle McCraney, my second committee member, who also supported and encouraged me throughout this process.

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Chapter 1: Introduction to the Study

Research shows that elementary teachers of mathematics do not receive the professional development (PD) they need to meet their professional needs (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019; Swars & Chestnutt, 2016). The PD offered to elementary teachers through the school districts they teach in has generally been found to follow a traditional model that includes one-time workshop trainings lacking the support necessary to implement new learning (Wake & Mills, 2018). However, PD that offers ongoing support aids teachers in implementing new content standards and programs (Desimone & Pak, 2017). Although changes in mathematics content standards often necessitate an increased understanding of content and pedagogical knowledge (Campbell & Griffin, 2017), elementary mathematics teachers do not always receive the specialized mathematics PD that a change in instruction requires.

At the elementary level, this lack of content-specific training can create a challenge for teachers because most elementary teachers have not had specialized mathematics instruction in their teacher preparation training courses (Campbell & Griffin, 2017). Understanding the perceptions of elementary teachers who teach mathematics regarding the PD they experience has the potential to improve administrators' decision-making regarding the types of PD they provide for teachers. More effective PD has the potential to increase teachers' confidence in their instructional practices related to mathematics instruction. Potential implications for positive social change include providing an understanding of the ways in which educators learn best and encouraging the use of best practices in teacher PD.

Chapter 1 serves as an introduction to the study. In this chapter, I provide the problem statement, the purpose of the study, and research question. The chapter includes a summary of the literature related to the types of PD teachers experience and the PD needs of kindergarten through fifth grade (K-5) teachers who teach mathematics. It also includes an overview of the study's conceptual framework of andragogy, an adult learning theory (Knowles, 1975). I also describe the nature of the study; define key terms; and discuss the assumptions, scope and delimitations, limitations, and significance of the study.

Background

Teachers participate in PD each year. The types, quality, and frequency of these PD activities vary based on location, content area, and school district requirements (Shirrell et al., 2019). PD activities are designed and implemented to help teachers improve their instructional practice (Osman & Warner, 2020). Traditional forms of PD such as one-day workshop style trainings are often a shared experience in which a group of teachers are present in the same environment and engage with the same material (Noonan, 2019). This form of PD is often necessary for implementing policy and creating unity across a school district regarding district-wide initiatives and is often used to address additional PD needs as well. In contrast, job-embedded forms of PD such as professional learning communities and instructional coaching offer a more tailored approach to supporting teachers and their individual needs (Desimone & Pak, 2017). Still other forms of PD such as online communities and forums provide a flexible and self-paced approach to learning (Owens et al., 2018). As shown, teachers experience PD in a

variety of forms. Regardless of the format of a PD activity, it should be designed to meet teachers' individual learning needs, offer differentiated choices, and provide a sense of agency over PD choices (Noonan, 2019).

Amid standards-based reform, educational leaders have increasingly emphasized the adjustment of teacher practice to increase student achievement (Desimone & Pak, 2017). School districts continually face changes in expectations for student achievement in mathematics (Campbell & Griffin, 2017). These changes in expectations and standards have created a sense of urgency for teachers to improve their mathematical content and pedagogical knowledge in order to effectively meet the needs of their students. A student's potential for achievement in mathematics is influenced by the learning and teaching of the prior year bringing attention to the importance a year of instruction has for students. Teachers must make shifts in the way they teach and present mathematical content to students to foster greater interaction (Spillane et al., 2018). School districts need to provide adequate supports to facilitate changes in teachers' instructional practices.

PD is often relied on as a means to support and improve teachers' mathematics instruction (Jacob et al., 2017). The most important parts of designing PD activities are organization and structure (Owens et al., 2018). Teachers often prefer on-the-job embedded PD, face-to-face formats, and peer observations. Research shows that these forms of PD can enable participants to experience learning in more effective ways. Kraft et al. (2018) found that when traditional trainings were combined with coaching programs there was a larger improvement in instructional practices. These large

improvements in the quality of instruction resulted in changes in student achievement. In contrast, traditional PD programs have failed to provide support that encourages improvement in instruction and student achievement (Pak et al., 2020).

Teacher preparation programs require elementary teacher candidates to take courses that prepare them for a basic understanding of major curricular areas. This training enables students to pass certification tests qualifying them to teach all subjects at the elementary level as generalists (Baroody, 2017). Not all preservice teachers are required to take specialized math courses. Because of this, teacher candidates often graduate with only basic mathematical skills, which can cause them to be limited in the mathematical content knowledge necessary for their teaching position.

Potential teacher preparation gaps coupled with the changes in mathematics standards and expectations demonstrate a need for adequate instructional support for teachers to successfully incorporate effective instructional strategies. Teachers often see the benefit of valuable PD and understand the relationship between instructional practices and student achievement (Tanner et al., 2017). Moreover, many teachers are eager to implement new learning due to the potential it has to positively impact student achievement. However, elementary teachers often do not receive the PD they need for effective mathematics instruction (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019). More needs to be known regarding the types of PD elementary teachers find supportive for mathematics instruction. By gaining a better understanding of teachers' perceptions of effective PD, district leaders can make more informed decisions when developing PD programs.

Problem Statement

There was a gap in practice affecting Grade K-5 teachers in public school districts throughout the United States. The problem that was addressed in this study was that Grade K-5 teachers are not getting the mathematics support they need from the PD activities offered by their school districts. C. Martin et al. (2019) provided evidence of this problem with their finding that PD for mathematics occurs less frequently than literacy PD. Their study also showed that the mathematics PD provided did not fully meet the teachers' needs. In another study, C. Martin et al. (2018) showed that the PD elementary teachers were provided did not benefit their teaching practices. Teachers, the researchers found, desired a deeper understanding of content and engaging instructional strategies, but these were not as readily available for math teachers. L.E. Martin et al. (2019) also found that elementary teachers were provided PD that did not prove beneficial to their specific classroom needs. Teachers participating in this study lacked ownership and voice in the PD activities they participated in. Last, Swars and Chestnutt (2016) found that elementary mathematics teachers were not receiving the PD they needed to help them implement new math standards. This research demonstrates the need for effective PD to provide Grade K-5 with the tools they need to effectively teach mathematics.

Purpose of the Study

District leaders often provide PD to their teachers through a top-down approach that emphasizes information dissemination (L. E. Martin et al., 2019). Although this form of PD is efficient for distributing general information on policies and programs, it does

not provide the individualized support teachers need to effectively teach specialized content areas such as mathematics, research shows (C. Martin et al., 2019). The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support mathematics instruction. This study has the potential to fill a gap in practice by exploring the support teachers receive related to mathematics instruction. This knowledge can provide a better understanding of the types of PD that teachers find effective and beneficial.

Research Question

School district leaders do not always obtain input from teachers regarding the type of PD they desire. As a result, teachers often lack ownership in the PD activities they participate in (L. E. Martin et al., 2019). Furthermore, the specific needs and content demands of students are not always considered by administration when designing PD activities (L.E. Martin et al., 2019). To learn more about how mathematics teachers, in particular, perceived the PD available to them, I developed the following research question: How do Grade K-5 teachers perceive the PD they are offered by their school districts intended to support mathematics instruction?

Conceptual Framework

I based the conceptual framework for this study on Knowles's (1975) theory of andragogy. Knowles's adult learning theory is based on five assumptions that should inform the development of adult learning activities. These assumptions are based on the premise that adult learners have valuable life experiences that influence learning, and they are generally self-directed and autonomous in learning situations. Additionally, adult

learners are intrinsically motivated to learn and desire new learning to be applicable to their current contexts (Powell & Bodur, 2019). As such, adults should have a voice in planning and evaluating their learning experiences (Powell & Bodur, 2019).

The adult learning theory of andragogy can provide a useful framework for PD development and evaluation. Andragogy encourages active participation and dialogue in learning situations while also considering the learner's needs and their connection to real-world situations (Knowles, 1984). In line with andragogy, effective forms of PD feature methods of collaboration and conversation for learning (Powell & Bodur, 2019). However, not all PD activities align with the model of andragogy. Some traditional PD sessions are based on models that focus on merely presenting information to participants without opportunity for collaboration or follow-up support. Traditional forms of PD, such as seminars and workshops, do not consistently provide evidence of change in teacher practice and student achievement (Barrett-Tatum & Smith, 2018). The reason for this could be that traditional forms of PD often follow the model of providing information rather than providing resources to help participants learn and synthesize new information (Wake & Mills, 2018). Providing opportunities for adult learners to make connections with content and apply new learning to their educational contexts encourages more effective learning.

The design of a PD program should take the needs of adult learners into account while trying to meet the learning objectives. However, in reality PD is generally designed to meet multiple objectives through a workshop or activity without much consideration of the adult learners' needs (C. Martin et al., 2019). In this qualitative study, I explored

elementary mathematics teachers' perceptions of PD. This research can provide valuable insight into what teachers perceive as the most effective types of PD to meet their learning needs. These insights can help inform effective mathematics PD plans. In Chapter 2, I will further describe andragogy and how it can inform PD design.

Nature of the Study

I used a basic qualitative research design. In this study, I explored the perceptions of Grade K-5 mathematics teachers' experience with PD intended to support mathematics instruction. Qualitative research is an effective tool for understanding participants' perspectives (see Monroe & Marvin, 2020); researchers use the qualitative method to understand how people interpret their experiences and the meaning they derive from their experiences (Merriam & Tisdell, 2015). I used a qualitative research design to explore teachers' perceptions of the types of PD they participated in as well as the frequency of PD activities. The basic qualitative approach was suitable for this study because it allowed for an understanding of how people make sense of their lives and experiences (see Merriam & Tisdell, 2015). The meaning a certain phenomenon has for those participating in it can be illuminated by a basic qualitative design.

In this study, I collected data by interviewing participants. Grade K-5 teachers whose teaching assignment includes mathematics instruction were recruited for individual semistructured interviews. Qualitative researchers investigate the perceptions of people who have experienced a phenomenon (see Monroe & Marvin, 2020). The researcher engages with participants so that a deeper understanding of the phenomenon can occur. I determined that the problem of teachers not receiving the PD they need from

their school districts could be explored through interviews. Weiss (1994) explained the benefits of using interviews to collect data. Qualitative interviews can help develop full, detailed descriptions of perspectives and experiences. By conducting individual semistructured interviews with elementary teachers who instruct in the subject of mathematics, I was able to gain a more comprehensive understanding of what types of PD are offered to teachers and how those activities are perceived. Semistructured interviews allow for a similar set of questions to be used with each participant. Probing questions to follow participant responses were also used to provide a deeper understanding (see Burkholder et al., 2016).

For this research study, I interviewed eight Grade K-5 teachers whose teaching assignment includes mathematics. These participants were recruited by posts made in Facebook groups dedicated to mathematics instruction. The goal was to interview teachers in the United States who currently teach mathematics in Grades K-5. Purposive sampling was used to choose participants. Interviews were recorded and transcribed. I coded the interview data to determine themes and recurring ideas.

Definitions

This section contains definitions of key terms used in this study.

College and career readiness standards: English and mathematics standards for kindergarten through 12th grade that are intended to help prepare students for college and 21st century careers (Pak et al., 2020).

Common content knowledge: General knowledge of mathematics that most educated people, including teachers, acquire (Ekmekci et al., 2019).

Common Core State Standards (*CCSS*): Learning goals in English language arts and mathematics that state what students should know and be able to do at the end of each grade (Common Core State Standards Initiative, 2021).

Instructional coaches: Instructional leaders who work in a variety of settings to improve teachers' instructional practices (Kraft & Hill, 2020).

Job-embedded professional development: PD that targets specific learning needs of teachers by identifying needs and developing a plan to meet those needs within the context of the school and classroom, embedded into routines that already exist (Cavazos et al., 2018).

Mathematical knowledge of teaching: A blend of content knowledge and pedagogical knowledge (Ekmekci et al., 2019).

Pedagogical content knowledge: The point at which a teacher's knowledge of content intersects with their knowledge of pedagogy (Ekmekci et al., 2019).

Professional development (*PD*): Any program, activity, or training that is aimed at improving instructional practice regardless of the structure (Osman & Warner, 2020).

Professional learning community: A group of educators who work collaboratively, with a set of norms, to complete lesson planning, evaluate student achievement, and share effective strategies (Carpenter, 2017).

Specialized content knowledge: Mathematical knowledge that is exclusive to and necessary for teaching mathematics (Ekmekci et al., 2019).

Assumptions

I had four assumptions in conducting this study. The first assumption was that participating teachers had experience with different forms of PD. The second assumption was that teachers would be willing to share their experiences with PD and provide insight into what they believed was needed and beneficial within PD activities. Another assumption was that teachers with varying experience levels might have different perspectives regarding PD. The last assumption was that teachers from schools with varying characteristics would be included. These assumptions were consistent with the qualitative research method that I used to explore teachers' perceptions of PD intended to support mathematics instruction. The research method I used included interviews to collect participants' perceptions on their experiences with PD.

Scope and Delimitations

This research study included eight Grade K-5 teachers in the United States whose teaching assignment includes mathematics. I set the boundaries for this study based on the focus of the research on the perceptions of Grade K-5 teachers regarding PD related to mathematics instruction. I pursued this research because of my experience with teaching mathematics in elementary and middle school settings. As a team leader and mentor to new teachers, I noticed that teaching in content areas such as mathematics can require specialized training and support.

There are two delimitations present in this study. The first delimitation was that the participants were limited to teachers in elementary settings whose teaching assignment includes mathematics. Because I sought to explore Grade K-5 teachers'

perceptions, I recruited only teachers who were currently teaching mathematics in those grades. The second delimitation was that the findings of the study are only applicable to Grade K-5 mathematics PD activities. The findings may not be generalizable.

Despite the delimitations, the results of the study may be transferable to other elementary mathematics settings. Readers of the study may find connections between the study context and their personal setting, allowing them the opportunity to apply the findings (Merriam & Tisdell, 2015). The intentional choices I made regarding recruiting and choosing participants assisted in establishing transferability. I used purposive sampling and inclusion criteria for participant selection. To meet the criteria, participants needed to be currently teaching mathematics in Grade K-5 in a U.S. school and have at least 1 year of teaching experience. These criteria supported the selection of participants who have experience with mathematics PD in the desired grade level.

Limitations

This study has three limitations. The first limitation was that the research does not include observations of teachers' instructional practices prior to or following engagement with a PD activity. The second limitation was that the sample consisted of only eight Grade K-5 teachers. The small sample allowed me to gather rich and detailed insight regarding a specific phenomenon from selected individuals (see Ravitch & Carl, 2016). Even though selecting participants who fit a certain set of criteria will increase the chances of gathering relevant data for the study, the small number of participants could limit the amount of data received. The third limitation was researcher bias. I have personal experience teaching mathematics content in the elementary and middle grades

setting. With my years of experience mentoring new teachers and facilitating department meetings, I place value in the PD process and content focused PD as a means to meet mathematics teachers' specialized needs. In order to prevent researcher bias, I employed participant validation strategies to verify participants' responses and ensure accurate understanding (see Ravitch & Carl, 2016).

Significance

This study is significant in that it addressed a gap in practice in the professional learning experiences that teachers are provided through their school districts. As researchers have noted, these experiences do not always fully meet teachers' professional needs (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019; Swars & Chestnutt, 2016). Teachers' perceptions regarding the PD they engage in could provide insight into specific components that promote collaboration, increased content knowledge, valuable strategies, and real-time feedback, all of which can encourage PD that is tailored to teachers' specific needs (see L.E. Martin et al., 2019). Stakeholders such as principals and district instructional leaders could potentially use this knowledge of teachers' perceptions to develop more effective district PD plans and programs.

This study has the potential to effect positive social change by providing an understanding of the components of PD that teachers view as most supportive. Ensuring that elementary mathematics teachers have the specialized support they need can enable them to be more effective practitioners (Desimone & Pak, 2017). An increase in teacher effectiveness has the potential to positively influence student achievement. Mathematics achievement is important because it can strengthen a student's potential to be successful

in subsequent grades (Campbell & Griffin, 2017). Perceptions of PD could also inform a strong professional community that has the potential to increase teacher job satisfaction and possibly decrease teacher attrition. Teachers who are satisfied in their roles are likely to experience greater enjoyment and increased self-efficacy (Madigan & Kim, 2021). The structure of teaching has changed over the years and has brought about an increase in teaching hours and demands. Some teachers have also experienced more constraints and a decrease in autonomy in their teaching roles (Madigan & Kim, 2021). These factors can lead teachers to believe they are not receiving the support they need and confront them with the choice of leaving their current school or the profession (Madigan & Kim, 2021). Retaining quality teachers, by providing PD that best fits their needs, could impact the surrounding community, including families, community members, and educators; if teachers choose to continue working in the same school for multiple years, this could provide consistency for students and families.

Summary

In Chapter 1, I outlined the major elements of the study. The problem that was addressed in this study was that Grade K-5 teachers in the United States are not getting the mathematics support they need from the PD activities offered by their school districts. The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support mathematics instruction. I developed the study's research question, in line with the purpose of the research, to gain an understanding of how teachers perceive their PD

experiences. This research was based on the adult learning theory of andragogy, which views adult learners as self-directed and autonomous (Knowles, 1984).

A basic qualitative research model was appropriate for this study as it allowed me to explore perceptions and gain insights into teachers' experiences. Assumptions included participating teachers had experience with various forms of PD, had varying levels of teaching experience, and were part of schools with differing characteristics. The scope of the study included eight teachers who were teaching mathematics in Grade K-5 at the time of the study. The participants were recruited based on inclusion criteria to ensure that they met the selection standards. Limitations of the study include that schools may implement forms of PD in various ways and that the study was focused on exploring teachers' perceptions of PD not on observations of instructional practices.

This study has potential to contribute to positive social change by increasing understanding of the types of PD teachers find beneficial and supportive. Educational leaders may be able to devise more effective PD plans with this knowledge. A strong professional community can foster a productive learning environment for teachers leading to higher student achievement and a higher retention rate for teachers (Banerjee et al., 2017). The school community and society, by extension, might benefit from an understanding of teachers' perceptions of the PD they are provided. Teacher retention could also increase with an understanding of what teachers desire in terms of professional support. By providing resources, including teachers in decision making, and providing PD programs to equip teachers, schools can work increase a teacher's job satisfaction (Madigan & Kim, 2021). Continuity of teaching staff could be beneficial for all

stakeholders including students, families, and other educational staff (Madigan & Kim, 2021).

In Chapter 2, I provide an overview of the literature regarding PD. In the literature review, I will examine different forms of PD and components of effective PD. I also discuss the specialized needs of Grade K-5 mathematics teachers. In the chapter, I provide an overview of literature detailing the support that schools should be providing Grade K-5 teachers in their PD programs.

Chapter 2: Literature Review

The problem that was addressed in this study was that Grade K-5 teachers in the United States are not getting the mathematics support they need from the PD activities they are provided by their school districts. The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support mathematics instruction. Educational reform initiatives at the national and local level have influenced mathematics education and instructional practices (Barrett-Tatum & Smith, 2018; Dennis, 2017; Fillippi & Hackmann, 2019). Reform initiatives and other factors can influence an elementary teacher's ability to effectively teach mathematics (Hill et al., 2019; Kutaka et al., 2018). One factor is that most elementary teachers are generalists, meaning they may graduate their certification program lacking specialized training in mathematics, preventing them from having a deep understanding of the content (Campbell & Griffin, 2017; Swars et al., 2018).

Another factor is the change in mathematical standards that teachers are required to teach. Many standards have undergone revision in recent years creating a demand for teachers to gain a more thorough understanding of the standards the instructional strategies necessary to effectively teach them (Barrett-Tatum & Smith, 2018; Fillippi & Hackmann, 2019). Last, the type and level of support provided to teachers can be a major factor in teacher effectiveness (Barrett-Tatum & Smith, 2018; C. Martin et al., 2019; L. E. Martin et al., 2019). The PD offered by districts and school administration often consists of 1-day workshops, lacks the components of effective PD, and does not always include job embedded continuous support (Cavazos et al., 2018; Tanner et al., 2017;

Vangrieken et al., 2017). In contrast, PD opportunities that are structured to include continuous support and have a relevant connection to a teacher's classroom needs have shown to be more effective methods of PD (Desimone & Pak, 2017; Russell, Correnti, Stein, Thomas, et al., 2020).

Many teachers see the value of PD and the potential it has to help them grow in their mathematical knowledge and use of instructional strategies, yet they do not always receive PD that is effective and beneficial (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019). In this chapter, I will review the current literature relating to the PD opportunities elementary mathematics teachers receive and find effective. This chapter will also include overviews of the literature search strategy used to obtain literature related to the topic of mathematics PD and the conceptual framework as it relates to the research literature.

Literature Search Strategy

To find current literature related to my research problem, I searched several databases available from the Walden University Library, along with the search engine Google Scholar. These databases included Education Source, Eric, Academic Search Complete, Taylor & Francis Online, APA PyschInfo, and Primary Search. To gather articles that fit the study, I used inclusion criteria that entailed that all articles be (a) published in the English language, (b) peer reviewed, (c) conducted in the United States, and (d) published between 2017 and 2021. I excluded studies that were not published in the English language or conducted in the United States. I chose this criterion because I

wanted the studies I reviewed and used as a basis for my literature review to be similar to the population used for my study.

I used the following key words to search for literature related to the PD needs and experiences of Grade K-5 elementary mathematics teachers: *professional development*, *in-service training*, *continuing education*, *instructional strategy*, *instructional method*, *elementary*, *primary*, *mathematics*, *mathematics education*, *teacher perceptions*, and *teacher needs*. My searches yielded between 600 and 2,000 results each. As I searched through the articles, I downloaded the ones that fit the inclusion criteria and added to my understanding of the research topic and began recording notes from them. I was able to find 65 articles that fit the specific criteria for the study. In exploring the articles, I was able to identify experts in the field of PD. I then searched for additional articles that the experts had authored that fit my inclusion criteria. I compiled the important findings from the collection of articles into a synthesis matrix, which enabled me to keep track of the relevant findings from studies conducted on mathematics PD as well as note the new emerging topics surrounding mathematics PD. Once I had reviewed all of the articles that fit my inclusion criteria and no new articles surfaced, I chose to begin writing my literature review using the 58 sources I had found.

Conceptual Framework

Knowles (1975) framed andragogy, an adult learning theory involving the art and science of teaching adults, in his seminal work. Andragogy is an adult learning theory that differs from pedagogy, the art and science of teaching children (Knowles, 1975). Andragogy is based on the premise of adults having innate qualities to direct and

encourage their own learning. According to Knowles, these qualities include a need to be self-directed, able to effectively analyze their learning experiences, be encouraged to learn based on current situations, and have the desire to immediately apply what they have learned. These qualities help to provide a framework for PD design.

It is important to note the difference between pedagogy and andragogy because each has the potential to influence a targeted set of learners (Knowles, 1980). Knowles noted that in some more traditional views of pedagogy, the role of the learner is dependent on the one providing the learning. Furthermore, the experience the learner brings into the lesson may not translate into a resource for learning. Additionally, the motivation to learn may be based on external motivators and learning may be viewed as merely accumulating subject knowledge. However, this is not a universal notion of pedagogy with many student-centered instructional practices present in today's classrooms (Keiler, 2018). Vygotsky (1978) advocated for the teacher to serve as a facilitator of learning, using the zone of proximal development to increase the quality of learning, along with incorporating cooperative learning structures. Still, traditional pedagogical assumptions have been the basis for many PD opportunities, including the 1-day traditional style workshop, which has not been found to be an effective form of adult learning (Clark et al., 2018; Noonan, 2019; Vangrieken et al., 2017). In contrast, andragogy provides a differing view of learning as it relates to adults, providing opportunities for relevance and reflection (Kraft & Hill, 2020; Powell & Bodur, 2019).

Andragogy is based on five assumptions that place the learner in a position of being part of the learning, not just receiving the learning (Knowles, 1980). These

assumptions include adult learners often experience a shift from dependence to self-responsibility in learning situations. Additionally, adults have a collection of experiences that contribute to learning, which helps guide their learning as new tasks and problems arise. Other assumptions are that adults are often task-oriented in their learning, meaning learning is more effective when focused on current issues and an adults' learning is influenced by internal motivators based on a need for self-fulfillment (Knowles, 1980). Last, adults are able to provide meaningful feedback and input regarding their learning experiences and appreciate the ability to apply new knowledge immediately (Knowles, 1980). Gaining an understanding of how andragogy differs from pedagogy can provide insight into beneficial PD activities (Appova & Arbaugh, 2018).

Using andragogical assumptions to inform the development and implementation of PD opportunities for teachers can encourage the design of effective PD (Knowles, 1975; C. Martin et al., 2019; Powell & Bodur, 2019). For example, educational leaders have designed instructional coaching programs based on insights from andragogy (Kraft & Hill, 2020). Kraft and Hill (2020) designed an instructional coaching cycle that encourages self-directed learning. Teachers choose the area and practice in which they would like feedback and coaching on. In this cycle, the conversation between instructional coach and teacher is based on the teacher's self-reflection and analysis of their teaching. These activities are in line with andragogical assumptions and have seen positive results in schools (Kraft & Hill, 2020). A study conducted by Appova and Arbaugh (2018) showed that a teacher's motivation to learn is based in part on their need for self-directed learning. On-the-job embedded PD learning opportunities can provide an

avenue for teachers to engage in activities that directly relate to their individual classroom context. An engaging format makes it more likely that teachers will be able to learn and apply new learning to their specific classroom needs. Powell and Bodur (2019) found evidence that PD should not take a one-size-fits-all approach to adult learning. This study found that several factors influence a teacher's learning needs, such as length of teaching experience, expertise, and classroom context. These findings echo andragogical principles showing that the personal experiences of the learner can inform learning experiences and provide opportunities for immediate applicability.

PD designers can apply the assumptions of andragogy when structuring PD activities (Smith & Robinson, 2020). The methods and techniques of teacher PD can be shaped by a deep understanding of how adults learn. Not only should the materials and learning in PD have direct relevance to a teacher's professional needs but teachers should also have a voice in the planning and facilitating of PD opportunities (Smith & Robinson, 2020). Knowles (1984) emphasized the importance of an adult learner's input on learning options as well as the importance of active participation and dialogue. This understanding of adult learning can enable PD opportunities to address multiple objectives along with meeting the needs of the learners (C. Martin et al., 2019; Smith & Robinson, 2020).

I concluded that the adult learning theory of andragogy was appropriate for exploring the PD that elementary mathematics teachers receive. Elementary mathematics teachers have specialized needs in terms of mathematics PD due to their academic background and the changing standards in mathematics (Hill et al., 2019; Swars et al., 2018). Even though many elementary teachers appreciate the learning they experience

through PD opportunities, they do not always receive the PD that fits their individualized needs via district-provided PD (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019). Andragogy can provide a beneficial framework for PD design and evaluation (C. Martin et al., 2019; Powell & Bodur, 2019).

Literature Review Related to Key Concepts and Variables

Professional Development

In the United States, school leaders spend tens of billions of dollars each year on PD to help teachers meet the needs of their students (Kraft et al., 2018). These investments in teacher learning have yielded limited results (Kraft et al., 2018; Noonan, 2019). The need for PD opportunities for teachers continues to grow as expectations for student growth and achievement increases. Expectations for teachers to teach new standards and incorporate higher order thinking activities into their instruction has prompted school leaders to offer PD activities with the intention of strengthening teachers' practice.

Generally, schools, districts, and educational centers organize and provide PD (Wake & Mills, 2018). PD can take a variety of forms and be utilized for many reasons. One reason teachers participate in PD is to complete PD hours in order to keep their teaching certificate up to date (Wake & Mills, 2018). Another reason includes a school district requirement. Some PD is required or mandated by a teacher's school district, and some is sought by the teacher to fulfill a personal desire for professional growth (Sprott, 2019). Although PD is intended to improve teachers' instructional practice, not all PD

activities are considered by teachers to be effective and beneficial (C. Martin et al., 2019; Osman & Warner, 2020).

Traditional Professional Development

PD activities provided to teachers by school districts often take the form of traditional 1-day workshops in which a group of teachers are presented with information on a program, initiative, or strategy (Wake & Mills, 2018). This form of PD saw an increase in use with the implementation of the No Child Left Behind Act of 2001 due to its cost effectiveness and time efficiency in training teachers in reform initiatives (Clark et al., 2018; Darling-Hammond et al., 2017; Wake & Mills, 2018). These workshops are often held outside of the teacher workday and focus on general topics instead of on specific teacher's needs and classroom contexts (Camburn & Won Han, 2017; Wake & Mills, 2018). Although group forms of PD such as 1-day workshops can encourage coherence across a school or school district regarding policy implementation, they have not shown to provide an increase in teacher knowledge and do not encourage professional learning (Clark et al., 2018; Darling-Hammond et al., 2017; Noonan, 2019; Vangrieken et al., 2017). Given that traditional PD often takes a one-size-fits-all approach to PD, it lacks critical components, such as the opportunity for reflection and continued support (Tanner et al., 2017; Wang, 2017). In contrast, effective PD involves teachers participating in a PD activity that provides active learning time and continuing support (Pak et al., 2020).

Professional Development Opportunities

Teachers participate in PD in a variety of ways. Whether the PD is mandated by the school district or chosen by the teacher, professional learning can take various forms. Teachers can attain professional growth through avenues such as university courses, professional conferences, and informal conversations with colleagues (Wake & Mills, 2018). However, the most common forms of PD provided to teachers by school districts include instructional coaching, workshops, online activities, and professional learning communities (Rotermund et al., 2017).

The focus of PD can also vary. Common themes include content, technology, strategies for reading instruction, classroom management, and teaching strategies for students with disabilities and English language learners (Rotermund et al., 2017). PD can also focus on national reforms, curriculum, research-based initiatives, and assessment (C. Martin et al., 2019). However, with the multitude of available topics and methods of PD, many teachers are not receiving the PD they need (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019). Teachers have reported spending varying amounts of time engaging in different PD opportunities with inconsistent results on teacher professional growth as a result of them (Jacob et al., 2017; Kraft et al., 2018).

Instructional Coaching. Instructional coaching is a multifaceted approach to professional learning (Desimone & Pak, 2017; Kurz et al., 2017). Instructional coaches can either work one-on-one with certain teachers or with grade-level and content area teams for the purpose of improving their instructional practice (Campbell & Griffin, 2017; Desimone & Pak, 2017; Kraft & Hill, 2020). Educational leaders have used

instructional coaching programs for the purposes of mentoring new teachers, garnering support for implementing new programs, and supporting classroom instruction. Notably, instructional coaching differs from traditional 1-day workshops because it provides ongoing support throughout the school year (Desimone & Pak, 2017; Wang, 2017). One advantage of instructional coaching programs is that coaches have the ability to vary their approach to working with teachers (Kraft et al., 2018; Tanner et al., 2017). For example, coaches can design their instructional support for teachers based on the teacher's needs rather than providing a general training to the whole faculty that does not include individualized support (Kraft et al., 2018; Wang, 2017). Additionally, coaching programs provide a support system that allows teachers to apply new information and skills in their current instruction with the help of their coach (Kraft et al., 2018; Wang, 2017).

Instructional coaching programs that focus on content areas such as mathematics have been found to be effective for teacher professional learning (Desimone & Pak, 2017; Russell, Correnti, Stein, Thomas, et al., 2020). Programs that include elementary mathematics coaches allow instructional coaches to engage teachers in conversations focused on mathematics content, research based instructional strategies for mathematics, and knowledge of students (Campbell & Griffin, 2017; Russell, Correnti, Stein, Bill, et al., 2020; Tanner et al., 2017). In addition, instructional coaches are often on-site which allows them to be easily accessible to teachers on campus, providing just in time support with mathematics learning standards (Campbell & Griffin, 2017; Cavazos et al., 2018; Russell, Correnti, Stein, Bill, et al., 2020). However, instructional coaching programs that focus solely on mathematics instruction have been implemented in schools less

frequently than literacy coaching programs (C. Martin et al., 2018, 2019; Russell, Correnti, Stein, Bill, et al., 2020).

Mathematics instructional coaching has been viewed as a valuable support by teachers (Hopkins et al., 2017; Russell, Correnti, Stein, Thomas, et al., 2020; Sprott, 2019). Teachers have noted the value of coaching activities that involve collaboration and reflection (Hopkins et al., 2017). Additionally, teachers appreciate the long-term support coaching provides (Hopkins et al., 2017). Even though instructional coaching has had positive effects on both teaching practices and student learning in some cases, not all coaching programs are effective (Kraft et al., 2018; C. Martin et al., 2019; Russell, Correnti, Stein, Bill, et al., 2020). One factor that can negatively affect a coaching program is choosing coaches who may have been effective teachers but lack the specialized skills needed to provide support in a coaching role (Russell, Correnti, Stein, Thomas, et al., 2020). Furthermore, inadequate training on coaching practices and barriers to implementing and sustaining a coaching program can be detrimental to an instructional coaching program (Monroe & Marvin, 2020; Russell, Correnti, Stein, Thomas, et al., 2020). Given these points, instructional coaching programs have the potential to be effective forms of PD if conducted correctly (Russell, Correnti, Stein, Thomas, et al., 2020).

Online Professional Development. Online PD opportunities include virtual trainings, social media groups, online video libraries, podcasts and blended activities (Beach, 2017; Parsons et al., 2019). Notably, the focus often mirrors what is offered with other forms of PD including topics such as content, technology use, mandated school

safety trainings, and assessment training with the advantages of ease of access, availability, and convenience being the reasons teachers might prefer this form on PD over another (Parsons et al., 2019). In fact, most teachers have participated in some form of online PD either by choice or school requirement (Parsons et al., 2019).

Teachers' views on participating in online PD vary (Lantz-Anderson et al., 2018; Leubeck et al., 2017; Owens et al., 2018; Parsons et al., 2019). Technology advances and accessibility have caused online PD to be an appealing option for teachers (Leubeck et al., 2017; Parsons et al., 2019). For example, online communities offer teachers a forum to engage in reflective conversations with other teachers which fosters a community of collaboration (Lantz-Anderson et al., 2018; Parsons et al., 2019). A further illustration includes active online learning opportunities that allow teachers to build their mathematical content knowledge (Leubeck et al., 2017). Lastly, online courses encourage teachers to interact in discussion boards and provide timely feedback which has proved to be beneficial (Leubeck et al., 2017). To sum up, online PD is generally perceived as a positive experience when feedback is provided, includes hands-on activities, and provides opportunities for collaboration between teachers (Leubeck et al., 2017; Powell & Bodur, 2019).

Although some teachers enjoy the convenience of online PD, others do not feel it is beneficial for them (Owens et al., 2018; Parsons et al., 2019). Despite the convenience and accessibility of online PD resources, some teachers prefer face to face PD opportunities (Leubeck et al., 2017; Owens et al., 2018). The presence of discussion boards, online communities, courses, and resources do not ensure quality of PD, only

quantity (Lantz-Anderson et al., 2018; Powell & Bodur, 2019). Instead of active participation, some teachers passively complete videos and webinars without reflection or feedback (Lantz-Anderson et al., 2018; Leubeck et al., 2017). Social interaction and active learning are components of effective PD (Desimone & Pak, 2017; Pak et al., 2020). Consequently, online PD opportunities that incorporate elements such as reflection and active learning into their design generally prove to be more effective (Powell & Bodur, 2019).

Professional Learning Communities. Professional learning communities allow teachers to participate in PD in smaller communities (C. Martin et al., 2019). Rather than a whole staff group participating in a 1-day workshop, teachers meet in communities of grade level or content area teams for the purpose of improving teaching and learning (Carpenter, 2017; Fillippi & Hackmann, 2019; C. Martin et al., 2019). Specifically, professional learning communities allow educators to collaborate on instructional decisions, evaluate student learning, and formulate plans for monitoring and adjusting instruction (Carpenter, 2017). Common characteristics of professional learning communities include shared leadership and decision making, collaborative inquiry, shared practice, accountability, and evolving relationships are the key components of a professional learning community. Consequently, professional learning communities have become a popular form of PD among schools (Carpenter, 2017).

Professional learning communities can help improve student engagement and the overall performance of a school as well as increase the efficacy of educators in subjects such as mathematics (Carpenter, 2017; DuFour & Fullan, 2013; Spillane et al., 2018).

One way in which professional learning communities enable teachers to grow in their mathematical instructional practice is through active participation (Matherson & Windle, 2017; Spillane et al., 2018). Active learning activities such as discussion, reflection, and collaboration often take place in a professional learning community with the added support of an administrator or instructional specialist (Hopkins et al., 2017; C. Martin et al., 2019; Spillane et al., 2018). Furthermore, these communities have the potential to build a risk-free environment where teachers are comfortable sharing true concerns, promoting effective learning (Korthagen, 2017).

Although there is evidence of professional learning communities proving effective, this effectiveness varies (Lantz-Anderson et al., 2018; C. Martin et al., 2019). In settings where professional learning communities have been viewed as successful, there has been appropriate focus and structure (Carpenter, 2017; C. Martin et al., 2019). For instance, the frequency of the professional learning community meetings and the expectations for participation are some determinants for the effectiveness of the meeting (C. Martin et al., 2019). Additionally, the content focus of a professional learning community will influence effectiveness (C. Martin et al., 2019). In particular, teachers have noted the lack of mathematics content focus in the professional learning communities they have participated in (C. Martin et al., 2019). To be effective, professional learning communities must be structured so that educators can learn and grow through the collaborative efforts of the educational team (Carpenter, 2017).

Components of Effective Professional Development

Content focus, active learning, coherence, sustained duration, and collective participation are all components found in effective PD programs (Desimone & Pak, 2017; Pak et al., 2020). Each of these components contribute to a PD experience that encourages more effective learning for teachers. By incorporating the components of effective PD into PD opportunities, the potential to make learning endure and applicable to classroom contexts increases (Desimone & Pak, 2017; Pak et al., 2020). It is important to note these components work best when combined in effective structures and might yield fewer effective results if implemented independently (Desimone & Pak, 2017; Griffin et al., 2018; Heck et al., 2019).

Including a content focus in PD can yield many benefits (Camburn & Won Han, 2017; Desimone & Pak, 2017; Heck et al., 2019; Pak et al., 2020). A content focus can increase a teacher's understanding of the content and in turn increase a teacher's confidence in the subject area (Kutaka et al., 2018; Pak et al., 2020). Increasing confidence is important because teachers who have less anxiety towards teaching mathematical content tend to see greater increases in student achievement due to a greater confidence in mathematics instruction (Kutaka et al., 2018). Notably, teaching mathematics requires a deep understanding and mastery of content knowledge which can be increased through content focused PD (Desimone & Pak, 2017; Noonan, 2019). Consequently, PD programs that have a content focus have shown to have considerable influence on student learning (Desimone & Pak, 2017).

PD is most effective when teachers have active learning opportunities to practice new strategies and receive feedback on their practice (Desimone & Pak, 2017; Pak et al., 2020). Feedback and observations have been some of the most desired components of PD by teachers (Kutaka et al., 2018; Owens et al., 2018). Explicit feedback based on diverse data sources, such as observations and student work samples, provides effective learning opportunities for teachers to reflect and refine practice (Desimone & Pak, 2017; Kutaka et al., 2018).

Coherence or alignment of PD with mathematical content standards, district curriculum, and lessons encourages the incorporation of new learning into instructional practices (Desimone & Pak, 2017; Hopkins et al., 2017). Not only does alignment provide a defined path for the implementation of new learning, since it does not leave teachers to make instructional decisions without support, it also provides a timely connection to specific classroom contextual needs of teachers (Desimone & Pak, 2017; Kutaka et al., 2018). Furthermore, coherence enables teachers to align their content and activities with the school's curriculum and goals which in turn helps meet the needs of students and aligns work with district and state policies (Pak et al., 2020).

Sustained duration is important in PD (Desimone & Pak et a., 2017; Liu & Phelps, 2020). Teachers' PD hours can be maximized by providing them ongoing opportunities to learn and then practice instructional strategies (Pak et al., 2020). Specifically, the number of PD hours and sessions will affect the effectiveness of PD opportunities (Desimone & Pak, 2017; Kutaka et al., 2018; Liu & Phelps, 2020). Common methods of ensuring sustained PD hours include weeklong summer sessions

with follow-up sessions through the school year and on the job embedded PD such as instructional coaching and professional learning communities (Desimone & Pak, 2017; Liu & Phelps, 2020).

Building collective participation with communities of learning through PD activities can encourage conversation, collaboration, and reflection (Desimone & Pak, 2017; Kutaka et al., 2018; Noonan, 2019). For example, groups comprised of teachers from the same grade level, content area, or across grade levels can participate in PD activities together in learning communities where they can analyze data, plan, and share ideas (Carpenter, 2017; Pak et al., 2020). The development of a productive learning environment can encourage a shared vision among educators in a school as well as a shared commitment and responsibility for the learning of students (Desimone & Pak, 2017; Owens et al., 2018).

Influences on Mathematics Instruction

There are several national reform initiatives that have had and continue to have an influence on mathematics instruction. One of the most controversial is the Common Core State Standards Initiative (see Deas, 2018). Proponents for the CCSS stated the need for uniform standards across the nation while opponents stated a one size fits all approach to education might not be most beneficial (Deas, 2018). Regardless of the opinions on both sides of the issue, 41 states have adopted the CCSS with reactions from parents, educators, and state entities being mixed on the CCSS, and with some states deciding to withdraw their support and not implement the CCSS (Common Core State Standards Initiative, 2021; Deas, 2018; Fillippi & Hackmann, 2019).

The development of the CCSS was based on the desire for more standardization of learning standards across the nation in response to the concern that the previous individual state standards were not fully preparing students for college and career expectations (Barrett-Tatum & Smith, 2018; Common Core State Standards Initiative, 2021; Russell, Correnti, Stein, Thomas, et al., 2020). The CCSS initiative began in 2007 and continued to evolve based on feedback from the public and educators (Common Core State Standards Initiative, 2021). The intention for the CCSS was for teachers to focus on developing critical thinking and problem-solving skills while teaching in a way that encourages conceptual understanding and analysis rather than rote procedures (Common Core State Standards Initiative, 2021). Additionally, the CCSS intended to provide a narrowed and deepened approach to mathematics instruction while focusing on increasing the rigor of content and application using higher order thinking (Deas, 2018; Fillippi & Hackmann, 2019). Significantly, the instructional methods necessitated by CCSS were different from those of traditional teaching strategies that had been considered best teaching practices (Fillippi & Hackmann, 2019). It is important to realize that with this shift in mathematics instruction there was a need for PD in order for teachers to gain an understanding of the new standards, how they compared to old standards, and how to best implement them (Common Core State Standards Initiative, 2021; Schweig et al., 2020). PD opportunities for CCSS varied across states and districts, leaving many teachers without the support they needed to implement the new standards (Barrett-Tatum & Smith, 2018; Deas, 2018; Schweig et al., 2020).

With the implementation of No Child Left Behind (NCLB) in 2002, an emphasis was placed on exposing achievement gaps in underserved students and accountability measures were implemented (Dennis, 2017; U.S. Department of Education, 2015a). With a heavy focus on accountability in NCLB some argued instruction suffered because educators were heavily focused on improving test scores (Hunter, 2019). Not all students were showing success on assessments further proving that without an adjustment to instructional methods to encourage higher order thinking, students are not as likely to succeed with higher order questions on assessments (Hunter, 2019). Even though there was a need for instructional support to meet new instructional demands, NCLB did not have a large focus on continued PD for teachers (Dennis, 2017). The desire to focus on the success of all students, which began with NCLB, encouraged the conversation necessary to begin improvements in the accountability realm of education (U.S. Department of Education, 2015a). Revisions were later made that allowed states to have more say in the development of state education plans (Polikoff, 2017; U.S. Department of Education, 2015a).

The enactment of Every Student Succeeds Act (ESSA) continued the revised approach of NCLB by allowing states to have more control over their educational decisions (Fillippi & Hackmann, 2019; Polikoff, 2017; Urick et al., 2018). ESSA brought change to previous educational reform initiatives with the intention for all students to receive instruction of the highest standard while advancing equity (Urick et al., 2018; U.S. Department of Education, 2015b). Consequently, the need for instructional strategies to effectively teach all students at high standards, so they could be successful in

college and career settings, increased the need for teacher professional support (Dennis, 2017; Pak et al., 2020). Notably, the ESSA encouraged support through continuous professional learning opportunities for teachers that were based on principles of effective PD and effective teaching (Dennis, 2017; Pak et al., 2020).

Elementary Mathematics Teachers' Professional Development Needs

Student Achievement in Mathematics

Many school districts are concerned with low student test scores in mathematics and face continuous demands to meet changing expectations and accountability measures (Campbell & Griffin, 2017; L. E. Martin et al., 2019). Based on the 2018 Program for International Student Assessment mathematics literacy results, the United States ranked lower than 30 other educational systems among a total of 77 educational systems from around the world (Schleicher, 2019). Markedly, education reform initiatives are often developed to address the presumed causes of low student achievement (L. E. Martin et al., 2019). It is important to note that the probability for a student's growth in mathematics during a school year is determined by the mathematics teaching and learning in previous years granting that student achievement can be influenced by multiple factors (Campbell & Griffin, 2017).

The context of a school and classroom can greatly influence student achievement in mathematics and is a significant component in school reform (L. E. Martin et al., 2019; Merritt et al., 2017). It is important for teachers to have knowledge of their students and their individualized needs (Hill & Chin, 2018; Merritt et al., 2017). Moreover, effective PD can help foster a teacher's awareness of student needs and ways in which to meet

those needs (Hill & Chin, 2018). However, many schools and PD developers do not take school context into consideration when designing PD opportunities (Gibbons & Cobb, 2017; L. E. Martin et al., 2019; Sprott, 2019). As a matter of fact, having an understanding of the classroom context and instructional needs can foster an environment where student learning can increase (Kraft et al., 2018; L. E. Martin et al., 2019). Additionally, a professional community that encourages collaboration, continuous learning, and collegiality can produce an environment that results in increased job satisfaction for elementary mathematics teachers which can also play a role in student achievement (Banerjee et al., 2017; Wang, 2017).

Mathematical Knowledge of Teaching

A teacher's knowledge of content combined with pedagogical knowledge and knowledge of students can determine the effectiveness of a teacher and their potential influence on student learning (Heck et al., 2019; Hill et al., 2019). Combining these components, mathematical knowledge of teaching was defined in the seminal work of Hill et al. (2008) as the mathematical knowledge teachers use to enact instruction and encourage student growth. Ekmekci et al. (2019) broke mathematical knowledge of teaching into two main components, content knowledge and pedagogical content knowledge. Within these components teacher can possess common content knowledge of mathematics, specialized content knowledge, and pedagogical knowledge (Ekmekci et al., 2019). In order to be effective with mathematics instruction, teachers must have more than mere content knowledge, they must combine content knowledge with pedagogical

knowledge to evidence an understanding of how content knowledge informs their instructional practices (Ekmekci et al., 2019; Gibbons & Cobb, 2017; Heck et al., 2019).

Mathematics knowledge of teaching includes a specialized set of skills and information used to influence instructional practices (Kutaka et al., 2018). As a result, elementary mathematics instruction and student experience is heavily dependent on the mathematics content knowledge of the teacher (Campbell & Griffin, 2017; Heck et al., 2019; Hill et al., 2019). Elementary mathematics teachers come into the teaching profession with varying levels of mathematical content knowledge (Ekmekci et al., 2019; Hill et al., 2019). Teacher candidates often finish their teacher preparation program as a generalist, meaning they are certified to teach all subjects in the elementary grades (Campbell & Griffin, 2017; Eichhorn & Lacson, 2019; Hill et al., 2019; Swars et al., 2018). Generalists typically have not taken specialized content courses in areas such as mathematics and can have limited knowledge in the subject (Campbell & Griffin, 2017; Hill et al., 2019). The amount of specialized content training the teacher has had and their mathematical knowledge of teaching have been found to be those most influential teacher factors on a student's success (Ekmekci et al., 2019; Hill et al., 2019). Although years of teaching experience can help grow mathematical knowledge of teaching, novice teachers have not yet necessarily had the opportunity to grow theirs. As a result, teachers without a strong mathematical knowledge of teaching may not provide students with rigorous questioning and learning that is necessary for student achievement with mathematical learning standards (Hill et al., 2019; Swars et al., 2018).

There is a need for elementary mathematics teachers to possess a deep understanding of the content they teach along with having the capacity to be responsive to students' needs (Hill et al., 2019; Kutaka et al., 2018). PD can provide training and support for teachers who need to increase their mathematical knowledge of teaching (Ekmekci et al., 2019; Heck et al., 2019; Kutaka et al., 2018; C. Martin et al., 2018). PD programs that have a content and pedagogical focus allow teachers to integrate new learning into their classroom context which can influence student achievement (Hill et al., 2019; Kutaka et al., 2018; Leubeck et al., 2017; Swars et al., 2018). PD opportunities that have focused on mathematical content have resulted in an increase in teacher confidence and motivation as well as an increase in student-centered learning practices (Kutaka et al., 2018; Swars et al., 2018). Although, teachers have noted the effectiveness of PD in improving mathematical content knowledge and instructional strategies, they do not always receive PD that consistently meets their mathematical needs (Heck et al., 2019; C. Martin et al., 2018).

Teachers' Involvement in Professional Development Design

PD opportunities for teachers are often mandated by school districts. Although district mandated programs are often implemented with the intent of meeting a need, being a solution to a problem, or implementing a research-based strategy to encourage student success, they can be a source of frustration for teachers (L. E. Martin et al., 2019; Sprott, 2019). In a study conducted by Sprott (2019) teachers evidenced that at times district mandates interfered with their ability to meet the needs of their students due to the lack of association between the classroom context and mandate requirements. Decisions

relating to the development of district mandates do not always include teacher input yet necessitate changes in a teacher's instructional practice (L. E. Martin et al., 2019; Sprott, 2019). L. E. Martin et al. (2019) found evidence of district programs being mandated in response to low test scores. In response to low test scores, a pre-determined prescriptive program was mandated for teachers to implement without an opportunity for them to collaborate and reflect on the scores as they relate to their instructional practices (L. E. Martin et al., 2019). Providing a chance for teachers to reflect could have enabled them to develop a plan of improvement based on their specific students' needs (L. E. Martin et al., 2019). Notably, a lack of teacher input can be a barrier to successful program implementation (Leubeck et al., 2017; L. E. Martin et al., 2019).

Teachers are not always given a voice in the PD activities they participate in. PD activities are often decided upon and required by district officials or campus administration without the input of the teachers who attend them and have the potential to glean new learning from them (C. Martin et al., 2018, 2019; Wake & Mills, 2018). The lack of teacher buy-in can be a barrier to any PD opportunity (Monroe & Marvin, 2020). For example, if teachers are unable to contribute to the PD design process, they may lack ownership and may find the PD is not aligned to their specific classroom needs (C. Martin et al., 2018; L. E. Martin et al., 2019). In contrast, teachers who have the ability to influence the content and structure of PD opportunities have the potential to experience productive learning opportunities (Wake & Mills, 2018). PD developers, such as campus and district administration, must establish and maintain infrastructures at the district and campus level for teachers to provide input into the PD they believe they need as well as

ensuring support is consistently available for teachers (Banerjee et al., 2017; Rigby et al., 2018; Shirrell et al., 2019).

Campus leadership sets the tone for the PD provided at the campus level with the professional learning community structures they put in place as they can have influence on the level of participation and fidelity of implementation (Banerjee et al., 2017; Owens et al., 2018; Shirrell et al., 2019). A disconnect between programs initiated by administration and the needs of the teachers implementing the programs can sometimes be found (Rigby et al., 2018). It is imperative that those making the decisions regarding PD opportunities take classroom context, teachers' needs and time into consideration (Leubeck et al., 2017; Monroe & Marvin, 2020). For PD opportunities to be viewed as a benefit by teachers and not a burden, they must be designed to make the most efficient use of time and resources while providing relevance to their current classroom contexts (Leubeck et al., 2017; L. E. Martin et al., 2019). Notably, an increase in collaboration and professional community in a school has the potential to increase job satisfaction among teachers and could in turn increase student achievement (Banerjee et al., 2017).

Summary and Conclusions

Elementary mathematics teachers have specialized needs when it comes to PD intended to support mathematics instruction (Kutaka et al., 2018). In efforts to meet these needs and other requirements, districts and schools provide PD opportunities to teachers every year based on educational mandates, new initiatives, and a variety of other topics (Kraft et al., 2018). Notably, components of effective PD can be integrated into the design of PD opportunities which can increase the effectiveness of PD opportunities

(Kraft et al., 2018). Moreover, there are several factors that can influence the need for mathematics PD (Ekmekci et al., 2019). For example, changes in mathematical standards at the national and state levels cause a shift in mathematical content as well as a shift in instructional strategies used by teachers (Spillane et al., 2018). These changes coupled with the academic background of generalist elementary teachers create a need for specialized PD in mathematics (Spillane et al., 2018; Swars et al., 2018). Correspondingly, teachers should have input in the PD they participate in to encourage relevance and connection to individual needs (L. E. Martin et al., 2019).

Studies have shown teachers appreciate and value the knowledge gained through effective PD opportunities (C. Martin et al., 2019). It is important to note, teachers have individualized learning needs based on experience, expertise, and classroom context (Ekmekci et al., 2019). These factors should be taken into consideration when designing PD activities. However, this is not always the case (C. Martin et al., 2019; L. E. Martin et al., 2019). Many teachers note they do not receive beneficial PD that supports them in their mathematics instruction. More needs to be known about the perceptions of elementary mathematics teachers regarding the PD they receive intended to support mathematics instruction.

The problem that was addressed through this study was Grade K-5 teachers in the United States are not getting the mathematics support they need through the PD activities they are provided through their school districts. More should be learned about the types of PD teachers are participating in, the types of PD they find most effective, and the ways in which PD design can be improved. Chapter 3 will explain the research methods that

will be used to explore teachers' perceptions regarding mathematics PD in order to gain a better understanding of how teachers' experiences with PD can inform future PD development.

Chapter 3: Research Method

The purpose of this qualitative study was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from school districts to support mathematics instruction. Elementary teachers do not always receive the mathematics PD support they need (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019). I used a basic qualitative research design to explore teachers' perceptions of the PD they receive and provide an understanding of the types of PD teachers find beneficial. The research method consisted of semistructured interviews of elementary mathematics teachers. The interview questions were based on the research question regarding how teachers perceive the PD they receive. The participants for this research study were elementary teachers in Grade K-5 whose teaching assignment includes mathematics. Data were collected through semistructured interviews and evaluated using thematic analysis.

In this chapter, I discuss the research design and rationale. The role of the researcher and the research methodology are also described. The overview of methodology includes details on participant selection; instrumentation; procedures for recruitment, participation, and data collection; and the data analysis plan. I address issues of trustworthiness by describing the credibility, transferability, dependability, and confirmability of the research. Last, a discussion of ethical procedures is provided, followed by a summary of the chapter.

Research Design and Rationale

The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support

mathematics instruction. I developed one research question based on the purpose of the study. This question was, How do Grade K-5 teachers perceive the PD they are offered by their school district intended to support mathematics instruction? The research question was aligned with qualitative research methods.

I used interviews as the primary data collection method. Qualitative research interviews are contextual, nonevaluative, and subjective (Ravitch & Carl, 2016). Interviews provide a means to gain an understanding of what the participants feel, think, and experience; the researcher can probe the participants' understanding of an issue. By conducting interviews, I was able to obtain an increased understanding of teachers' perceptions of the PD they are offered.

I chose a basic qualitative research design for this study. There are several forms of qualitative research, all based on the premise that knowledge is formed through a continuous process as people engage in and make meaning of an activity, experience, or phenomenon (Merriam & Tisdell, 2015). A researcher using a basic qualitative study seeks to understand the meaning of a phenomenon by exploring how people interpret their experiences and the meaning they attribute to them (Merriam & Tisdell, 2015). Basic qualitative research designs are common in educational studies and often involve data collection methods such as interviews (Merriam & Tisdell, 2015). The problem statement, purpose of the study, and research question for this study were best suited for a basic qualitative design. Use of this design enabled me to gain an understanding of how teachers perceive the PD they receive to support mathematics instruction. I considered other types of qualitative study designs during the development of this study. One

approach that was considered was a single-case study design; this design centers on one case and includes a variety of data sources such as interviews, observations, and documents (Ravitch & Carl, 2016). This approach was not ideal for this study because I wanted to interview a group of participants and gain multiple perspectives, not focus on a single case. Narrative inquiry is another qualitative design that was considered for this study. A researcher conducting a narrative inquiry focuses on one to two individuals and relays information regarding their storied life experiences (Ravitch & Carl, 2016). A narrative design was not ideal for this study because the focus was on perceptions regarding experiences with PD, not personal life histories or biographies. I selected a basic qualitative design because it allowed me to probe participants' experiences related to the study phenomenon.

Role of the Researcher

As the researcher, I served as the primary instrument in this qualitative research study. As such, my identity was an important component of the research design (see Ravitch & Carl, 2016). Positionality and social location are key to understanding the role of the researcher. Qualitative researchers have the potential to take on many roles in research studies. It is important that researchers are explicit about the role they will take and their relationship to the participants (Merriam & Tisdell, 2015). My role in the research was that of an observer collecting teachers' perceptions regarding the PD they receive to support mathematics instruction.

My professional role during this research was as a university clinical instructor. At the time of the study, I taught introductory education courses, in addition to

supervising teacher candidates in the field. My prior experience includes being a sixth-grade mathematics teacher with additional responsibilities including mentoring new teachers and leading the sixth-grade mathematics department. I taught sixth-grade mathematics for 6 years. My teaching experience also includes 12 years of teaching second-grade all-subject generalist classes, third-grade departmentalized mathematics and science, and third-grade all-subject generalist classes. I did not have a professional relationship with any of the participants and, therefore, did not have a position of power over any of them.

Bias can be found in all forms of research, and researchers should acknowledge and account for it (Ravitch & Carl, 2016). My bias related to this study stemmed from my experience in teaching mathematics at the elementary and middle school level along with my experience mentoring new teachers in the mathematics setting. Through both roles, I have seen the need for specialized mathematics instructional support and have also participated in various forms of PD. The advantage of my experience with teaching mathematics was that I had content and pedagogical knowledge applicable to this study. This knowledge enabled me to recognize key words and phrases used by the participants and helped me to develop appropriate follow-up questions for interviews.

Methodology

The methodology for this study was consistent with the use of a basic qualitative design. I conducted semistructured interviews with eight participants to obtain their perspectives on the PD that Grade K-5 teachers receive for mathematics instruction. By recruiting and interviewing eight teachers, I was able to gather multiple perspectives and

insights. As the researcher, I developed the interview protocol (see Appendix) and ensured that it aligned with the purpose of the study and the research question. Data collected from the interviews with participants were reviewed and coded. Thematic analysis was used to identify categories and themes that emerge from the codes derived from interview transcripts. In this section, I describe the procedures that I used for recruitment, participation, and data collection in further detail.

Participant Selection

I recruited eight participants for this study to obtain a thorough description of teachers' perceptions of PD. Notably, the number of participants chosen by the researcher depends on the research approach and the amount needed to reach data saturation (Creswell, 2013). Qualitative researchers using similar designs have included a comparable number of participants and reached saturation (Groenwald, 2004; Guest et al., 2006; van Manen, 1990). Participants were recruited through the Walden University participant pool, social media posts, and snowball sampling. I used email to contact participants and schedule their interviews. Purposive sampling was based on the following three criteria, which enabled me to choose participants who had shared experiences with elementary mathematics PD, increasing the potential for participants to meet common criteria and describe a shared experience (see Guest et al., 2006). The participants must be currently teaching mathematics in a Grade K-5 classroom in the United States and have at least 1 year of teaching experience. This sampling strategy allowed me to explore and gain insight from participants who have a specific area of experience and provided a strong understanding of the phenomenon; I was able to reach

the point where no new information arose, proving saturation (see Merriam & Tisdell, 2015).

Instrumentation

I served as the primary instrument of data collection because of my involvement in interviewing participants and evaluating data (see Saldana et al., 2011). The interview protocol that I developed (see Appendix) centered on exploring the research question (see van Manen, 1990). At the beginning of the interviews, I asked questions to gather demographic information about the participants, which served as a warm-up for the interview. To encourage the collection of sufficient data, I included a set of questions to learn more about the participants' experiences with PD and the features of what they perceive as effective and noneffective PD. The interview questions also allowed the participants to explain the challenges they face and whether PD addresses them. I included questions to encourage participants to explain what an experience was like, request specific examples, and clarify situations (see van Manen, 1990). I used open-ended questions to gain an understanding of the study's phenomenon (see Creswell, 2013). By incorporating effective questioning strategies, such as using probing questions in which I asked the interviewee to clarify a response or provide further detail or examples, I gained a more comprehensive understanding of the participants' perceptions.

To increase validity of the instrument, doctoral student peers and an expert panel comprised of my committee members reviewed my interview protocol and provided feedback on its contents and structure. I incorporated their feedback and made revisions that improved the protocol's efficiency. Doctoral student peers provided feedback that

included the need to phrase questions succinctly. As a result of this feedback, I used clear, concise language in the questions to enable participants to easily understand what was being asked and be able to provide a corresponding answer. Peer feedback also included that specific probes should be predetermined and clearly stated with the corresponding question. An additional recommendation from my peers was to word questions so that the participant would describe the experience in adequate detail.

The expert panel also provided beneficial feedback on the protocol. The panel recommended that the questions should begin by asking about PD in a broad sense and then narrow down to PD related to mathematics instruction. Additionally, the panel suggested that the interview questions have a larger focus on mathematics PD specifically to align better with the research question. The panel advised me to use open-ended questions and phrase questions in such a way that did not make presumptions about what the participants had experienced. I incorporated the suggestions from the panel and in turn increased the effectiveness of the protocol to collect data that answers the research question.

Procedures for Recruitment, Participation, and Data Collection

Procedures for Recruitment

I recruited participants from the Walden participant pool, through social media posts, and snowball sampling. The recruitment posts included the research study purpose along with the requirements for participation. I asked participants to self-identify to ensure that they met the selection criteria to be eligible to participate in the study. When the initial recruitment plan yielded too few participants, I made posts in additional social

media groups. When further measures were required to gain enough participants, I used snowball sampling by asking participants to recommend acquaintances for the study (see Ravitch & Carl, 2016).

Procedures for Participation

I informed prospective participants that participation would include an initial interview via the videoconferencing platform Zoom and a follow-up interview using the platform for the purpose of member checking. I scheduled the interviews based on the participants' availability through email. Zoom was a viable option for conducting interviews with people in different geographical locations because it provides a password-secure meeting option and secure data storage and does not require the interviewee to have any specific software to participate; the participant can join by merely clicking a link (Gray et al., 2020; Mirick & Wladkowski, 2019). Zoom is a valuable tool in qualitative research because it enables researchers to build rapport with participants that might be limited with phone interviews (Archibald et al., 2019). Another advantage is that Zoom provides a video feed so that body language and tone of voice are still discernable (see Burkholder et al., 2016). Overall, Zoom offers participants a convenient, user-friendly platform making it an ideal mode of communication for the qualitative researcher and participant (Archibald et al., 2019).

Procedures for Data Collection

I collected data using the Zoom video conferencing platform. I conducted an initial interview with each participant which lasted approximately 1 hour. I also conducted a follow-up interview with a subset of four participants for the purpose of

member checking, which lasted about 30 minutes. I audio recorded all interviews through the Zoom platform.

I conducted interviews using a semistructured approach to obtain participants' views, beliefs, opinions, and attitudes about personal experiences (see Saldana et al., 2011). The interview protocol (see Appendix) I developed included a set of predetermined questions as well as opportunities to ask probing and follow-up questions in response to the participant's answers. A benefit of using this approach to interviewing is that it allows for all participants to be asked similar questions regarding the phenomenon while allowing the researcher to follow up with probing questions based on participants' responses (Merriam & Tisdell, 2015).

Data Analysis Plan

To organize the data from the study, I made a file for each participant that included the interview transcript and notes I made relating to the interview (see Groenwald, 2004). The organization of the data was vital to my analysis process (see Creswell, 2013). Data analysis is a process comprised of many components (Creswell, 2013). Preparing and organizing the data, coding, finding themes within, and representing the data are all important steps in the process.

I made a transcript of each interview using transcription software (see Burkholder et al., 2016). The transcripts provided me a detailed account of what each participant said in response to each question. I used the transcripts in conjunction with the notes I took during and following the interview. I was able to gain an in-depth understanding of the

interviewee's experience and build a foundation for data analysis by using both sources of data.

I used a thematic analysis approach to analyze data for this study. This approach focuses on finding similarities, differences, and relationships within the data (Ravitch & Carl, 2016). Using this approach, I drew themes from the significant ideas present in the data. My work to identify themes began with reading the notes I took during the interview along with the transcripts to review what was learned and to find valuable insights. Then, I began the coding process. I used descriptive coding to summarize what the interviewee said through a word or phrase (see Saldana, 2016). To begin this process, I conducted initial coding of the transcripts. From the codes, I began to see broad categories emerging (see Creswell, 2013). I was able to interpret the larger meaning of the data from these themes and categories. Finally, I represented the data using Microsoft Excel and Word programs.

There is a possibility that discrepant cases may arise in a study. As discrepant cases surfaced, I included them in my data analysis. In efforts to ensure the findings are true to the study, I did not force the data to fit any preconceived ideas related to my experience with the phenomenon. It is important to note, qualitative research centers on understanding participants' experiences and appreciating the variation in those experiences (Ravitch & Carl, 2016). Accordingly, I included and used discrepant data that surfaced within the study to challenge findings, increasing the dependability of the results.

Trustworthiness

The development of a valid research study is key in qualitative research (Ravitch & Carl, 2016). There are four recommended criteria for researchers to use when evaluating a study's quality and trustworthiness: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). In addition, validation strategies can be used to ensure each criterion has been met (Shenton, 2004).

Credibility

I informed participants during the recruitment process and at the beginning of the interview that they are encouraged to speak freely and honestly about their experiences. Because I did not have a professional relationship with the participants, they should not believe they are limited in what they can share due to a professional relationship of authority. The agreement for honesty from the participants will be vital to the process of ensuring credibility (see Lincoln & Guba, 1985). Determining the credibility of a study establishes whether the research accurately studied and reflected participants' experiences and serves as one of the most important elements of proving trustworthiness.

Transferability

To encourage transferability, I prompted participants to provide descriptions of their experience with PD (see Shenton, 2004). These descriptions provided the reader an opportunity to connect their personal experience with those present in the study. Descriptions also allowed for similarities to emerge between participants from different sites. In addition, I provided contextual information related to the study to support the reader's ability to make the findings relatable to their setting (see Lincoln & Guba, 1985).

Establishing transferability refers to the applicability of the findings to the reader's setting and experience.

Dependability

I used an audit trail to encourage dependability as well as noting areas of fluctuation. An audit trail provides the raw data used in the study, documents the process used to analyze the data, and provides information regarding the development of the instrument (see Ravitch & Carl, 2016). By describing the design of the study, its implementation, data gathering, and evaluation of the process I can provide the reader every detail and allow for recreation of the study. I noted areas of fluctuation in the study so there would be potential for the study to be recreated and yield similar results (see Shenton, 2004). Ensuring dependability requires me to state areas of change and variability in the study (see Lincoln & Guba, 1985).

Confirmability

To ensure confirmability, I used two forms of member checking. The two forms of member checking complemented each other by eliciting feedback from each participant regarding my findings as well as eliciting feedback from a subset of four participants through follow-up interviews. According to Doyle (2007) allowing participants to participate in member checking enables the researcher to understand the participants' experience better and helps the interpretation better align with the participant's experience. Birt et al. (2016) described the different methods of member checking and stated that the process of member checking can vary based on the study. My research question was focused on learning about the perceptions of teachers on their

PD experiences. I believe that it was important for me to gain a full understanding of each participant's experience and receive feedback on my interpretations. I believe the two forms of member checking I chose best fit my study and enabled me to confirm and verify my findings. All participants were informed during the initial interview regarding how the member checking process would be conducted. All participants were told that a subset of four participants would be randomly selected to participate in a follow-up interview for the purpose of member checking. All participants were informed that they would be receiving an email containing the findings from the study.

For one form of member checking, I developed a subset of participants, consisting of four people, to participate in a follow-up interview for the purpose of member checking. I provided the subset of participants the findings from the study as a whole gathered from coding and thematic analysis (see Birt et al., 2016; see Madill & Sullivan, 2017; Merriam & Tisdell, 2015). I provided this summary prior to the follow-up interview and asked participants to give feedback on how my interpretation resonated with the data and allowed them to state whether they believed any changes should be made (see Birt et al., 2016; see Madill & Sullivan, 2017; Merriam & Tisdell, 2015). The participants confirmed and verified my findings providing a strong base for the overall findings of my study (see Birt et al., 2016). I reviewed the feedback provided by the participants and included it in the final phase of analysis by including any new data that had surfaced and integrating any new findings.

For the second form of member checking, I emailed all participants the findings from the study (see Birt et al., 2016). I believe it was important to get the participants'

feedback on the findings in order to provide them the opportunity to confirm and verify my interpretations (see Birt et al., 2016). Providing the study's findings to participants by email was not the mere review of the interview transcript (Hagens et al., 2009). The checking of a transcript for accuracy should be done by the researcher with the help of the audio recording (Hagens et al., 2009). The study conducted by Hagens et al. (2009) showed that the advantages to transcript review for accuracy by participants were small. Instead, it was suggested that researcher use targeted communication with the participants in order to gain confirmation and verification of the findings (Hagens et al., 2009; Merriam & Tisdell, 2015). Therefore, each participant received the findings and recommendations from the study.

Objectivity in qualitative research can be a challenge due to the human element of instrument design and role of the researcher (Shenton, 2004). However, member checking provides an avenue for the participants to be actively engaged in the data analysis process increasing the likelihood that the study's results capture the participants' true experiences (Birt et al., 2016). In order to ensure confirmability, it is important that the findings of the study are a true picture of the participants' experiences and not merely based on my preferences as the researcher.

Ethical Procedures

I filed an application with Walden's Institutional Review Board prior to any recruitment or data collection to ensure that the research study mets ethical standards. Once I gained approval from the Institutional Review Board (approval no. 11-29-21-0996064), I began to recruit participants. I included informed consent information in the

recruitment email to participants. Participation was voluntary, and participants had the opportunity to withdraw from the study at any time. Confidentiality was guaranteed by an assurance that participants would not be identifiable or referred to by name in the study.

Another key step to ensuring ethical research is having secure data storage. I stored digital data including audio recordings of interviews, notes, and transcripts in a password protected online cloud storage. I stored physical data such as handwritten notes in a personal locking file cabinet. I will store collected data in a secure location 5 years from the date of research publication.

Summary

The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support mathematics instruction. The research design followed a basic qualitative approach. The role of the researcher was an observer collecting teachers' perceptions regarding the PD they receive. Purposive sampling was used to select eight participants who fit a set of inclusion criteria. An interview protocol was used as the primary form of instrumentation. Participants were recruited from the Walden participant pool, social media, and with snowball sampling. Participants participated in an initial interview through Zoom and then in a follow-up interview for the purpose of member-checking.

Data analysis was conducted using thematic analysis. Strategies were used to ensure the trustworthiness of the research. Participants were asked to speak freely and honestly about their experiences to encourage credibility. Descriptions of experiences were gathered to encourage transferability. An audit trail was used to ensure

dependability of the findings. Confirmability was ensured with member checks. Ethical procedures included informed consent at the beginning of the recruitment process and voluntary participation from participants with the ability to withdraw their participation at any time.

Chapter 4: Results

The purpose of this qualitative research was to explore the perceptions of Grade K-5 teachers on the PD activities they receive from their school districts to support mathematics instruction. The research question for this study was, How do Grade K-5 teachers perceive the PD they are offered by their school districts intended to support mathematics instruction? I collected data from eight elementary mathematics teachers using semistructured interviews. In this chapter, I describe the research setting and provide demographics of the participants. I also discuss the data collection and data analysis process I used. I also provide evidence of trustworthiness and present the results of the study.

Setting

I selected eight participants who met the criteria for the study. Participants were recruited from the Walden participant pool and from posts in social media groups dedicated to elementary mathematics teachers. Prospective participants indicated their interest by commenting on the posts made in social media groups or through email. I provided the consent form to interested individuals by email, and I asked them to self-identify to ensure they met the participant criterion. I asked participants to choose a day and time that was the most convenient for them for the interview. I conducted the semistructured interviews using Zoom, a video conferencing platform. Most participants chose to have their camera on, although internet connection issues prevented camera use for one. Some participants participated in the interview from their educational setting and some from their homes. I conducted the interviews from my home office where there

were no distractions. The recruitment and interview process were conducted over a period of 5 weeks.

Demographics

I interviewed eight participants for this study. Table 1 shows the demographic information for the participants. Per the eligibility criteria, participants taught in Grades K-5, taught in a school in the United States, and had at least 1 year of teaching experience. The years of experience ranged from 3 years to 41 years. Because this study was conducted with a national sample of teachers, the teacher participants were located in various states across the United States. The participants taught in both private and public schools. Four participants were general education teachers, teaching in Grades 2-4, whereas four participants served as math interventionists teaching in Grades K-5.

Table 1

Research Participants' Demographics

Participant	Years of experience	Current grade level teaching
Participant 1	41	K-5
Participant 2	7	K-5
Participant 3	15	K-5
Participant 4	3	4
Participant 5	35	2
Participant 6	10	3
Participant 7	16	4
Participant 8	30	K-5

Note. K = kindergarten.

Data Collection

I conducted semistructured interviews with eight participants. All participants participated in one initial interview using Zoom. The interviews ranged in length from 45

minutes to 1 hour and 15 minutes. The average length of an interview was 50 minutes. My original plan was for the interviews to last about 1 hour; most were close to that time frame. A few participants had both succinct answers and limited experience with PD intended to support mathematics instruction. Both of these factors could have caused the length of their interviews to be shorter than those who had more experience with PD.

I recorded data from the interviews using the Zoom video conferencing platform. I used the features within Zoom to capture audio and video recordings of each interview. I also used the Rev recorder app to make an audio recording of each interview. Zoom created a closed captioning text file that I used to create a transcript. I transferred the closed caption text created by Zoom into a Microsoft Word document and manually checked the text for accuracy. I listened to the audio recording for each interview and edited the transcript as needed to correct words and phrases that were not recorded accurately by Zoom. I took notes during each interview and included them in the physical file I kept for each participant. I created a digital file for each participant that included the video and audio recordings of the interview as well as the transcript. These data were saved in an online password-protected storage area and on an external drive that will be stored in a locked cabinet for a minimum of 3 years.

Data Analysis

I uploaded the Microsoft Word transcripts into the Quirkos program to begin data analysis. The first cycle coding method I used was descriptive coding. Descriptive coding involves summarizing the data using a word or short phrase (Saldana, 2016). I identified open codes as I read through the transcripts several times. In the Quirkos program, I

highlighted sections of the participants' responses and dragged them into the *quirk*, or code, to which it corresponded. I then used a priori codes to code my data according to my conceptual framework. For second cycle coding methods I used pattern coding that allowed me to group my first-cycle summaries into categories and subcategories (see Saldana, 2016). As I highlighted and dragged sections of the text into the quirks, I found it easy to see groups or categories of codes develop. The quirks would increase in size as more sections of text were added. I rearranged the canvas in Quirkos to show the groupings of the codes. There were 40 codes and six categories. I exported a report from Quirkos that allowed me to group participants' quotes by code. I generated a table within Google Sheets that presented the codes, categories, subcategories, and quotes from the transcripts that corresponded with each code.

To complete the process of thematic analysis, I followed the six phases outlined by Braun and Clarke (2006). After completing Phase 1 and 2, familiarizing myself with the data and generating initial codes, I began to search for themes. In Phase 3 I reviewed the organization of the quirks or codes into groups or categories within the Quirkos canvas. I used the table I created in Google Sheets to identify the themes that I saw emerging from the data. I recorded the themes I identified onto the Google Sheet and then began Phase 4, reviewing the themes. I looked at the excerpts from the transcripts that corresponded to each theme to ensure there were enough data to support them. I reviewed the transcripts again to ensure the themes worked within the set of data as a whole. I included a column in the table in Google Sheets for my personal memos for each of the six categories. Reviewing the excerpts from the transcripts and my memos ensured that I

had a firm grasp on what the essence of each theme was (see Braun & Clarke, 2006). Phase 6 focused on the final analysis and write-up of the results including extracts from the data.

I identified four themes that addressed the research question. The four themes were as follows: (a) a common belief of teachers is that they have valuable insight into PD that is effective for them and are able to identify their PD needs; (b) teachers perceive PD to be most effective when it is hands-on and provides strategies that can be immediately applied in their classrooms; (c) overall, teachers perceive the PD that they are provided as not fully meeting their needs; and (d) overall, teachers are provided a limited amount of math PD from their schools or districts. Table 2 shows the codes, categories, subcategories, and themes identified in the data.

Table 2

Overview of Codes Organized Into Categories and Emergent Themes

Code	Category: Subcategory	Theme
Code 1: Desire to improve teaching capacity of others	Andragogy: Teacher autonomy	Theme 1: A common belief of teachers is that they have valuable insight into PD that is effective for them and are able to identify their PD needs.
Code 2: Teacher input		
Code 3: Teacher led professional development		
Code 4: Self-directed learning	Andragogy: Andragogical assumptions	
Code 5: Role of experience		
Code 6: Teaching experience		
Code 7: Readiness to learn		
Code 8: Orientation to learning		
Code 9: Internal need to grow		
Code 10: Ineffective qualities	Effective and ineffective PD qualities	Theme 2: Teachers perceive PD to be most effective when it is hands-on and provides strategies that can be immediately applied in their classrooms.
Code 11: Effective qualities		
Code 12: Hands-on activities in professional development		
Code 13: Collaboration		
Code 14: Professional development that fits individual needs		
Code 15: Factors affecting participation in professional development	Factors affecting participation in PD: PD concerns and factors	Theme 3: Overall, teachers perceived the PD they were provided did not fully meet their needs
Code 16: Administration support		

Code	Category: Subcategory	Theme
Code 17: Barriers, resistance to professional development	Factors affecting participation in PD: campus and district role	
Code 18: State funding		
Code 19: Effects of the Covid 19 pandemic		
Code 20: Frustration with provided professional development opportunities	PD provided by school or district	
Code 21: Are professional development needs met by school or district		
Code 22: Training and professional development experiences	Training and PD experiences: PD opportunities	Theme 4: Overall, teachers are provided a limited amount of mathematics PD from their schools or districts.
Code 23: Online professional development		
Code 24: Book study professional development		
Code 25: Staff or Team meetings		
Code 26: Professional development centers and providers		
Code 27: University experience		
Code 28: Outside professional development opportunities		
Code 29: Mentoring and new teacher training	Training and PD experiences: Coaching	
Code 30: Instructional Coaching		
Code 31: Teachers observing teachers		
Code 32: Curriculum and instruction professional development	Curriculum and instruction	

Code	Category: Subcategory	Theme
Code 33: Outside of district curriculum support	Curriculum and instruction: Outside of district support	
Code 34: School or district support	Curriculum and instruction: In school or district support	
Code 35: Learning standards and planning support		
Code 36: Content needs		
Code 37: Intervention and student needs		
Code 38: Challenges in teaching mathematics	Challenges	
Code 39: Students struggling academically		
Code 40: Prioritization of reading over mathematics		

Note. PD = professional development.

I indicated in my original research design that I would include any discrepant cases that arose during the study. Although most of the participants shared similar PD experiences with PD intended to support mathematics instruction, one participant shared an experience with PD that differed from those of other participants. I included this data in my data analysis. It is important that different experiences and perspectives are included to provide a better understanding of PD experiences across the United States (see Ravitch & Carl, 2016).

Results

This study had one research question. The research question was as follows: How do Grade K-5 teachers perceive the PD they are offered by their school districts intended to support mathematics instruction? I have organized the results by theme. In discussing

each theme, I identify the patterns that emerged from the data and provide evidence using quotes from the participants.

Theme 1

Theme 1 was the following: A common belief of participants was that they have valuable insight regarding PD that is effective for them and are able to identify their PD needs. Theme 1 provides an understanding of how teachers' perceptions of PD related to the conceptual framework of andragogy. This theme describes how teachers view PD, the motivation for participating in PD outside of their school setting, and the input they have in their district's PD offerings. Specifically, teachers in the study described their experience with providing input regarding their PD opportunities. The experiences varied and left many participants believing that their input was not valued. A pattern that emerged: Participants wanted to give input into PD decisions, but their input was not always requested or integrated into PD decisions. Participant 7 described the PD provided to them by their school by saying: "You really don't have an option of what you're going to get." Participant 7 continued:

> Every time we have one of those meetings a survey comes out and it asks for our feedback. What we think, how it went, was the presenter prepared, was it beneficial? And I can say from talking to my colleagues that most of us just think it's something they feel like they need to do. They don't really look at it. They don't really take it into consideration. They don't make any changes.

Participant 7 characterized their experiences with attending PD activities provided to them by their school district as being repetitive and not tailored to their individual needs.

In addition, Participant 7 shared their desire for the district to take the input received from teachers and integrate it into the design of the PD they provide.

Experiences varied among participants regarding processes in place to allow teachers to provide input into PD. Comparatively, some participants described committees in their districts devoted to PD, whereas others described only district personnel being the guiding force behind PD decisions. Participants 4 and 8 shared similar experiences with PD committees designed to organize PD. Participant 4 described the PD committee for their small district as not being representative of the whole district. They justified their statement by saying the committee consisted of "a middle school history teacher, first grade teacher, and the art teacher." According to the participant, this committee surveyed the teachers in the district about the PD they had been provided by asking: "What do you want to see? What did you like from this year?" Participant 4 added that although this committee had teachers representing different campuses, grades, and subjects, the PD they provided was not widely varied and was not specific to mathematics instruction.

Similarly, Participant 8 described the district committee that met to discuss school climate and performance concerns in their district: "It's very broad; it's not like okay we're talking about math. What do we need for math? We're talking about language arts. Where do we see a deficit with language arts?" Participant 8 added that this committee was volunteer driven so there was "not a wide range of individuals" who participated. Furthermore, Participant 8 described that because it was a district level committee with a

broad focus, input into PD decisions that affected teachers at the campus level, such as PD to support mathematics, was not always addressed.

One variation arose from Participant 2 regarding the level of input teachers had in district provided PD. Participant 2 described the district PD team they were a part of and the representation of teachers on it: "We now have a better representation of teachers. There is at least one person from every school building on the team. There is also a good representation of all grade levels and subjects." Participant 2 further described the change in representation as being positive compared to the representation in past years. In addition, Participant 2 described the responsibilities of the PD team by saying it "runs the mentor and new teacher program for the district." To describe the duties of the PD team, Participant 2 explained the process of meeting to plan trainings and the importance of using the teachers' input they had received from teacher surveys as they designed the next PD sessions.

There was a similarity between the experiences of Participant 2, 4, and 8 in that they stated that their input was not fully influencing their districts' PD plans. Participant 2 explained that even though the district had a PD team with a wide representation from the district and a collection of feedback, they did not believe they had input into PD. Additionally, Participant 2 described that the official role on the PD committee was a leadership position however in reality they served as a facilitator of the agenda provided to them by administration. To illustrate, Participant 2 stated the following:

> We're called the professional development team, but I don't really feel like we have the power to make huge decisions. The district handles the district-wide

> professional development, they do their own thing with that. I would say we focus in on new teachers. That's probably what we do the most.

The experience of Participant 2 revealed a similarity with the experiences of Participants 4, and 8 regarding the use of district PD committees and the lack of teacher input. These participants described committees dedicated to district PD which did not seem to take teachers' input into account and did not use it to guide the development of PD.

One difference in this pattern was found in the experience of Participant 1, who described how their campus administration had met with teachers to discuss the focus of the campus for the year. In fact, when teachers had expressed an interest in focusing on critical thinking, the campus administration decided to gear their PD towards that topic. The description provided by Participant 1 portrayed the campus administration as having had respected teacher input and showed it regularly used teacher input to guide PD decisions.

A second pattern that emerged was that teachers were reflective of their experience and identified areas in which they needed support and training. Participants 7 and 8 shared similar beliefs regarding their ability to identify areas of need. Participant 7 explained how years in the classroom had provided them the ability to recognize areas where they needed support. As an illustration, Participant 7 stated: "I think as a teacher, especially at this point in the game, you know your strengths, you know your weaknesses, and you know what you need." In like manner, Participant 8 shared a similar view: "Years of experience helps me know that I don't know everything and that there's always another way. I think that being an experienced teacher lends me to being

comfortable in saying I need help. I need a better way." Both Participants 7 and 8 described how years of teaching experience enabled them to have a strong understanding of the areas in which they needed support through PD.

Participants noted that there were multiple factors that influenced the PD they chose to participate in. Similarities emerged for Participants 2, 6, 7, and 8 as they described how a change in teaching assignment had influenced the PD they had chosen. When describing the experience participating in PD outside of their school setting, Participant 2 said: "As the new title math teacher, I felt like the more professional development I could get the better." Participant 2 explained that they had searched for PD opportunities to help them be effective in their new teaching position. Furthermore, Participant 2 described that their new position was a new position for the campus. Because the position was new, Participant 2 believed they needed to search for resources and support that would help them be effective in that position. In like manner, Participant 7 explained their experience with choosing outside PD opportunities based on a change in teaching assignment: "I started out in first grade and spent four years there. I had just been moved to fourth grade. The concepts were much harder, and I was trying to find new ways to teach." To illustrate, Participant 7 explained that the change from grade 1 to grade 4 had caused them to need to supplement their current instructional strategies. Participant 7 had identified the areas they needed some training and support in and searched for PD to meet those needs. Similarly, Participant 6 shared how a recent change in teaching assignment had influenced the focus of the PD activities they had participated in. A move from a solely mathematics classroom to a classroom where the participant

taught all subjects had influenced the PD Participant 6 had decided to participate in. Participant 6 noted that they felt it was beneficial for them to choose PD that would support them in their new role.

Another pattern that emerged was that teachers desired to participate in PD to satisfy a desire for professional growth. Participants shared the reasons why they searched for and participated in PD outside of what they were provided by their schools. These reasons included a desire to learn new strategies, participate in a community of like-minded professionals, and the desire to find ways to meet their students' needs. Participants 1, 3, 6, and 8 shared similar views on the reasons they searched for and participated in PD. To illustrate, Participant 1 said: "I like to learn new things. I have a strong foundation, so when I go to a conference, I want to just add, just fill in, and make my tower of knowledge bigger." Participant 1 described their efforts to find PD that built on their current knowledge and provided them additional ways of teaching. Participant 3 echoed Participant 1 by saying: "I love when I have the opportunity to learn about better ways of teaching, or why doing it this way is important, because that's how I can go back into the classroom and know what I'm doing." In addition, Participant 3 described PD by saying "all of it is important and necessary." To further explain how PD had helped them grow professionally, Participant 3 stated that PD had improved the ability to discern effectiveness of resources: "That's how I can pull a resource and know if it's a valuable resource, or not."

In like manner, Participant 6 described their views on PD: "I'm such a PD geek! Just my love of learning, and wanting to be a better instructor, and finding PD that is

inspirational and very relevant." Notably, Participant 6 described their view on PD as a means to support their love for learning and the desire to be a better instructor. This view of PD being a catalyst for professional growth by Participant 6 was similar to the views of Participants 2 and 7 of PD being a way to improve as a teacher. On the other hand, Participant 6 shared that an additional appealing aspect of PD was the potential for meeting like-minded individuals. They said: "I'm looking for the ones who are taking notes like I am. The ones who are excited and asking questions." An added bonus of PD was that they were able to create collaborative relationships with other teachers who shared their love for learning. They saw PD as not only an opportunity to learn but as a way to develop professional connections: "I like seeking out those things where I'm getting to talk to like-minded educators, and getting to just expand my curiosity."

The views of Participant 8 were similar to those of Participants 2, 6, and 7. Correspondingly, Participant 8 described their view on PD by reflecting on how it has supported them in the past. They said:

> I just found that I needed something more to be a better teacher. When I've struggled in the past, knowing that I've had to find a path to success for myself plus being comfortable knowing that it's okay to say I don't know or constantly asking questions. I think both of those things have contributed to me seeking out that professional development.

Participant 8 added that they liked to keep up with new trends in education: "As I was hearing buzz words of what seemed like was going to be trendy, I would try to educate

myself." By staying up to date on education trends through PD they believed they were better able to support their students and coworkers.

A variation emerged in the experience of Participant 4. Whereas Participants 1, 3, 6, and 8 described their desire to grow as a professional in a general sense, Participant 4 described a more particular area for growth. Participant 4 was a new teacher and shared specific content needs as they reflected on their university pre-service training and personal history with mathematics. Participant 4 noted that their pre-service experience with teaching math was limited. To justify their statement, Participant 4 shared the concern that they did not feel as though they were prepared to teach mathematics in a way that differed from the way they were taught. To illustrate this claim, Participant 4 stated: "The only way I know is the way that I was taught which is a very old-fashioned way of teaching math. I only know one way to teach math, and it's not a way I enjoy teaching math." Recounting their experience with teaching mathematics, Participant 4 said they noticed the students as well as themselves were dreading the mathematics part of the day. Participant 4 reflected on this experience: "So that's kind of why I started doing it a little bit different last year." They had students on varying levels and wanted to find a way to meet all of their students' needs. They also started conducting personal research on different methods of mathematics instruction. Participant 4 wanted to find more effective ways to teach their students and stated: "I decided to go out and figure some things out."

Theme 2

Theme 2 was the following: Teachers perceive PD to be most effective when it is hands-on and provides strategies that can be immediately applied in their classrooms. Participants noted that they preferred PD that allowed them to work with new resources and provided demonstrations. There were similarities in Participants 1 and 8 in their desires for PD to include time to both be shown how to use materials and time to work with them. Participant 1 explained how they would like PD to provide them a chance to "really experience and model it, have us mess around with it." They added that they would find this type of presentation an effective form of PD because it allowed the opportunity to practice using new resources. In like manner, Participant 8 described their desire to attend PD that allowed them to "have time to play with the materials." To support their view, they went on to explain that teachers have limited time to explore new materials within their school day so the opportunity to do so during PD was beneficial.

Participants shared their experiences with attending hands-on PD sessions. Similarities emerged between the experiences of Participants 5 and 7. Participant 5 described their experience with attending PD where the session focused on allowing teachers to ask questions and enabled them to "make the journals" they had learned about. Correspondingly, Participant 7 described a PD where the presenter provided them the opportunity to work with manipulatives so they could learn multiple ways to use the manipulatives in their classrooms. This hands-on experience proved to be effective for Participant 7. To further explain how this experience had advanced their knowledge,

Participant 7 said: “When you see things like that it changes everything.” Having the chance to work with new resources was invaluable according to Participant 7.

Participants noted mixed experiences with the level of hands-on PD sessions provided by their schools or districts. The experiences described by Participants 5 and 7 varied from that of Participants 6 and 8 regarding hands-on PD opportunities. Participant 6 described their experience with district provided PD by saying “it’s a lot of sit and get and it’s a lot of telling us about something. It doesn’t feel as engaging.” To illustrate, Participant 6 explained that these types of PD sessions have the potential to provide a lot of information but do not always allow teachers to walk away with practical ways to implement it. Identical to Participant 6, Participant 8 also experienced PD that was not hands-on. To expound on their experience, Participant 8 described PD as being designed as a lecture. In this lecture, Participant 8 was not shown how to “apply it in my classroom, how to help struggling learners, or how to incorporate it into our lessons.” To justify their view on what the PD had not provided, they said: “We learn more by doing.” Participant 8 added that the PD had not offered them a chance to use and work with the new resources.

Teachers appreciated PD opportunities that provided ideas, activities, and strategies they could take and implement in their classrooms immediately. Participants 1, 3, and 6 shared similar views on how these components made PD effective for them. Participant 1 explained that teachers do not have a lot of time to find resources within their school day, so they valued being provided things that fit their classroom needs and that could be used right away. To illustrate this belief, Participant 1 said: “You have to

pump me up with like a B12 shot of math things and make it useful." Additionally, Participant 1 explained that they valued PD that stayed on topic and was an appropriate fit for their classroom needs. Likewise, Participant 3 shared a similar view to Participant 1 regarding effective PD. Participant 3 explained that they wanted to receive resources from PD that "is zero prep and can be used right away." Echoing Participants 1 and 3, Participant 6 explained that they desired PD to provide strategies that could be used with their class immediately. To illustrate, Participant 6 said they want PD facilitators to "plant the seeds for your own classroom so you walk away ready to do at least one thing with your class." PD sessions that allowed the PD presenter to serve as a facilitator guiding teachers to learn and practice with new resources was an effective PD component according to Participant 6.

Similarities emerged among participants' experiences with PD that revealed PD activities did not always meet teachers' needs. Participants 5 and 7 shared similar experiences with ineffective PD sessions. Participant 5 described PD sessions that did not prove useful for the participant. In these sessions the presenters were not aware of the participants' needs or level of engagement. Participant 5 noted that PD should be designed to mimic the strategies teachers should be using with students. To illustrate this, Participant 5 said that teachers, as adult learners, benefitted from engaging and interesting learning activities. Participant 5 explained that teachers enjoyed PD that used engaging methods to provide strategies that met the instructional needs of their students by saying: "I like them too because it gets me up and moving." Likewise, Participant 7 reflected on ineffective PD sessions they had attended and described how the PD had covered topics

such as differentiation but had not integrated principles of differentiation into the PD session. To illustrate, Participant 7 explained that the PD design should have taken learner differences into account such as “we might have visual learners and we might have kinesthetic learners.” Participant 7 added that it seemed PD was designed with the assumption that teachers are “grown-ups so they’ll just get it.” To explain, Participant 7 stated that if learner differences had been taken into account, the PD session might have been more engaging and fitting to individual needs. Participant 8 supported their view by saying that PD should fit the professional and classroom needs of the teacher.

When describing qualities of effective PD, similarities emerged regarding what participants desired in PD. Participants 4, 6, and 8 shared similar views on the benefits of PD that provided collaborative opportunities. Participant 4 explained the desire to meet with teachers of other grade levels to participate in vertical planning. To explain, Participant 4 said they would like to have PD that enabled discussions between upper and lower grade mathematics teachers so that teachers in lower grades could learn ways to present mathematical concepts that would support the students’ future learning in upper grades. Participant 4 said they would like to teach students effectively without “making them confused” and they believed collaborative, vertical PD sessions would support effective teaching. In like manner, Participant 6 noted that they liked to participate in PD that encouraged “dialogue between the teachers.” This collaboration proved to increase the sharing of ideas and strategies according to Participant 6. Additionally, Participant 6 said they liked to see PD shift to a more “collaborative approach.” PD that encouraged collaborative discussion enabled teachers to share ideas as well as brainstorm ways to

address classroom concerns. These were the desired components of PD, as explained by Participant 6.

Participant 8 echoed the views of Participant 4 and 6 regarding the desire for PD that included collaboration. Participant 8 explained that they benefitted from having discussions with other teachers about the strategies that worked for them. To illustrate, Participant 8 said: “I love being able to sit at a table with other educators and share strategies.” Additionally, Participant 8 stated that being part of a group PD discussion has been the “most effective way” to learn new strategies from other educators.

Theme 3

Theme 3 was the following: Overall, teachers perceived the PD they were provided did not fully meet their needs. Teachers were provided PD opportunities by their schools and districts that varied in method, frequency, and topic. A pattern that emerged was that teachers believed the PD their schools and districts provided was not adequate in meeting their PD needs. Similarities were seen in the experiences of Participants 4, 7, and 8 regarding the PD they were provided by their school or district. Participant 4 described the amount of PD to support mathematics instruction by saying, “For math nothing. I mean honestly, it has been nothing.” To further explain, Participant 4 stated that the PD had been focused on reading, state-mandated training, and socioemotional needs of students. Participant 4 relayed their beliefs in how these topics were important but also stated they had desired to receive PD related to mathematics and had not received any.

In agreement with Participant 4, Participant 7 explained that the PD provided by their school or district was limited and did not meet their needs. To illustrate their perception of the PD they had been provided regarding the new curriculum, Participant 7 stated, “There’s really nothing concrete. We’re just thrown in, good luck.” Furthermore Participant 7 explained that they had wanted to receive more in-depth and hands-on training on the new curriculum but had not. In addition, Participant 7 described the format of other PD sessions they had attended as having had consisted of presenters showing an idea and instructing those in attendance to “go use it,” but they did not “bring in manipulatives for us to play with or come into our classroom and demo it.” To summarize their beliefs regarding whether their mathematical needs had been met, Participant 7 said, “I honestly don’t think they have been.” To justify these beliefs, Participant 7 stated:

> It’s not as much as I think everybody would like, they really don’t offer opportunities to go out of district to see someone else or attend a conference or workshop. We’re very limited on that. We’re not given too many opportunities.

Participant 7 described a desire to attend PD that provided an opportunity for application and implementation of new strategies as well as a frustration with not being provided an opportunity to experience external PD opportunities.

Similar to the description provided by Participants 4 and 7 regarding their perceptions of PD, Participant 8 described the PD by saying, “In the past, we have not had very strong professional development.” To explain, Participant 8 described PD as having had a focus on data collection and evaluation of state tests as they relate to

standards. Although these PD topics were valuable, PD focused on mathematics instruction was not provided according to Participant 8. In addition, Participant 8 stated they had not had mathematics PD other than what they had sought on their own from outside of the district. To illuminate the desire for PD related to mathematics, Participant 8 said, “We obviously as educators need more professional development in the math that we are teaching. That’s no doubt one of the things the school could provide.”

The experiences of Participants 4, 7, and 8 regarding PD varied from the experiences of Participants 3 and 5. Whereas Participants 4, 7, and 8 believed they had not received PD to meet their mathematics instructional needs Participants 3 and 5 reflected on experiences where their PD needs for the subject of mathematics had been met. As an illustration, Participant 3 expounded on their experience with the PD their district provided, “So, it’s constant, it’s there, it’s available and free for anyone who wants it. I haven’t had to pay anything for the training I have received, and I have hundreds of hours of math PD.” Participant 3 described the mathematics support that was available: “We have three people who are just dedicated to supporting math teaching and the elementary schools in any way we want. I could call someone to coach me and ask for resources.” Participant 3 noted that their district provided both support from inside the district and from outside sources. In addition, Participant 3 explained that their district provided many PD opportunities, and they believed they were able to receive support in any way they needed it. Notably, Participant 3 chose to participate in a large amount of PD beyond what was required by the district. Participant 3 took advantage of many PD activities provided by their district even though they were not all required.

Participant 5 also described PD related to mathematics. Similar to Participant 3 being provided ample amounts of mathematics PD, Participant 5 explained that they had participated in several mathematics-related PD opportunities. To illustrate, Participant 5 stated they had been given strategies and "examples" to aid in their understanding and application. In addition, Participant 5 also described the support from district mathematics positions in the past as providing "resources and support in working with the curriculum." Participant 5 stated that they believed they had been provided beneficial PD opportunities from their district.

A pattern that emerged in participants' experiences was that the PD used a variety of methods. Participants 3 and 6 described similar experiences with being provided virtual training from their school or district. As an illustration, Participant 3 described the virtual training they had received by saying, "During the pandemic they still gave us virtual training. They tried hard to provide everything to help increase teacher capacity." Although these virtual PD sessions were provided outside the regular school day, Participant 3 noted appreciation for the ability to grow professionally through the virtual format because other formats were not available at that time. In like manner, Participant 6 described a recent training by saying, "[It] was all online." The virtual training gave Participant 6 five to six actual strategies to "take and run with right then." In addition, Participant 6 noted that trainings held in person seemed to be more effective but was appreciative of the district providing the virtual training.

Participants 2, 3, and 5 shared similar experiences with participating in book studies. Participant 2 described a book study that focused on the mathematical topic of

"number sense." To further explain, Participant 2 stated, "[I] wished the district would have gone further with that book study, but they haven't so far." Participant 2 noted that they had wanted to revisit the book because it contained valuable information that could apply to their current teaching placement. Contrastingly, Participant 5 described the two book studies they had participated in by saying that one of the studies had been conducted with the whole staff and the other with only the lead teachers. The book study with the whole staff was not completed but the study conducted with the lead teachers was completed and was seen as beneficial by Participant 5 because of the reflection and response built into the study's format.

The experience of Participant 3 with book studies provided by their district varied from the experience of Participants 2 and 5 in that Participant 3 was compensated financially for participation in the book study. Participant 3 described that the faculty members were presented with three books and were allowed to choose the ones they felt would best meet their needs. Additionally, the books focused on mathematics topics such as how to teach mathematics to children who have learning disabilities and how to do math workshops. As an example, Participant 3 described the book study format saying the participants "met once a month" to discuss chapters of the book. Participants were paid for the time spent reading the book as well as for the time spent participating in the group discussion.

An additional pattern that emerged was that teachers valued the opportunity to observe strategies in practice and to receive feedback through conversation. Schools and districts varied in the format and amount of instructional coaching and demonstrations

provided to teachers. Participants 3,5,6, and 7 shared experiences with instructional coaching and demonstrations. The experience of Participant 6 provided a look into instructional coaching used as a support for teachers. As an illustration, Participant 6 explained that they had been provided instructional coaches to help specifically with the subjects of mathematics and language arts. The instructional coaches would provide "training" for the staff, "push-in for support," and co-teach lessons. To further explain, Participant 6 said that teachers can request the instructional coach to come into classrooms to both observe and demonstrate a whole class or group lesson.

Similar to the experience of Participant 6 concerning teachers being able to request support from instructional coaches, Participant 3 described that they also can request support from the district-provided instructional coaches. As an illustration, Participant 3 stated, "I can get as much coaching and training as I care to have." Participant 3 justified a recent decision to set up monthly sessions with their instructional coach due to a change in teaching assignment. The participant had planned to take advantage of the additional support and receive strategies and resources that would benefit them in a new grade level and subject area. The amount of coaching was not determined by the school or district, rather it was based on the teacher's request. When reflecting on the coaching, Participant 3 had taken advantage of the coaching that had been available to them and had viewed it as productive and valuable support. To summarize their experience with instructional coaching, Participant 3 said, "It seems to be one of the most effective things when someone can be in the classroom with you and you can discuss what happened."

There was a variation related to instructional coaching and demonstrations in the experience of Participant 5. Whereas Participants 3 and 6 described the opportunity to request coaching from district staff, Participant 5 said that their district had built-in support by identifying certain teachers as demonstration teachers. As described by Participant 5, demonstration teachers were classroom teachers who also worked to provide instructional support for coworkers. To further explain the position, Participant 5 described that the demonstration teachers provided training to staff as well as support to individual teachers. The campus administrators met with the demonstration teachers and discussed areas in which the faculty needed support. Participant 5 explained that having this discussion enabled the demonstration teachers to "intervene as teachers and talk to the new teachers and see if we can help. Instead of administrators coming from the outside in, we're coming from the inside to the inside." As made clear by Participant 5, teachers were able to request the demonstration teachers to come into their classrooms and teach a lesson. Teachers were also able to go observe the demonstration teachers teach. Reflecting on how the new support role of demo teachers had benefitted the campus, Participant 5 stated, "I think it's opened a door where the new ones and just anybody knows they can come to us."

The experience of Participant 7 varied from that of Participants 3, 5, and 6 in the availability of instructional coaching and demonstrations. Participant 7 reflected on a time when the school had an instructional coach designated for mathematics support. To describe this position, Participant 7 said the instructional coach was assigned to the campus and would "come in and demo lessons" as well as observe and provide feedback

regarding suggested strategies and techniques. In addition, Participant 7 said the instructional coach would also bring "different manipulatives and different programs to us." However, due to changes caused by the Covid-19 pandemic, the mathematics and reading instructional coaches were moved into classroom teacher positions, leaving no instructional coaches. The following year, the district decided to reinstate instructional coaches for reading but not for mathematics. In describing their perception of the effectiveness of instructional coaches designated for mathematics support, Participant 7 stated: "Bring back our math coach. That would be number one, having a program like that." Participant 7 explained that they had valued their experience with having an instructional coach to model new strategies and provide feedback.

An additional pattern emerged regarding the desire participants had to search for PD to meet their needs. Participants 1,2,3,4, and 6 described free and low-cost sources they had found for mathematics support such as podcasts, articles, books, and social media groups. On the other hand, Participants 5,7, and 8 shared experiences with the challenges associated with attending PD outside their school setting. Participant 5 described that daycare and transportation costs factored into a decision on whether to participate in outside PD or not. In addition, Participant 5 noted it did not seem feasible to have to pay for outside PD when teacher pay is often low. In like manner, Participant 7 justified a decision to not participate in outside PD because these included "too much red tape." Not only were teachers responsible "for finding them" and paying for the PD, but they also then had to wait to be reimbursed which could take up to 2 months. Participant

7 added that outside PD opportunities were often costly adding up to hundreds of dollars, so waiting for reimbursement created a hardship.

Correspondingly, Participant 8 described their experience with outside PD by explaining that PD sessions can "get pretty pricey, and we don't get reimbursed 100% of the time." In addition, Participant 8 stated that teachers were not always allowed the time off of school to go participate in outside PD opportunities. They would often be required to use a personal day instead of being given a school business day off. Although Participant 8 desired to learn and grow professionally they were torn concerning the decision to choose to pay for the outside PD themselves because the school and district were "not providing anything." Participant 8 found it more feasible to pay for outside PD if the district was providing them sufficient PD opportunities. In this case, it would be a personal choice to receive extra PD in addition to what was being provided by the district. However, if teachers chose to participate in outside PD, it seemed they would be paying out of pocket for the only PD they were receiving.

Theme 4

Theme 4 was the following: Overall, teachers are provided a limited amount of mathematics PD from their schools or districts. Teachers were provided various amounts of mathematics curriculum training PD by their district. A pattern that emerged was that districts varied in the amount and type of PD support they provided teachers. Participants 1, 2, 3, and 6 shared similarities in the curriculum training PD they had received. Participant 1 described the curriculum PD sessions the school had provided and said that the curriculum training "has been the only training over the last 2 years" the school had

provided. Participant 1 explained the curriculum training was “very, very general” and did not get to the “meat and bones” of the program. To provide more detail, Participant 1 stated that they believed the training would have been more useful if it would have provided specific information and ways to implement the new curriculum.

Participant 6 indicated a similar experience to that of Participant 1 with curriculum PD. An initial curriculum training along with a refresher course had been provided to teachers. Reflecting on the training, Participant 6 stated: “I think having the training with a new curriculum is important with any new curriculum adoption.” The initial training “was really strong,” explained Participant 6. In this training, teachers were led through the curriculum and told how to implement the new program. The follow-up training proved to not be as strong. Participant 6 explained that there had been some resistance to the new program on the part of some teachers so the presenter “was putting out fires” instead of moving the group forward in curriculum understanding and application.

Participants 2 and 3 had similar experiences as Participants 1 and 6 with curriculum PD. Participant 2 described that the curriculum PD they had received included an initial 3-day training and a follow-up refresher training the following year. Included in this training was how to spiral the lesson “with the scope and sequence” and also how to “hone a lesson.” These topics were both important to the implementation of the curriculum, and Participant 2 believed the training had provided a strong understanding of the curriculum. Comparatively, Participant 3 also described their experience with the “formal and intensive” curriculum training. A difference surfaced in the experience of

Participant 3 in that teachers were provided bimonthly follow-up PD for the new curriculum and how it could be implemented to be "specific to our school." The frequency of the follow-up PD sessions proved to be useful as well as the individualized connection to classrooms.

A difference was revealed between the experience of Participant 8 and the other participants. Participant 8 described a curriculum training they had attended, and that the curriculum program was "never implemented." Participant 8 explained that teachers had attended the training and had learned about the new program, but it was never used. An additional difference in the experience of curriculum training emerged in the experience of Participant 7 when compared to that of Participants 2 and 3. Participant 7 explained that they had been teaching in the district for a few years and had "never been trained on the curriculum they were using. To further explain, Participant 7 stated that they knew there were resources available with the mathematics curriculum, but they were unaware of how to access and use those resources.

An additional pattern that emerged was that districts provided varying amounts of mathematics content support. The amount of support districts provided depended on the available funding and the effectiveness of the district support person. Participants 3, 5, and 6 all indicated they had a district curriculum support person. The roles of the curriculum support person varied by district. Participant 5 described the curriculum support as helpful and providing good direction for mathematics teachers in planning and providing resources. To explain the ways the curriculum support position had benefitted them, Participant 5 said: "We had some really good math direction from our district.

That's why I think I have so much stuff." The person in the district curriculum support position had changed through the years but Participant 5 was able to reflect on what each had provided for teachers through resources and guidance that allowed them to have such a strong collection of resources at their disposal.

A variation emerged between the experience of Participant 3 and the experiences of Participants 5 and 7 regarding their experience with curriculum support positions. Whereas Participants 5 and 7 spoke of their districts having a designated mathematics curriculum support person, Participant 3 explained that they had several different curriculum support people available to them. To illustrate the amount of support available to them, Participant 3 explained: "I can ask someone for resources, they could come do a PD for the school, and help me with absolutely anything." Another difference between Participant 3 and the other participants was that Participant 3 had a curriculum support person available to them who was outside of the district. The district not only provided support from district staff but also an outside source. Participant 3 explained by saying: "I can call this person right now and say, 'let's walk through Unit Eight on the Grade 8 level,' and they will give me a time and day we will be looking at Unit Eight." Participant 3 described the quantity and quality of support available to them as valuable and said they often take advantage of all of the individualized support available.

Participant 8 described their curriculum support as being new and in the midst of learning the new role. In the past, there had been a supervisor for each content area but more recently the district had reorganized personnel due to funding. Participant 8 described the new supervisor as being "much more proactive about educating the staff"

than previous supervisors. The new math supervisor had already served as the English Language Arts Grades K-12 supervisor and had the Grade K-5 math role added on the following year. Participant 8 described this as a positive because the new supervisor had "been asking a lot of questions" because the supervisor was learning the new role. Those questions had brought mathematical concerns to light such as the use of manipulatives in instruction.

Differences emerged with the experiences of Participants 4 and 7 regarding district curriculum support. Participant 4 stated that they did not have a designated person to serve as district curriculum support. The district that Participant 4 teaches in is a small district, so their central office support staff is minimal. Participant 7 described their experience with having a designated mathematics curriculum support person on their campus at one time but then, due to the budget, positions were cut, and the only curriculum support that had been reinstated was for reading.

Another pattern that was revealed was that reading was often the focus of PD. Participants described experiences with the subject of reading being more of a priority than mathematics in the areas of PD and curriculum. Similarities were revealed between Participants 4, and 8 regarding the PD focus of their school. Participant 4 explained that they entered the district after a new reading curriculum had been adopted. The training that had been provided since Participant 4 had begun working in the district had been focused on the reading curriculum. To explain, Participant 4 noted that there had not been any mathematics PD since they had started working there. In like manner, Participant 8 explained that their district was "a heavy language arts district" when describing the

focus of their district's PD. Participant 8 added that the language arts curriculum is very "immersive" and involved so there were "people coming in to support the staff" with the curriculum implementation. Additionally, Participant 8 explained the district has a focus on integrating language arts into other subjects so "everything we do is language arts based."

Discrepant Case

There was a discrepant case that emerged during this study. In regard to Themes 3 and 4, the experience of Participant 3 distinctly varied from the experiences of the other participants. The overall pattern revealed in Theme 3 was that the PD provided to teachers by their districts did not fully meet their needs. However, Participant 3's experience was that many PD opportunities available to teachers in their district. These opportunities included a mix of formats, frequencies, and themes which the participant noted as being beneficial and meeting their needs. This participant had many resources available at the campus and district level as well as support from outside the district. Participant 3 explained that the district provided training sessions that encouraged hands-on activities and resources that could be taken right into the classroom, and teachers could "start using it right away." In addition, Participant 3 had even received payment from the district for some of the book studies they had participated in. Participant 3 noted that the PD experiences had been comprehensive, and they believed their mathematics PD needs had been met.

In regard to Theme 4 the overall pattern was that teachers were provided a limited amount of mathematics PD from their school or districts. Participant 3 described that they

were able to participate in as much PD as they desired by saying: “They have offered so many things. It’s constant, it’s available and free for anyone who wants it.” Participant 3 exhibited a strong desire to learn and grow professionally similar to other participants, but the difference was that Participant 3 had many mathematics PD opportunities available to them. In addition, Participant 3 explained they had choice in the trainings attended and had access to instructional coaches who could support them in any way based on the teachers’ requests. The structure of the trainings not only allowed teachers to learn how to use curriculum programs but also “how to better teach math.” Even though the district was not able to require teachers to participate in all of the PD opportunities they offered, Participant 3 chose to participate in many PD activities and spoke of how the activities had provided valuable teaching strategies and resources.

Some participants noted the presence of instructional coaches in their districts and yet others stated they did not have anyone filling that position. Participant 7 indicated the mathematics instructional coach position on their campus “had been removed” due to funding. Similarly, Participant 4 stated that they did not have instructional coaches in their district. In contrast, the support available to Participant 3 was greater in size and frequency. Instructional coaching was used to provide teachers with individualized support. There were “three designated people to help at the elementary level” with resources, PD, and coaching. Teachers were able to reach out to instructional coaches with individual requests and coaches would respond with on-the-job-embedded support. Two academic deans on the campus of Participant 3 were available to “provide PD

whenever teachers wanted it." They would coach teachers in the classroom, provide materials, and discuss best practices.

Many of the participants described varying levels of mathematics curriculum support available to them. However, some of the participants indicated they had not received any mathematics PD in recent years. Participant 4 and 7 both indicated they had not received any training on the mathematics curriculum they were using. Conversely, Participant 1 stated they had received some curriculum training, but it had been the "only training in the last two years" they had been provided for mathematics. In contrast, Participant 3 explained their district provided continuous and comprehensive mathematics curriculum support. Participant 3 described the overall design of PD sessions as providing teachers a "minilesson" which provided a more in-depth understanding of the topic and provided an opportunity for "teachers to try new learning." Sessions also included a chance for teachers to leave with something they could "use right away in their classrooms with zero prep" required. Curriculum training consisted of initial and follow-up sessions designed to reinforce prior learning as well as provide effective teaching strategies. This training went further than just program logistics and included a connection to specific school needs. The support was continuous and offered consistently throughout the school year.

All participants described their experiences with PD. However, not all participants experienced PD in the say way. Some participants indicated they had not received any mathematics PD in recent years. Participant 4 described the amount of PD they had received by saying, "for math nothing, we have received nothing." In like

manner Participant 8 explained that in recent years the PD they had received had been "minimal other than what we looked for outside of the district." Most of the remaining participants described the amount of district-provided mathematics PD as minimal to average. Participant 5 had been provided an average amount of "district curriculum support" through the years that had given them "resources" and described the efforts being made to incorporate additional support this year. All participants expressed a desire to grow professionally and searched out PD to meet their needs. The case of Participant 3 differed from the others because of the amount and quality of PD available to them. Participant 3 stated they had completed "hundreds of hours of math PD" and emphasized that the PD is "free and available" to anyone who wants it. Another difference between the experience of Participant 3 and the other participants is the fact that Participant 3 was able to search within the district's PD offerings to have their mathematics needs met whereas other participants had to search outside of their district.

Evidence of Trustworthiness

Credibility

Several strategies can be used to ensure the trustworthiness of a study (Lincoln & Guba, 1985). I used various methods to ensure credibility, transferability, dependability, and confirmability. To ensure credibility I informed all participants during the recruitment process and at the beginning of the interview to be open and honest about their experiences. I used the interview protocol I developed to ask all participants certain questions about their experiences. Notably, I designed the questions to encourage participants to speak freely about their experiences. In addition, I did not have a

professional relationship with any of the participants so they should not have felt limited in what they could say due to a professional relationship.

Transferability

To encourage transferability, I prompted participants during the interview to provide descriptions of their experiences. These descriptions allowed both similarities and differences to emerge among the experiences of the participants. To provide contextual information regarding the study, I included a table showing the grade level each participant taught at the time of the interview along with the number of years of teaching experience.

Dependability

I used an audit trail to encourage dependability. I provided a description of the design of the study, its implementation, data gathering, and evaluation of the process. I provided a detailed description of how I developed codes, categories, and themes. In addition, I provided information regarding the development and review of the interview protocol.

Confirmability

To ensure confirmability, I used two forms of member checking. I emailed the findings and recommendations of the study to all participants and requested feedback regarding their reactions, opinions, and reflections of the findings. Using two forms of member checking provided all participants the opportunity to provide feedback regarding the findings. The email I sent them stated that I was including the findings of the study

and that I would love to hear back from them concerning their reactions and feedback of the findings. None of the participants replied by email with feedback.

In addition, I conducted member checks with a subset of four participants through follow-up interviews conducted by Zoom. I provided participants with a copy of the findings and recommendations from the study prior to the interview and asked for their feedback. Of the eight participants who participated in the study, five agreed to participate in member checking. One participant had a scheduling conflict leaving four participants to participate in the follow-up interview. The subset of participants confirmed and verified the findings during the follow-up interviews.

The participants who participated in the follow-up interviews agreed with the findings and even provided some additional details to build a better understanding and more complete picture of the finding. When asked if my findings echoed their experiences, one participant said: “I liked your summary a lot. I agree with your findings.” Another participant noted, “You’re exactly right, you hit the nail on the head.” Referring to the finding regarding teacher input, one participant said:

> I agree with your findings, but I believe there should be some balance with teacher input. Teachers may not know what they don’t know, so we need district experts to provide the PD they believe meets the needs of teachers to help build capacity.

I recorded the thoughts the participants shared and integrated them into my findings to reflect the additional information.

Participants also shared their reactions to the findings and recommendations. In reference to the finding related to limited PD opportunities, one participant said: “This breaks my heart because you know I have access to so much PD. PD isn’t required in my district and it is required in many other districts, so it’s sad.” To follow up they added: “It makes me wonder what is the state of math education in the country if math PD isn’t provided.” Several participants shared an enthusiastic “yes” in reaction to the statement that PD should be as engaging as teachers’ lessons are expected to be. One participant added: “Why isn’t PD reflecting what we are expected to do in our classroom?”

When reflecting on the participants being representative of a national sample of teachers, one participant said: “I’m not sure if this makes me feel better or worse. We’re all in the same boat.” To follow-up this participant said, “It’s hopeful” that there was one district who provided an “exemplar” of PD opportunities. This participant also indicated an interest in the way other districts are supporting teachers such as the example of a demonstration teacher. They said that is a “genius idea.” In addition, a participant said: “I love that the results came back that the district needs to be innovative and creative, and that PD should be hands-on.” To follow-up the participant said: “I think that’s great, we need to experience math as the students do.” The member checking process not only allowed me to hear the participants confirm my findings but also provided me additional insights that I was able to integrate into the findings.

Summary

In this study, there was one research question used to explore Grade K-5 teachers' perceptions of PD provided by their school or district intended to support mathematics

instruction. Eight elementary school teachers participated in the study to share their perceptions concerning the PD they are provided by their school or district. I made an audio recording of the interviews then developed transcripts of each. The transcripts were used to begin the data analysis process. I used the Quirkos program to code the transcripts and to develop categories and subcategories. From these categories and subcategories, I developed four themes to answer my research question. The four themes were as follows: (a) a common belief of teachers is that they have valuable insight into PD that is effective for them and are able to identify their PD needs; (b) teachers perceive PD to be most effective when it is hands-on and provides strategies that can be immediately applied in their classrooms; (c) overall, teachers perceived the PD they were provided did not fully meet their needs; and (d) overall, teachers are provided a limited amount of math PD from their schools or districts.

In Chapter 5, I provide my interpretation of the findings for the study. I describe how the findings compare and contrast to the existing literature and how they align with the conceptual framework of andragogy. I provide a description of the limitations of the study. I also present recommendations for future research and practice. Lastly, I provide an explanation of the implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative research study was to explore the perceptions of Grade K-5 teachers on the PD activities they received from their school districts to support mathematics instruction. Using a basic qualitative design, I conducted semistructured interviews to explore the perceptions of teachers on the types of PD they participate in and the frequency. The semistructured interviews allowed me to gain a more comprehensive understanding of how participants perceived the PD activities offered by their school. I used the conceptual framework of andragogy (see Knowles, 1975) for the study. A key finding was that participants did not receive PD that fully met their needs. Another key finding was that participants were limited in the amount of PD they received that specifically supported mathematics instruction. In this chapter, I interpret the findings, discuss the limitations of the study, offer recommendations for future research, and consider the study's implications for positive social change.

Interpretation of the Findings

I will interpret the findings from this study by using the conceptual framework of andragogy (see Knowles, 1975) and empirical literature. Andragogy is an adult learning theory that encourages active learning and dialogue in learning situations (Knowles, 1975). Andragogy assumes that adult learners bring valuable reflection and insight into their learning needs. The findings from this study are consistent with the assumptions of andragogy; as such, the framework provides a strong framework for the interpretation of findings. In analyzing the data, I identified four themes regarding the perceptions of Grade K-5 teachers on the PD they receive intended to support mathematics instruction. I

relate the findings to both the current literature and the conceptual framework of andragogy.

Teacher Input

The first finding that emerged from the study is encompassed in Theme 1, which concerns teacher input. A common belief of participating teachers was that they have valuable insight into PD that is effective for them and are able to identify their PD needs. Teachers in the study stated they had valuable insight into the types of PD they needed as well as the areas in which they had PD needs. This finding highlights the need for teachers to provide input into the PD they participate in. Teachers should have a voice in planning and facilitating PD opportunities (Smith & Robinson, 2020). However, when district leaders are developing PD, they do not always gather teacher input (L. E. Martin et al., 2019). A lack of teacher input and buy-in can become a barrier to effective PD (Monroe & Marvin, 2020).

During member checking, Participant 3 revealed a difference in opinion regarding teacher input. They stated that teacher input is valuable and important but also said there should be some PD that the districts have control over. Balance could benefit teachers by providing PD that is driven by the experience of the district. Engagement in PD can be a result of teacher buy-in so district decisions should be balanced with teacher input.

Participants were able to identify specific topics they needed PD on through reflection of their experiences. This study shows that teacher input is not always valued by districts. Concerning teacher input and buy-in, participants stated that they did not believe their input was taken into consideration in the design of PD. Even though some

districts survey teachers regarding feedback on PD, it is often done as a protocol instead of as an instrument to provide meaningful feedback. These findings are consistent with the findings of Wake and Mills (2018) showing that teacher input is often not taken into account when districts design PD. Wake and Mills also found that teachers who have input into the design and structure of PD are more likely to find it effective. This finding was evident in the participants who noted that their campus administrators requested teacher input regarding the campus' PD focus each year. When teachers have input into PD, they are more likely to take ownership of new learning (L.E. Martin et al., 2019). Studies have shown the value of teacher input into PD, but it is important that districts have procedures in place to not only collect teacher input but also to genuinely integrate it into PD plans.

Campus and district leadership set the tone for the PD that is offered to teachers (Shirrell et al., 2019). Districts must work to make sure they have set supports in place to integrate teacher input into PD decisions so that teachers receive the PD they need (Shirrell et al., 2019). Overall, participants in this study noted that they did not believe district leaders valued their input. District leaders need to integrate teachers' input into PD decisions. In addition, they should improve upon the development of PD committees so that the representation of teachers aligns with the teachers in the district. These committees should be designed so that teachers can give input and genuinely inform PD decisions.

These findings correlate with what Rigby et al. (2018) found regarding the value of teacher input into PD design at the district level. The researchers concluded that

district leaders need to take teacher feedback into account when making PD decisions. As evidenced in Rigby et al., using teacher input can help ensure that teachers receive the support they need. Many districts have existing structures in place to collect teacher input and integrate it. District leaders should be willing to improve upon these structures to meet the needs of teachers. In addition, leaders must strive to incorporate teacher feedback when designing PD models for adult learners.

Effective Professional Development

The second major finding of this study is reflected in Theme 2. Theme 2 was the following: Teachers perceive PD to be most effective when it is hands-on and provides strategies that can be immediately applied in their classrooms. Participating teachers described the PD activities they participated in and emphasized that PD should provide them opportunities to work with new information and materials as well as provide resources and strategies that can be used right away. PD is most effective when components such as active learning and collective participation are incorporated into the design, according to Desimone and Pak (2017). Participants echoed this finding. In addition, they stated that they preferred to participate in learning opportunities where they are able to work with new resources and try out new strategies. This finding aligned with the conclusions of Pak et al. (2020) in that participants wanted to practice new learning and receive feedback. Furthermore, they valued opportunities to observe other teachers or instructional coaches demonstrating new strategies. Therefore, district leaders should design PD to include time for teachers to work with new materials and see demonstrations.

Teachers are limited in the amount of time they have to search for new resources and try out new materials during the school day. They should be provided the opportunity to do this during PD. It could provide them a chance to gain a better understanding and enable them to use it effectively in their classroom. In addition, participants stated that they value PD that allows them to work cooperatively with other teachers and gives them time to prepare and plan how to use new strategies. Without the components of active learning and collective participation, participants expressed that PD was less meaningful and less relevant. Accordingly, district leaders should design PD so that teachers have ample time to explore new resources and work with other teachers.

An additional component of effective PD is coherence (Hopkins et al., 2017). Coherence refers to the ability to take what was learned in PD and apply it immediately in the classroom to meet specific students' needs (Kutaka et al., 2018). Kutaka et al. (2018) posited that aligning PD with curriculum goals enables teachers to match their lessons and instructional activities effectively to state learning standards. This finding supports the results of this study. District leaders should design PD that is tailored to teachers' professional and individual classroom needs. PD should provide strategies and techniques that can be used right away. This study confirmed the findings of Desimone and Pak (2017) in that teachers in the study appreciated the support districts provided in the implementation of new strategies and programs. Continual support is more beneficial than PD that provides a 1-day training without a refresher course or follow-up support.

Instructional coaching varied in its implementation among the districts represented in this study. The findings of this study added to Kraft et al.'s (2018) finding

that instructional coaching did not have to be done in high doses to be effective. An important realization from this study was that participating teachers had varying expectations for instructional coaching. Some teachers expressed a desire for high doses of coaching whereas others believed they needed lower amounts of support. The participants appreciated coaching that allowed them to request help when they needed it. The study findings support a need for districts to integrate teacher input into PD design so that teachers can determine the frequency of PD support.

The findings of this study align with the assumptions of andragogy in that the reflect that learning is more meaningful when it is focused on current issues and can be applied immediately (Knowles, 1975). The participants confirmed this with their responses. On-the-job embedded PD is one way to provide teachers timely strategies that relate to their individual classrooms (Appova & Arbaugh, 2018). This finding was supported with responses from this study. PD often focuses on topics that relate to broad ideas (Appova & Arbaugh, 2018). Instead, as the study shows, teachers need PD that is connected to the current issues they face in their individual classrooms. PD should be designed so that it provides teachers with strategies they can take and use in the classroom immediately.

Professional Development Needs Not Met

Another key finding from this study is reflected in Theme 3. Theme 3 was the following: Overall, teachers perceived the PD they were provided did not fully meet their needs. The participants explained that the PD they received often does not fit their professional needs. This finding is consistent with research showing that traditional

workshops that are structured so that teachers sit and listen to a presenter do not encourage teacher learning (Clark et al., 2018). One-day workshops often take a one-size-fits-all approach to PD that does not take individual learner differences into account (Tanner et al., 2017). This finding was supported by this study. Participants stated that PD often follows a "sit and get" approach in which PD presenters talk to teachers and tell them information but do not always provide a chance for teachers to discuss the new learning or practice new strategies.

This approach also limits collaboration and active participation for teachers. PD is more effective when teachers are provided active learning time (Pak et al., 2020). The recommendation of Pak et al. (2020) was supported by this study. PD should allow teachers to have discussions with other teachers and build connections with teachers who are experiencing the same challenges they are. In addition, PD should be just as engaging as teachers' lessons are expected to be. Teachers should experience learning in engaging ways also. Adult learners benefit from learning new information in ways that encourage interaction with content and colleagues (Pak et al., 2020). There are a variety of PD activities schools and districts can use to provide support for teachers (C. Martin et al., 2018). The participants in this study indicated PD often follows a common format and is not always built upon the effective components of PD.

An assumption of andragogy is that adult learners are often task-oriented in learning situations and are motivated based on self-fulfillment (Knowles, 1975). The findings of this study confirm this assumption. PD should involve teachers in learning and should fit their professional needs. Notably, teachers have a desire to search for new

strategies, ideas, and techniques to support them in their current teaching assignment. PD should be available for teachers who might need additional support because of a change in teaching assignment or classroom context. PD should allow teachers to work and apply new information with colleagues.

This study contributes to existing studies by describing the barriers teachers face in regard to participating in PD outside of their school setting. Whereas teachers aspire to grow professionally by searching for PD outside of what they are provided, outside PD can be costly (Appova & Arbaugh, 2018). Teachers often have to use personal days to attend PD (Appova & Arbaugh, 2018). Sometimes the registration fees are reimbursed, and sometimes they are not. This finding aligned with the study conducted by Appova and Arbaugh (2018) that showed teachers appreciated their schools providing compensation and reimbursement for outside PD. Teachers also have to give up time from their families to do outside PD. This finding was also similar to that of Appova and Arbaugh showing that teachers wanted to be sure that the outside PD was going to be worth the time they were giving up with family. To address these barriers, district leaders should provide effective PD or coordinate outside PD opportunities so teachers are able to receive the support they need.

Limited Professional Development Opportunities

Theme 4 offered a final finding regarding PD intended to support mathematics instruction. Theme 4 was: Overall, teachers were provided a limited amount of mathematics PD from their schools or districts. The frequency and amount of mathematics PD varied among participants. Most teachers said their district did not

provide an adequate amount of mathematics PD. Some teachers had not received any mathematics PD in recent years. Notably, one component of effective PD is that is has a content focus (Desimone & Pak, 2017). Providing a content focus can increase a teacher's understanding of the content they are teaching (Pak et al., 2020). It is important for PD to be designed to increase teachers' pedagogical content knowledge and mathematical knowledge of teaching (Desimone & Pak, 2017). These findings were confirmed by teachers in this study. Districts should provide PD that is focused on mathematical skills and pedagogy.

Adding to the existing literature, this study found teachers experienced changes in teaching assignments that influenced their need for mathematics PD. As teachers experience changes in grade level assignments through the years, they need to revisit content and strategies that fit their changing instructional needs. This study highlighted the need for content-focused PD that provides continual support. Even though teachers may receive PD to support their mathematics instruction during a school year, districts should provide continual support to help when a teacher faces a change in teaching assignment in a subsequent year. This study presents the need for PD support that fits the specific content demands of mathematics.

The findings of this study were consistent with those of C. Martin et al. (2019). Teachers expressed that PD seems to be more focused on reading than mathematics. Both mathematics and reading are vital to students' academic achievement. PD should be balanced between mathematics and reading. It was evidenced in this study that oftentimes reading seemed to take priority over mathematics in regard to PD and campus goals.

Districts should provide effective training for mathematics and reading that supplies ample support for the specialized needs of these subjects.

Funding seemed to have a big influence on the mathematics support and PD available to teachers. Districts have to make decisions on where they will spend their money, and there often is not enough left to provide the quality PD teachers want. A study conducted by Kraft et al. (2018) described the budgetary restrictions districts face and how they influenced the PD that was offered. This study echoed these findings. Some districts have removed mathematics instructional coaches and support positions due to funding. In addition, funding has also prevented teachers from having mathematics PD conducted in their districts. Districts should work to maximize the use of funding so that teachers can receive the mathematics focused support they need.

The andragogical assumption that adult learners have experiences that contribute to their learning and helps guide new learning is relevant to the findings of this study. Districts should capitalize on teachers' prior experiences and internal reflection when designing PD. This study highlighted the fact that teachers were able to identify the areas in their pedagogical content knowledge that needed support. This support came from both district and outside PD sources and varied. Districts should organize mathematics PD so that teachers have access to PD that matches the frequency, theme, and format they desire. The subject of mathematics requires a knowledge of content as well as the knowledge of effective instructional strategies. An important finding from this study is that the PD provided to teachers concerning mathematics varies by district and is often limited.

Discrepant Case

Distinct differences arose between the experience of Participant 3 and the other participants regarding the availability of mathematics PD and the degree to which needs had been met. Overall, participants expressed varying degrees of mathematics PD offered to them by their districts. Most participants said their PD needs had not been met and PD opportunities were limited for mathematics. However, Participant 3 indicated their mathematics PD needs had been fully met, and they had an abundance of support available. The case of Participant 3 offers an exemplar for districts concerning the design of their PD structures.

The exemplar provided by the district of Participant 3 showed that a district can build an effective PD program that benefits teachers. This district's program showed that PD is more effective when teachers are provided a variety of formats, frequencies, and themes. For example, instructional coaching proved to be a valuable option for consistent and continuous support centered on teachers' needs. Other forms of PD were available such as book studies and mathematics curriculum support. This district provided a balanced amount of support at the campus and district level. Districts can use this as a model when making decisions concerning PD. There are many options when it comes to PD and teachers have valuable insight into the methods that work best for them. It is possible for a school district to offer PD that meets teachers' needs if they follow the exemplar provided by the district of Participant 3.

Limitations of the Study

This study had three limitations. The first limitation was that the study did not include observations of teachers' instructional practices prior to and following participation in PD. Being able to observe how a particular PD activity changes a teachers' practice could provide more insight into effective forms of PD. The second limitation was the sample size of eight participants. To increase the chances of gathering pertinent data for the study I had the participants self-identify they fit the inclusion criteria. The participants were a national sample and represented multiple states in the United States. However, a larger sample size might have provided more information on teachers' perceptions in other parts of the United States.

The last limitation was researcher bias. To prevent researcher bias, I used validation strategies such as member checking to ensure I had accurately recorded and analyzed participants' responses. I used two forms of member checking. I provided the findings from the study to all participants and held follow-up interviews with a subset of participants to request feedback. The participants confirmed the findings and included additional information to build a better understanding of the findings. I integrated the new information that surfaced in the follow-up interviews into the findings.

Recommendations

There are four recommendations for future research based on the findings of the study and the literature surrounding the topic. The experiences of the participants provided a better understanding concerning their perceptions of the PD they are provided by their district. The discrepant case of Participant 3 provided insight into a district that

provided ample PD opportunities for its teachers. This district offered a variety of PD formats, themes, and frequencies that were driven by teacher input. The experience of other participants showed a range of minimal to average amounts of PD and most indicated they did not feel their needs were met. The comparison of the structure of PD for the district of Participant 3 to that of other districts informed my recommendations.

The first recommendation is to conduct this study with a narrowed focus on specific states. It was evident in this study that the funding provided to districts for PD varied by state. It could be beneficial to focus on how teachers across a specific state perceive the PD they are provided. Doing this could give insight into how state funding could be allocated to better meet teachers' needs.

The second recommendation is to research how PD influences teachers' practices. This study focused on teachers' perceptions of mathematics PD. It could be beneficial to study how different types of PD guide teachers' instructional decisions. Understanding the guiding force behind teachers' decisions could provide insight into which PD activities teachers prefer and the ones that encourage positive change in practice. These perceptions could inform PD design leading to more effective learning activities.

The third recommendation is to study the specific needs elementary mathematics teachers have. Understanding teachers' needs could provide insight into the particular areas in which teachers need support. Campus and district administrators could benefit from a better understanding of these areas that include content, instructional strategies, and intervention techniques. Having an understanding of these areas could help districts design PD that more accurately fit the needs of teachers.

The final recommendation is to conduct a case study on the exemplar district described in the discrepant case. Gaining an understanding of how a district with robust PD opportunities designs and maintains such a program could inform other districts' decisions regarding PD. Decisions concerning funding, resources, and support could be positively influenced by increasing awareness of the best ways to structure and sustain PD.

Implications

This study has the potential for positive social change. Gaining an understanding of how teachers perceived the PD they were provided allows stakeholders such as principals and district instructional leaders to learn what teachers believe are essential components of PD. It is important teachers have the specialized mathematics support they need to build effective instructional strategies and to gain a strong understanding of mathematical content. It is vital that teachers are provided with meaningful PD activities that meet the individual needs of their classroom context because student achievement can be influenced by teacher effectiveness. In addition, providing teachers ample support could also influence job satisfaction. Teachers that believe they are well prepared to teach mathematics and know they have resources available such as on-the-job embedded PD support could be more confident in their teaching practices and in their teaching assignment. This could lead to a decrease in teacher attrition in districts.

The findings of this study showed that overall, teachers did not receive PD that met their mathematical needs. Some participants indicated that their district provided some PD focused on mathematics whereas other participants noted they had not received

any in recent years. The range of PD provided by districts was wide and showed discrepancies across districts and states. The discrepant case of Participant 3 informed my recommendations for practice. The structure of PD programs for the district of Participant 3 can advise other districts in effective ways to provide consistent and continual mathematics support.

The first recommendation for practice would be to use the district of Participant 3 as an exemplar. This district provided an abundant amount of PD for teachers. It would be beneficial to identify ways to create those same PD structures in other districts so that teachers have input and choice in PD. It is possible districts can take a look at current funding and find ways to increase the frequency and form of PD support. The discrepant case could provide a model for building an effective PD structure in districts. In this case, teachers were able to request instructional coaching as they needed it. They were also able to request support with content and lesson design. The PD in this district centered on a connection to specific classroom and campus needs. This model of PD has the potential to inform other districts as they design their PD programs.

The second recommendation for practice was informed by a participant who indicated their district had built-in demonstration teacher positions that allowed current classroom teachers to also serve as support for their peers. This district had not merely instructed teachers to help their coworkers but had provided training for them to assist in supporting teachers. The district had also designated time for the demonstration teachers to support other teachers. Districts should be willing to be innovative and creative in the ways they design the structure of PD programs. Funding had a big impact on the PD

provided by districts. Finding resourceful ways to meet teachers' mathematical PD needs could have a positive impact on teacher effectiveness and student performance.

An additional recommendation for practice was that districts should consistently request teacher input and integrate it into PD plans. A small number of participants expressed that campus administrators listened to teacher input and allowed teachers to choose PD themes. Although some participants noted they had completed surveys and participated in PD committees, the overall belief was that their feedback was not valued or used in the design of PD. Many participants stated that they did not believe districts integrated their input into PD plans. Districts should genuinely request teacher feedback and make an honest effort to integrate teacher input into their PD design. Teachers in this study expressed the ability to identify areas in which they needed support and had a strong understanding of how they learned best. Districts should take adult learner differences and experiences into account and build PD to meet teachers' needs.

A final recommendation for practice would be for districts to design and provide hands-on learning activities in PD. Teachers in this study emphasized the importance of designing PD so that there is time to try out new manipulatives and resources during the session. Districts should provide these opportunities so that teachers can take new learning and begin to apply it to their classroom contexts. When teachers can do this in a collaborative PD setting, they are more likely to integrate new learning into their instructional practices.

Conclusion

There was a gap in practice affecting Grade K-5 teachers. The problem that was addressed through this study was that Grade K-5 teachers were not getting the mathematics support they needed through the PD activities they were provided through their school district. The focus of this qualitative study was to explore the perceptions of Grade K-5 teachers on the PD they received from their district to support mathematics instruction.

Researchers have argued that elementary mathematics teachers do not receive the PD support they need (C. Martin et al., 2018, 2019; L. E. Martin et al., 2019; Swars & Chestnutt, 2016). Desimone and Pak, 2017 posited PD that provides support in understanding the specialized demands of mathematics instruction enables teachers to implement new standards more effectively. When comparing the frequency and amount of PD of reading and mathematics, it was found that PD for reading occurs more often than it does for mathematics (C. Martin et al., 2019). Research has also shown that teachers do not always have input into the PD in which they participate, affecting the amount of buy in they experience (L. E. Martin et al., 2019). Additionally, studies showed the PD teachers are provided did not consistently advance their instructional practices (C. Martin et al., 2018). Even though research makes recommendations for components of effective PD overall teachers believe their mathematics PD needs are not met.

Key findings from this study showed that overall, the PD teachers receive from their district do not support their needs. The amount of support from campus and district

administrators varied among participants. Most teachers indicated they had not been provided enough PD to support their mathematics needs. In contrast, there were a few participants who expressed their PD needs had been met through the district's plenteous PD opportunities. For example, there was a discrepant case in this study which showed a participant who had received an abundance of mathematics PD and believed their needs had been met. This teacher had received continual support through the school year and was able to receive personalized training based on their instructional needs. Overall, teachers did not believe their input regarding PD was taken into consideration by districts and emphasized the need for administrators to factor their input into PD decisions. In addition, teachers explained the need for PD that was hands-on, collaborative, and timely. The conceptual framework of andragogy aligns with the findings of this study in that adult learners bring valuable experiences into learning and have insight into the most effective ways to learn. However, most teachers described PD as being one-size-fits-all and not taking their individual learning differences into account. Lastly, teachers highlighted the need for PD that provided a mathematics content focus so they could better meet the requirements of mathematics instruction.

This study provides insight into teachers' perceptions concerning the PD they receive. Recommendations for practice included districts should study other districts that are providing an ample amount of PD for their teachers. Districts should also be creative in the ways they meet their teachers' PD needs. In addition, districts should regularly receive input from teachers regarding the themes and formats of PD and should make an honest effort to meet teachers' needs. Lastly, districts should provide PD that includes

hands-on learning activities that allow teachers to work with new resources and information prior to integrating them into their instructional practices.

Campus and district administrators can use the findings from this study to inform their decisions regarding PD. This study has the potential to encourage positive social change in that campus and district administrators can gain a better understanding of what teachers view as effective forms of PD. Teachers have the potential to provide meaningful feedback to the PD that best meets their mathematical needs. I challenge PD designers to genuinely ask for teacher input and be innovative in how they meet teachers' PD needs.

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Appendix: Interview Protocol

Interviewee Name: Interview #:	Conducted by:
Date: Location:	Start time: End time:

Greeting:

Hi this is Shannon Manley. I want to thank you for agreeing to participate in my research study. I will be asking you some questions regarding your experiences with professional development intended to support mathematics instruction at the elementary level. The interview will consist of some pre-determined questions and follow-up questions. The follow-up questions will allow me to gain a fuller understanding of your experience. Please be open and honest with your responses.

This interview should take no longer than 1 hour. I will be recording the interview to assist me in data analysis and to ensure I have accurately captured your responses. I will also be taking notes during the interview.

The data collected in this interview will be kept confidential. Your name and/or identity will not be included in the study, it will only be known to me. You do not have to talk about anything you do not feel comfortable with and can choose to end the interview at any time. Please ask for clarification at any time regarding a question that may not be clear to you.

Do you have any questions you would like to ask at this time? Can we proceed?

1. Opening Questions: How long have you been a teacher? How long have you taught mathematics at the elementary Grade K-5 level? What grade level and subjects do you currently teach?
2. What opportunities for professional development, provided to you by your school or school district, have you participated in?
3. Describe your experience with professional development, provided to you by your school or school district, intended to support mathematics instruction.
4. What opportunities for mathematics professional development activities seem to be the most effective for you? Can you provide examples?
5. Describe any experience you have had with professional development intended to support mathematics instruction that seemed ineffective. Can you share some examples with me?
6. Describe any experience you have had with participating in mathematics professional development outside of your school setting. Did you coordinate these activities on your own, without the guidance of your school? What contributed to your decision to participate in these specific activities?
7. Describe any challenges you face as a mathematics teacher. Have these challenges been addressed through the professional development provided to you by your school or school district?
8. Describe ways in which your mathematics professional development needs have been met by your school or school district?

Closing:

Thank you so much for participating in my study and providing feedback regarding the area of professional development. Remember that I will keep your responses confidential. I would like to schedule a follow up call for next week so that you can review the transcript of the interview and the notes I have taken to help ensure I have accurately recorded your responses. Do I have your permission to contact you for a follow up interview?

Do you have any questions?

Thank you.