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Secondary Mathematics Teachers' Perceptions and Experiences with Implementing Collaboration in US Classrooms

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This is to certify that the doctoral dissertation by

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Abstract

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MA, Western Governors University, 2014

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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In Curriculum, Instruction, Assessment, and Evaluation

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Abstract

Collaboration is an underused teaching strategy despite its benefits and the call for curriculums worldwide to increase its use. To aid in discovering why the strategy is underused, more information was needed about the implementation of collaboration in the mathematics classroom. The purpose of this study was to investigate mathematics teachers' perceptions and experiences when implementing collaboration in their classrooms. The conceptual framework that grounded this study was Vygotsky's social constructivism. Data for the basic qualitative study were collected through 12 interviews with mathematics teachers in California, Oregon, and Washington who have implemented collaboration. Through inductive analysis, seven themes emerged which included the procedures, grouping methods, group work skills, and classroom environment teachers use to implement collaboration as well as the issues teachers face and the benefits teachers outlined when using collaboration. The findings may contribute to social change as they provide school administrators with pertinent information on how to support teachers in implementing collaboration successfully. By providing more professional development on collaboration to teachers, students may gain the benefits from the successful implementation of collaboration in the mathematics classroom.

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Dedication

This dissertation is dedicated to my children. When someday you have a dream to do something everyone around you says is not possible, I will look you in the eye and say, "Go for it because I did, and this paper is proof that nothing is impossible."

This is also dedicated to my wife, who was the engine that kept this machine running. Without her, I would never have known what I could have done.

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Chapter 1: Introduction to the Study

Introduction

Collaboration in the mathematical classroom is a strategy that is currently being integrated into the curriculum throughout the United States (US; Dolma et al., 2018; Guffey & Slater, 2020; Tunali, 2020). Collaboration has many benefits that come from implementing the strategy (Arlsan, 2020; Erdogan, 2019; Voskoglou, 2019). However, despite the benefits, the method is underused in the mathematics classroom (Buchs et al., 2017). To determine why the strategy might be underused even when presented with training, more information is needed about the implementation of the strategy in the mathematics classroom. Thus, a gap in the literature is the experience and perceptions of mathematics teachers when implementing collaboration in US classrooms (Veldman et al., 2020), more specifically in California, Oregon, and Washington.

Chapter 1 is an introduction to the study. The chapter includes information about what is currently known about the benefits of collaboration. Next, it explores what is being shown about teachers' perceptions and experiences and how the information can be used to inform. The chapter then continues to lay out the problem statement, purpose statement, and research questions that guided the dissertation. Then, the conceptual framework of social constructivist theory and how it relates to a qualitative study are discussed. Finally, the chapter ends by examining the study's nature, key definitions, scope, delimitations, and limitations.

Background

The use of student collaboration in the classroom is a strategy that has shown many positive results. Researchers have shown that when compared to a control group, the group of students that is taught using a collaborative approach outperforms those of the control group (Erdogan, 2019; Kalaian et al., 2018; Voskoglou, 2019). Beyond better assessment performance, the use of a collaborative approach has also been shown to have other benefits. For example, Dzemidzic Kristiansen et al. (2019) mentioned that collaboration can improve students' decision-making skills. Social skills also improved (Arlsan, 2020; Liebech-Lien, 2020; Erdogan, 2019), and collaborative learning could enhance intrinsic motivation to learn (Namaziandost et al., 2019). It has even been reported that collaboration can improve students' critical thinking skills when used with reflective practice (Erdogan, 2019). Hence, the use of collaboration can aid students to improve in many ways.

Although student collaboration appears to have many benefits, implementing the practice can have challenges. Teachers reported that they do not believe implementing collaboration would be an easy task (Dzemidzic Kristiansen et al., 2019). A possible reason for this belief is a lack of acceptance of the practice by the community, amongst other reasons (Ampadu & Danso, 2018). Also, teachers tend to prefer collaboration when they are taught to use collaboration for their studies (Bhusumane & Nkhwalume, 2019). In addition, there are challenges such as students getting by doing no work (Le et al., 2018), and teachers reinforcing the notion that some students are smarter and more

capable than others (Louie, 2019). Despite the challenges, teachers who have a more learner-centered belief were found to be more capable of overcoming those challenges (Dzemidzic Kristiansen et al., 2019). In addition, when teachers had a more positive attitude towards the use of collaboration, the student performed better (Veldman et al., 2020). Besides beliefs and attitudes, the teacher's ability to know when to step in to help and when to let students work out the solutions was an essential part of creating a more collaborative classroom (Duran et al., 2019; Munson, 2019; Van Leeuwen & Janssen, 2019). Even if a teacher lacks this skill and the belief, training around the use of collaboration could improve the success of implementation (Dzemidzic Kristiansen et al., 2019). Therefore, despite the challenges and teachers' experiences associated with the implementation of a collaborative approach; teachers can successfully implement the approach if given training.

Although the challenges and backgrounds of teachers can influence the implementation of collaboration, the students' perceptions and backgrounds can also influence it. High achiever students expect to work less in a group, whereas lower performing students expect to work more (Guy et al., 2019). The student's family background can also influence the student's willingness to participate in collaborative learning (Tunali, 2020). Thus, students' backgrounds and perceptions must also be considered to implement collaboration successfully.

Not only are students' perceptions essential for implementation, teachers' perceptions are as well. Even when a collaborative practice is part of the curriculum,

teachers do not consistently implement it in meaningful ways (Dolma et al., 2018). Teachers would often know the effectiveness of using collaboration in the classroom (Abramczyk & Jurkowski, 2020). However, teachers could also hold misconceptions about collaborative learning that would hinder their ability to complement the practice effectively (Guffey & Slater, 2019). Even at the university level, the teachers' collaborative approach appeared to be related to their research on education (Cao et al., 2019). However, teachers showed a greater willingness to implement collaboration when they were trained on properly using it (Osmanoglu & Dincer, 2018) and given specific strategies to use (Ghaith, 2018). Consequently, teachers' perception of implementation of collaboration can be positively influenced by the use of professional development.

Problem Statement

Collaboration in the classroom is a topic that is prevalent in educational research. In 2018, Ampadu and Danso found a need for the mathematics classroom to use more collaboration. The findings are consistent with the trend of new curricula in the United States moving toward more collaboration in instruction (Dolma et al., 2018; Guffey & Slater, 2020; Tunali, 2020;). Van Leeuwen and Janssen (2019) showed that one kind of collaboration in the mathematical classroom is when the teacher gives guidance to the students as the students work in groups collaboratively to problem-solve. Researchers have shown that using collaboration in an instructional approach could substantially impact the students' learning and growth (Asha & Al Hawi, 2019; Munson, 2019; Voskoglou, 2019). However, despite the positive benefits of using collaboration in the

classroom, too few teachers use collaboration in their classes (Ghavifekr, 2020).

Nonetheless, Veldman et al. (2020) found that teachers could have favorable perceptions

of collaborative mathematics when presented with training on using the method and

hands-on implementation. Therefore, Veldman et al. (2020) suggested conducting further

research about the subject-specific teachers' experiences and perceptions about

implementing collaboration in their classrooms. Thus, a gap in the literature is the

understanding of the experience and perceptions of mathematics teachers when

implementing collaboration in the US classroom. Considering this gap, the research

problem for this study was mathematics teachers' experience and perceptions of

implementing collaboration in US classrooms.

Purpose of the Study

It is recommended by researchers and school associations that there should be a

shift toward more collaboration in mathematical instruction in the United States (Dolma

et al., 2018; Guffey & Slater, 2020; Tunali, 2020). Despite the many benefits to students

of using collaboration in a mathematics classroom (Arlsan, 2020; Erdogan, 2019;

Liebech-Lien, 2020;), the instructional strategy of collaboration seems to still be

underused in the classroom setting (Louie, 2020). Understanding teachers' experiences

and perceptions can aid in discovering ways to change their practice (Cao et al., 2019).

Thus, the purpose of this study was to investigate mathematics teachers' experiences and

perceptions of implementing collaboration in US classrooms.

Research Questions

As stated, the purpose of this study was to investigate mathematics teachers' experiences and perceptions with implementing collaboration in US classrooms. Therefore, qualitative research questions were chosen because this study investigated teachers' perceptions and experiences. Thus, two different research questions were chosen, one to investigate the experiences of the teacher and the other to investigate the perceptions:

RQ1: What are mathematics teachers' experiences of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

RQ2: What are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

Conceptual Framework for the Study

The conceptual framework for the study was social constructivism, as laid out by Adams (2006). Social constructivism has two main features: knowledge is constructed by an individual's experience and prior knowledge because of their interaction with the physical and social world (Oluwatosin & Ajani, 2022). Kosnik et al. (2018) discuss one of the critical elements of social constructivism in collaboration, and students helping students. This is the basis for incorporating group work as it enables the students to construct the knowledge needed for the problem through their social interactions. This theory forms the basis for the use of incorporating collaboration in a classroom setting for math education (Oluwatosin & Ajani, 2020). Thus, both the interview questions and the

interpretation of the data were viewed through the social constructivist lens, similar to what was done previously (Kosnik et al., 2018).

Nature of the Study

The study used a basic qualitative approach. Merriam and Tisdell (2016) described a basic qualitative approach as investigating "how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (p. 24). Therefore, this study focused on teachers' experiences and perceptions and, thus, how they interpret those experiences and perceptions. The study focused on experience to see how those experiences are interpreted and the meaning attributed to those experiences. The study also focused on teachers' perceptions to look further into how the teachers construct their point of view about the implementation of collaboration.

To investigate the experience and perceptions, data were collected by conducting semistructured interviews. The method of semistructured interviews was chosen because it allows for the interviewer to ask more probing questions and for the interviewee to ask clarification questions (Kosnik et al., 2018). The tool that was used to conduct the interviews is a digital tool called Zoom, which allows people to communicate live through audio and video. The audio was recorded so that the interviews were transcribed accurately. The transcripts were analyzed using an inductive approach, with the help of Excel to find any patterns or trends. The participants were twelve secondary (students ages 11-18) mathematics teachers who have, or currently are, implementing collaborative

learning in their mathematics classroom in the US (California, Oregon, and Washington). The participants were selected using purpose sampling because they had to have experience using collaboration in a mathematics classroom. Twelve participants were chosen, as it is the amount recommended by Veldman et al. (2020). I offered a $20 gift card to the participants for participating. The teachers were recruited from schools in the United States by contacting the Walden participant pool and using online communities.

Definitions

For this study, several key terms were defined to ensure clarity in what is being studied and why. All the terms center around the components of teachers' experience and perception when implementing collaboration in the mathematics classroom. Therefore, the terms chosen focused on education and the implementation of collaboration as an instructional strategy.

*Collaboration: S*tudents working in small groups (two to five students) for the purpose of solving problems through discussions (Le et al., 2018).

Critical Thinking: When one seeks to gain a better understanding of an object through analyzing, evaluating, and synthesizing (Egege & Orr Vered, 2019).

Engagement: When students participate in their learning on a behavioral, affective, and cognitive level (Groccia, 2018).

Instructional Practice: The strategies used by a teacher to improve the learning of the students. (Osborne, 2021).

Learner-Centered Instruction: An instructional design that uses students' perspectives to guide the learning experience for student success (Hwang, 2021).

Problem Solving: A mental process of seeking out problems and engaging with solving them using data to reach a suitable conclusion (Yazgan, 2021).

Teacher-Centered Instruction: Instruction is designed to transfer knowledge to the students through the teacher (Beyhan, 2018).

Secondary school: School for students ages 11 to 18 (Fernández-Agüero & Hidalgo-McCabe, 2022).

Assumptions

Several assumptions were made throughout this study. The first is that the teachers effectively incorporate collaboration in their classes. Another assumption is that teachers were honest about their experiences with implementing collaboration. Finally, it was also assumed that teachers could properly reflect on and articulate their perspectives.

Scope and Delimitations

The scope of this study was to get the perceptions and experiences of secondary mathematics teachers when it comes to implementing collaboration in a US classroom, particularly classrooms in California, Oregon, and Washington. Data were collected from mathematics teachers who are currently using collaboration as a learning strategy in their classes. The teachers were from secondary schools in the states of California, Oregon, and Washington. Thus, data collection was specific to those mathematics teachers who are willing to participate and who use collaboration as a teaching strategy in their

classrooms in those states. Teachers of other subjects besides mathematics were not considered unless they were also teaching mathematics. This was due to the lack of use of collaboration as a teacher strategy in mathematical classrooms (Ampadu & Danso, 2018). In addition, secondary teachers were chosen because the strategy is used less often in secondary schools than in primary schools (Louie, 2020). The states were chosen because they were three that use the Common Core State Standards for Mathematics (CCSSM). The reason for choosing states that use the CCSSM is because the skills learned from using the collaboration strategy align with the CCSSM's learning outcomes of "construct variable arguments and critique the reasoning of other" (Common Core State Standards for Mathematics, 2009, p.6) and "attend to precision" (Common Core State Standards for Mathematics, 2009, p. 7). I gave a $20 gift card to the participants for participating. A variety of experiences, genders, and races were included in the study. The reason for selecting these participants in this matter is to make the results more transferable to mathematics teachers in a secondary classroom setting in the US.

Limitations

The limitations would be finding participants and the ability to collect data. I am looking for teachers with a particular kind of experience, so it might be challenging to find enough teachers with that experience to do the study. Also, I live in Sri Lanka, but the study focuses on the US. That being the case, I would have to account for the time difference to collect data through Zoom or Skype calls; many of those calls might have to be conducted during the middle of the night.

Significance

This study is vital to the field of mathematical education because it offers insight into mathematics teachers' experiences and perceptions of implementing collaboration in the classroom. Gaining insight into the experience and perceptions could be used to learn about what goes into implementing collaboration in the classroom. Experiences and perspectives could affect the ability to implement the practice (Sleenhof et al., 2019); the information could be used to help improve classroom collaboration training. The training would lead to positive social change because proper training can encourage more teachers to collaborate (Osmanoglu & Dincer, 2018). More use of collaboration in the mathematical classroom could have many positive outcomes for student learning (see Arlsan, 2020; Erdogan, 2019).

Summary

In this section, I introduced the topic of the dissertation. The dissertation centered around the experience and perspectives of secondary mathematics teachers implementing collaborative learning in their classrooms in the US. The dissertation includes background information on the topic, as well as the purpose of studying the topic. I then explain how the topic was studied, and some of the assumptions and limitations associated with the study. In the next chapter, I will discuss the literature surrounding the topic of secondary teachers' experiences and perceptions when implementing collaboration in US classrooms.

Chapter 2: Literature Review

Introduction

The research problem for this study was mathematics teachers' experience and perceptions of implementing collaboration in the classroom. The purpose of this study was to investigate mathematics teachers' experiences and perceptions of implementing collaboration in the classroom. The current literature on the topic focuses on student collaboration, implementation, and teacher perceptions. The literature on students' collaboration concentrates on the benefits of using collaboration in education, including in the mathematics classroom. Implementation aims to discover what sorts of challenges teachers might have when implementing the instructional strategy of collaboration. Finally, teacher perceptions show how teachers view the use of the strategy in their class.

In this chapter, I covered the search process I used to find the articles for the literature review. Then I explored the background of the conceptual framework I used to focus my study. After that, I wrote about all the current research surrounding my topic. Finally, I will end by summarizing the chapter.

Literature Search Strategy

The following are articles selected for my dissertation. I used two fields in the Education Source Database and the Thoreau multi-database search. For field one, I used *teacher perceptions* OR *teacher attitudes* OR *teacher views* OR *teacher beliefs* OR *educator perceptions* OR *educator attitudes* OR *educator beliefs*. In the second field, I used *Group Discussion* OR *peer discussion** OR *peer collaborate** OR *peer cooperate**

OR *student discussion** OR *student collaborate** OR *student cooperate*.* In addition to using search engines, I use two other tools to help me find articles. First, I searched recent doctoral dissertations in ProQuest that had a similar topic to mine the articles they used. Lastly, when I found an article relevant to my study, I would use the "cited by" feature on Google Scholar to find more articles.

Conceptual Framework

In education, several significant knowledge theories exist, including cognitivism, social learning, behaviorism, and constructivism (Eryaman & Genc, 2010). Multiple theories for learning exist due to different theorists' views on how people acquire knowledge. These theories frame the context in which education is present, and the way teachers operate within the educational institute (Clark, 2018). For example, one of the theories in cognitivism is when the material is taught in such a way as to give meaning to students through learning, instruction, and memory (Clark, 2018). According to Clark (2018), learning occurs once the information is meaningfully organized. The social learning theory emphasizes observational learning, which is when students make observations and respond to them (Bandura, 1977). However, these two theories did not appear to influence instructional practices significantly.

One theory of knowledge that has been popular for a while is behaviorism. In behaviorism, an instructor provides knowledge acquired by the learner through a finding process (Boghossian, 2006). This theory is usually described as the traditional method of teaching where students sit and listen to the teacher's lecture and often take notes. This

teaching style was essentially the only teaching style of mathematics until the 1970s (Ampadu & Danso, 2018). Although other theories started to come into classrooms after the 1970s, behaviorism-style instruction is still considered to be the dominant form of teaching today (Muhammad, 2021). However, this approach has been an ineffective learning form (Gordy et al., 2018). It often only promotes procedural knowledge and can lead to a lack of depth in students' understanding (Voskoglou, 2019). This means that this teaching method has been unable to properly develop students' critical thinking skills (Ampadu & Danso, 2018). One cause of the lack of critical thinking development is that in behaviorism, tasks are often decontextualized to avoid distraction (Li, 2020). This is in part because, in a behaviorist approach, students are far less autonomous when it comes to the learning process (Li, 2020). However, many theorists believe that the behaviorist way of teaching mathematics does not work, and students need to actively construct their knowledge (Ahmed et al., 2020) through constructivism.

Constructivism is when the instructor supports the learner's construction of knowledge through natural processes (Boghossian, 2006). Dewey first developed constructivism (1916) because he did not view children as machine-like, in the sense that they were not something to be told what to do and would repeat and follow commands. In constructivism, students engage in activities to acquire knowledge instead of listening to lectures (Erbil, 2020). The student uses prior knowledge to shape their engagement in the activity, which allows them to gain new knowledge (McHaney et al., 2018). The

constructivist approach to teaching is linked to increased academic performance and problem-solving skills when implanted into the classroom (Erbil, 2020).

Even with constructivism, multiple types exist. One is cognitive constructivism, where knowledge is gained through an individual internal process (Piaget, 1953). A second is a radical constructivist developed by Von Glasersfeld based on Piaget's original constructivism theory (Voskoglou, 2019). This theory builds off the previous but finds that there cannot be an accurate depiction of reality (Von Glasersfeld, 1989). Through social constructivism, knowledge is gained through social interactions and can be accurate (Vygotsky, 1962). Collaboration is a key element of social constructivism (Powell & Kalina, 2009; Retnowati et al., 2017). More specifically, student-to-student collaboration stems directly from social constructivist theory (Kosnik et al., 2018). Social constructivism has also been used to frame interview questions (Kosnik et al., 2018). Therefore, collaboration as a learning strategy stems directly from social constructivist theory.

The conceptual framework for the study is social constructivism, as laid out by Adams (2006). Social constructivism has two main features: knowledge is constructed by an individual's experience and prior knowledge as a result of their interaction with the physical and social world (Doubleday et al., 2015). Kosnik et al. (2018) discuss that one of the key elements of social constructivism is collaboration and students helping students. This is the basis for incorporating group work, as it enables them to construct the knowledge needed for the problem through their social interactions. This theory

forms the basis for the use of incorporating collaboration in a classroom setting for education (Oluwatosin & Ajani, 2022). The theory of social constructivism has been used in classrooms as a foundation for using collaboration more frequently (Oluwatosin & Ajani, 2022). Collaboration is being encouraged in many schools across the world to address modern learning outcomes (Tampubolon, 2018). It is embraced in part due to students having shared goals and holding each other accountable, unlike in a behaviorist approach in which students work independently (Tampubolon, 2018). Thus, both the interview questions and the interpretation of the data are to be viewed through the social constructivist lens, similar to what was done previously (Kosnik et al., 2018).

Benefits

Collaborative learning in mathematics is considered an innovative approach to learning, even though it has been around since the 1980s as a pedagogical approach (Saborit et al., 2016). The collaboration first appeared over 250 years ago in the writing of Rousseau, and 150 years later was expanded on by Dewey (Fujita et al., 2021). It is an essential principle in effective pedagogy (Rodphotong, 2018). This is because using collaboration in the class can benefit students and teachers (Rodphotong, 2018). Furthermore, this approach allows students to learn from their teachers and peers (Oluwatosin & Ajani, 2022). Collaboration is also a vital part of decision-making and is considered to be one of the most critical skills an individual can have (Hortigüela Alcalá et al., 2019). For all these reasons, the benefits of collaborative learning have been

studied from multiple perspectives to find the extent to which it is an effective strategy for learning.

Although many benefits have been found from using collaboration, academic success is one that has been researched extensively. Multiple studies show that the use of collaboration in a classroom can increase student achievement scores from a wide range of settings that include primary (Van Leeuwen & Janssen, 2019), secondary (Van Leeuwen & Janssen, 2019), and college-level students (Chen, 2018; Kalaian et al., 2018). These gains in student academic progress also translate across multiple cultural contexts (Abramczyk & Jurkowski, 2020; Ahmed et al., 2020). This academic success translates to multiple subjects as well. Kalaian et al. (2018) found that this academic increase was hn technology and engineering courses. It is also true in social science (Shah, 2019), natural science (Guffey & Slater, 2019), and language classes (Egege & Orr Vered, 2019). This strategy favors good students more (Guy et al., 2019; Voskoglou, 2019). However, low-performing students can also significantly benefit from collaborative learning when paired with a higher-performing student (Oluwatosin & Ajani, 2022). Hence, collaboration is a pedagogical strategy that has been shown to improve students' academic performance in various settings, including secondary mathematics.

Even though academic performance is a critical element of the school, it is not the only thing the school can help students improve. Many good student skills have been shown that can be enhanced by collaboration. For example, Dzemidzic Kristiansen et al. (2019) mentioned that collaboration can improve students' decision-making skills.

Collaboration can also improve students' critical thinking skills (Erdogan, 2019). In addition to critical thinking, collaboration could increase analytical thinking (Fujita et al., 2021)m as well as creative thinking (Ghaith, 2018). These increased mental skills are in part due to the use of collaboration to improve students' conceptual understanding (Fujita et al., 2021), cognitive development (Guy et al., 2019), meta-cognitive development (Van Leeuwen & Janssen, 2019), and problem-solving skills (Chen, 2018; Ghaith, 2018). Also, students can use collaboration to aid them in learning complex material by allowing the students to share the learning with multiple members of the group (Oluwatosin & Ajani, 2022).

Another important area collaboration improves revolves around language. The use of collaboration can also improve students' speaking skills (Namaziandost et al., 2019, Fujita et al., 2021), even for those learning a second language (Chen, 2018). Students speaking the language more in a collaborative setting allows them to explain their perspective; this helps them construct new ways of thinking and makes them reflect more on their vocabulary use (Cañabate et al., 2019). Using collaboration frequently with English language learners will help students talk more effectively on particular topics by increasing the words and phrases needed for the topic and eliminating words and phrases that make for inefficient communication (Nur & Butarbutar, 2022). This, in turn, boosts the student's confidence in speaking the language (Nur & Butarbutar, 2022). The increased speaking also improves the students' attitudes towards the topic and the use of language (Rodphotong, 2018).

In addition to all the aspects of language use that collaborative strategies can improve, there are some that can be reduced. One issue that some language learners face is language anxiety (Arta, 2019). This can stem from fear of making mistakes in pronunciation or grammar. The reason for the fear is possibly being judged by the teachers or peers, thus making the student feel anxious about participating. However, collaboration in small groups has been shown to help students reduce language anxiety by affording them a more emotionally safe environment to practice their skills (Arta, 2019). Therefore, collaboration can have significantly positive benefits in the form of language acquisition.

Another significant benefit of using collaboration is the nonacademic skills it helps improve. Collaboration increases students' interaction with each other (Namaziandost et al., 2019). This increased interaction can help enhance peer relationships (Abramczyk & Jurkowski, 2020) and improve social relationships as a whole (Doney et al., 2021; Dyson et al., 2021). As part of that, collaboration prompts social learning (Dyson et al., 2021), increases social skills (Ahmed et al., 2020; Liebech-Lien, 2020), and prompts interpersonal learning (Dyson et al., 2021). Another benefit of collaboration is students' increased positive attitudes toward learning (Namaziandost et al., 2019; Tabach & Schwarz, 2018). Collaboration can also lead to better attendance and increased independence (Oluwatosin & Ajani, 2022). Students appreciated the collaborative approach (Rodphotong, 2018; Ghavifekr, 2020), which increased as the approach was used more (Arlsan, 2020). This has been shown to help improve the

student's motivation to learn (Chen, 2018; Ghaith, 2018; Fujita et al., 2021; Namaziandost et al., 2019), specifically intrinsic motivation (Namaziandost et al., 2019). Collaboration can also improve learning engagements (Fujita et al., 2021), students' self-confidence, and students' self-esteem (Bosch et al., 2019). These benefits can even apply to shy students, and collaboration can help improve their class participation by encouraging them to express their opinions (Chen, 2018). It also allows other students to become more familiar with shy students, which can lead to increased empathy and understanding between the students (Dzemidzic Kristiansen et al., 2019). Increasing familiarity and empathy can help some students overcome previous conflicts in relationships (Dzemidzic Kristiansen et al., 2019).

The social interaction that stems from the use of collaboration can also prompt an increased sense of care and respect between students (Hortigüela Alcalá et al., 2019). This also allows students to learn from other students who are from different races, ethnicities, religions, or socioeconomic backgrounds (Tampubolon, 2018). Collaboration has also been shown to be embraced by both male and female students (Ghavifekr, 2020). The improved relationship among the students can improve the overall social culture of the school (Ghavifekr, 2020). This is because the students sometimes engage in social interaction beyond the lesson (Ghavifekr, 2020). With all the various benefits that collaboration in the classroom can have for students, it is apparent why collaborative strategies are more prevalent in curriculums worldwide.

Collaboration is a teaching strategy that has many benefits for the students inside of the classroom; it can also benefit students beyond the classroom. As mentioned, there have been demands for a change in how mathematics is taught (Kalaian et al., 2018). This is the case for several countries' curricula, with some having collaboration skills as an educational outcome (Liebech-Lien, 2020). The teacher-centered approach to learning is no longer suitable to meet the needs of modern students, especially concerning engagement (Shah, 2019). The calls to change the curriculum focus on many aspects such as being reflective, thinking critically, communicating effectively, and collaborating (Kalaian et al., 2018). Today, people are asked to have more developed interpersonal skills in the workplace and in communities (Erdogan, 2019). There is a growing need in several industries to hire people who can collaborate effectively (Liebech-Lien, 2020b). The skills developed from the use of collaboration can improve students' employability after school as well (Katiandagho & Listyani, 2020). It is also a valuable skill to have in and around the community (Ferguson-Patrick, 2020). This is due to collaborative learning encouraging students to help each other towards a common goal (Ahmed et al., 2020). The skill of collaboration can only be mastered by practicing it at a young age and continue improving on it as a student matures through their school life (Liebech-Lien, 2020b). Collaboration also allows students to work on more complex problems by being able to work together to arrive at a solution (Fujita et al., 2021). Likewise, collaboration allows the students to be more actively engaged in solving problems (Chen, 2018). It also allows students to learn by giving students autonomy while developing the ability to

work with others (Tabach & Schwarz, 2018). However, putting students into groups does not mean they will develop collaboration skills. Collaboration goes beyond simply group work as teachers are essential to structure student interactions and aid the students in cooperation (Abramczyk & Jurkowski, 2020). In order to foster the transition from group work to collaboration, students need other skills such as communication, conflict resolution, and time management (Ferguson-Patrick, 2018). Consequently, improving students' collaboration skills could have major benefits for the student well beyond their time in the classroom setting.

However, collaboration is not always considered to be the best strategy. For example, Thiel et al., (2022) mentioned that when working on worked examples, a more traditional approach was found to be more effective. Despite that, they concluded that collaboration was more effective when problem-solving, which is the focus of this study. Another area where collaboration might cause issue for some students is in its every changing nature (Oluwatosin & Ajani, 2022). Some students might feel that due to constantly changing between the communication and solving they might miss parts of the learning. Also, higher performing students might feel that they are being held back by lower-level students. Teachers might also use the strategy to just keep students busy instead of having them do meaningful work. Another difficulty from using collaboration is in the cases where students developed hatred towards other students who might be bullying them (Oluwatosin & Ajani, 2022). But all these reasons are why teachers need to make sure that proper implementation of the strategy. So, collaboration is a strategy that

could be used frequently with many benefits; even so, it is not necessarily the best strategy to use in every situation in the classroom. But, due to all the positive benefits, it is a strategy that will be explored further in this study.

Teacher Perceptions and Experiences

Despite the benefits of collaboration in the classroom, teachers do not seem to use the strategy frequently (Abramczyk & Jurkowski, 2020). This infrequent use can hold true even when the strategy of collaboration is written into the curriculum (Dolma et al., 2018). One reason for the lack of implementation of the strategy might be that courses need to be more organic so that collaboration between students can occur (Kosnik et al., 2018). According to Bhusumane and Nkhwalume (2019), when studying student-teachers, another reason might be that teachers prefer to teach in the way they were taught. Therefore, teachers' strategies can parallel how they have been taught (Muhammad, 2021). Furthermore, students' approach to learning is affected by a teacher's teaching strategy (Cao et al., 2019). Also, a teacher's belief about the strategy's importance impacts their willingness to implement it (Ahmed et al., 2020). Teachers also believe collaboration is better suited for higher performing and older students (Abramczyk & Jurkowski, 2020). Hence, a teacher's belief in the effectiveness of collaboration is vital to successful implementation (Veldman et al., 2020). Moreover, teachers' beliefs and experience affect their willingness to try new strategies, such as collaboration (Dolma et al., 2018). An additional reason might be teachers' development of 21st-century skills, impacting their willingness to adopt the strategy (Anagün, 2018).

Also, teachers were concerned that using the strategy would slow the coverage of the material in the class (Dzemidzic Kristiansen et al., 2019). But, often, the improper use of components of collaboration, such as choosing groups that would foster good collaboration, slows down the strategy (Le, Janssen, & Wubbels, 2018). Some teachers found implementing the strategy too difficult (Dzemidzic Kristiansen et al., 2019). Teachers mentioned difficulties, such as time management and getting students ready to work collaboratively (Veldman et al., 2020). In addition, teachers need to change how they interact with the students in small groups instead of the whole class, as the small groups require a more personalized approach (Tabach & Schwarz, 2018). Also, some teachers felt too unfamiliar with the approach to properly implement it (Arta, 2019). Despite the factors that might contribute to a teacher's lack of implementation, teachers value the use of collaborative learning (Abramczyk & Jurkowski 2020; Ghaith 2018). Teachers recognize collaboration's possible value (Liebech-Lien, 2020b). Also, teachers seem more willing to adopt the strategy if they can get training to implement collaboration in their classrooms (Abramczyk & Jurkowski, 2020). However, the teacher needs proper training about the effectiveness of the strategy, along with being able to experience the strategy both during professional development and after the development as well. (Dzemidzic Kristiansen et al., 2019). With adequate training, teachers can foster a more positive experience for their students using collaboration; this includes better results when using the strategy (Dzemidzic Kristiansen et al., 2019). Yet professional development does not always happen due to factors such as time and educational tools

(Muhammad, 2021). Even if teachers get professional development in implementing collaboration, they must use it consistently. Teachers who have implemented collaboration longer tend to have more positive results (Abramczyk & Jurkowski, 2020). Teachers can know the positive benefits of implementing a collaborative teaching strategy, but the strategy can sometimes be too difficult to implement without proper professional development and follow-through. Thus, teachers' perceptions and experiences are important perspectives to investigate to learn more about how to implement the collaborative learning strategy.

Implementation

As mentioned, collaboration is a strategy teachers want to implement yet often struggle to do so. It can be difficult for some teachers to move towards a more collaborative approach as it requires less interaction between the teacher and the whole class and more interaction between students (Duran et al., 2019). The new dynamic of releasing control of the class can be challenging for many teachers (Abramczyk & Jurkowski, 2020). However, collaboration as a pedagogical approach can have other reasons that make it difficult for teachers to incorporate (Liebech-Lien, 2020b), as it requires many changes to how the teacher previously taught (Muhammad, 2021). This shift can have teachers still focusing on the curriculum over the collaborative aspect of the strategy (Le et al., 2018). Hence, another challenge comes from the curriculum's constraints on implementing a new strategy, such as collaboration (Liebech-Lien, 2020). Lack of familiarity with the approach can also lead to problems implementing the

approach (Liebech-Lien, 2020b). Teachers can often use strategies such as collaboration without planning, which can lead to many challenges (Abramczyk & Jurkowski, 2020). Lack of planning usually stems from a lack of time needed to properly plan for collaboration (Abramczyk & Jurkowski, 2020; Liebech-Lien, 2020). However, even after professional development to aid in familiarity and time management, teachers can stop using the strategy or reduce the frequency of use after professional development (Liebech-Lien, 2020b). This can lead to the proper use of collaboration not being adequately implemented in the classroom in subjects such as mathematics (Ampadu & Danso, 2018). One way this can occur is when teachers could still hold on to other practices that can be damaging to collaboration, such as holding to the notion that some students are smart and better than others (Louie, 2019). This notion could lead to the strategy being misused by teachers not using stronger abilities with students with lower abilities and even giving closed-ended questions to lower-ability students, therefore not differentiating from traditional teaching methods much (Louie, 2019). There can also be issues within the group, such as a lack of communication, that can lead to a negative group experience (Le et al., 2018). A negative group experience can make the strategy no more effective than an individual learning approach (Ferguson-Patrick, 2018). This is why it is crucial for teachers to monitor groups and intervene when needed. However, it can be difficult for teachers to properly manage collaboration as it requires a complex skill set (Van Leeuwen & Janssen, 2019). Consequently, teachers cannot simply create groups to implement collaboration; they must teach the skill to the students and help

facilitate the growth of the skill (Van Leeuwen & Janssen, 2019). Other constraints to the proper implementation of collaborations are ones such as culture (Ghaith, 2018), the space necessary (Abramczyk & Jurkowski, 2020), and the use of proper assessments (Liebech-Lien, 2020). With all these challenges, it is no wonder that less than 33% of teachers in Switzerland and Germany use the strategy consistently (Abramczyk & Jurkowski, 2020).

Although there are many challenges teachers face when implementing collaboration, there are ways in which teachers could work towards a more successful implementation. Teachers getting professional development on the use of collaborative strategies is a major factor in the success of implementing the strategy (Liebech-Lien, 2020). However, part of professional development needs to focus on how to teach the skills required to collaborate. The skills need to be taught because students need to develop collaboration as a skill through engagement and trial and error, which the teacher needs to facilitate properly (Oluwatosin and Ajani, 2022). Learning these skills will help the students work together to solve problems instead of relying on the highest-performing student to do everything for them (Fujita et al., 2021). In addition to professional development, teachers can use strategies such as praise and funneling to help the collaboration be more successful (Munson, 2019). Another quality shown to be positively associated with the successful implementation of collaboration is a teacher's positive attitude and belief in using the strategy (Veldman et al., 2020). Teachers should also focus on students' problem-solving while collaborating (Van Leeuwen & Janssen, 2019).

Teachers should be less controlling in allowing the students to work through problem-solving; nonetheless, they should give formative feedback about their progress and understanding (Chen, 2018). However, teachers must actively participate in the groups by monitoring and fostering good collaboration. (Dzemidzic Kristiansen et al., 2019). To avoid being too passive, teachers must watch how the students work and provide assistance when required (Van Leeuwen & Janssen, 2019). Without this guidance, the groups could have a negative experience in the problem-solving process, resulting in an ineffective collaboration strategy (Van Leeuwen & Janssen, 2019). Another way teachers can be more successful is to plan ahead of time about what sorts of social, collaboration, and academic outcomes would be the aim of the lessons (Veldman et al. 2020). After the lesson, the teachers should also reflect on the use of the strategy to make adjustments to the strategy for the next class (Enriquez et al., 2018). It is also vital that teachers use collaboration with the understanding that developing student collaboration skills is a goal in itself (Oluwatosin & Ajani, 2022). Lastly, teachers need access to resources to consistently implement collaboration and continuously improve (Hortigüela Alcalá et al., 2019). Through these approaches' teachers can mitigate the negative impact of the challenges of implementing collaboration.

Besides the teacher, the students also have a role to play in successfully implementing collaboration. Student use of various problem-solving strategies can also indicate success in collaborative learning (Fujita et al., 2021). Dzemidzic Kristiansen et al. (2019) mentioned that students with minimal collaboration experience before being a

part of the setting tend to struggle to use the strategy with more experienced students. The students struggle because some of the skills needed are interpersonal skills and the management of group interactions (Liebech-Lien, 2020b). These skills need to be explicitly taught to experience an increase in the group working together more often (Ferguson-Patrick, 2018). Teachers need to teach the skills because the students more directly engage with each other's thinking as they listen and respond (Oluwatosin and Ajani, 2022). These interactions must be on task to maximize learning (Van Leeuwen & Janssen, 2019). The success of these interactions largely depends on how the teacher structures them (Oluwatosin & Ajani, 2022). Students can feel better about their learning, school, and each other, and self-esteem will increase if these interactions are structured well by the teacher. The benefit is why teachers need to structure the interactions in such a way that allows them to listen to the discussions to give direction and insight to the students in order to hold them individually accountable for their learning (Oluwatosin & Ajani, 2022). In addition, the students' behavior when on task dramatically impacts their learning as they can get the most from the experience when they are extending each other's thinking and being helpful in their responses (Van Leeuwen & Janssen 2019). Another behavioral influence is making sure everyone is heard, understood, and understood the task before moving on (Fujita et al., 2021). For successful collaboration, students need to be aware of how their behavior affects others and reflect on it to improve group cooperation (Dzemidzic Kristiansen et al., 2019). Hence, students need to play an active role in aiding the successful implementation of collaboration.

Beyond teachers' approaches and the students' skills, other factors can contribute to a more successful implementation. Several factors must be considered when forming groups, such as prior knowledge and experiences (Chen, 2018), age, ability levels, and students' relationships (Hortigüela Alcalá et al., 2019). Student relationships are essential as students who have mutual respect for one another and can smile and laugh with their group mates are more likely to learn from collaboration (Fujita et al., 2021). Students who are in a collaborative group for longer develop more of a caring relationship with each other and are more committed to the success of their fellow group mates (Oluwatosin & Ajani, 2022). These relationships create an environment of collaboration, which is paramount to success (Dzemidzic Kristiansen et al., 2019). Hence, there are other elements to consider for the successful implementation of collaboration. Consequently, how teachers take these elements into consideration is a part of the focus of this study.

Summary

During this Chapter, I discussed what is known about mathematics teachers' perceptions and experiences with implementing collaboration in a mathematics classroom up to this point. I first presented how I search for the current search on the topic. Next, I explained social constructivism, how it differs from other learning theories, and why it is the conceptual framework for studying this topic. Next, I described the multiple benefits for students when teachers implement collaboration in their classes. These benefits include increased academic scores in numerous subjects. These benefits extended to

improved student skills, increased intrinsic motivation to learn, language development, and increased enjoyment of the learning process. There are also benefits beyond the classroom that will help the students later in life. The following sections focus on teacher perceptions of implementing collaboration and how it would benefit teachers to understand how other teachers implement and use the strategy. Finally, the last section has information about barriers to implementation such as time management, lack of understanding of the strategy, changing teaching style, etc. The section also discusses how professional development around strategies can aid teachers in successfully implementing collaboration. Through all this research, it is clear that there needs to be more understanding of how teachers can successfully implement collaboration in multiple subjects, especially mathematics.

More research is still needed on how effective collaboration is in other settings, such as mathematics (Erdogan, 2019). The teacher's role in collaboration is another area that needs further exploring (Liebech-Lien, 2020b). In addition, more research is required to determine the longer-term implementation of collaboration and how it can be consistently used (Liebech-Lien, 2020b). Another area that needs more exploration is teachers' perceptions of implementing collaboration (Ghavifekr, 2020). This study addresses this gap in research by investigating mathematics teachers' perceptions and experiences with implementing collaboration in the classroom. To investigate this, I did a basic qualitative study focusing on interviewing mathematics teachers who have implemented collaboration in their classes. Next, I will discuss the research method I

used to explore secondary mathematics teachers' perceptions and experiences when

implementing collaboration in US classrooms.

Chapter 3: Research Method

Introduction

In order to discover teachers' perceptions and experiences of incorporating collaboration in a mathematical environment, I conducted the study in several steps. This chapter clarifies those steps by discussing the research design and rationality. Then, it goes on to explain my role as the researcher. The next part will examine the methodology used for the study. Finally, the trustworthiness of the study is investigated.

Research Design and Rationale

The study used a basic qualitative approach. Merriam and Tisdell (2016) described a basic qualitative approach as investigating "how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (p. 24). The study focused on teachers' experiences and perceptions and, thus, how they interpret those. The description fits the nature of the study as it examined the experiences and perceptions of the mathematics teachers.

I conducted this study by doing semistructured interviews. I chose this method because it allowed me to ask more probing questions and the interviewee to ask clarification questions (Kosnik et al., 2018). I used Zoom to conduct the interviews and recorded the audio so that I could transcribe the interviews accurately. I analyzed the transcript using an inductive approach with the help of Excel to organize the information. The participants were 12 secondary mathematics teachers who have, or currently are, implementing collaborative learning in their mathematics classroom. I chose 12

participants as it was four more than a similar study conducted by Veldman et al. (2020), who mentioned that they should use more participants the next time. I paid attention to having the sample be diverse in the level of mathematics taught, race, and gender. I recruited teachers from California, Oregon, and Washington state schools.

Role of the Researcher

During the time of this study, I was a teacher at a small international school in Sri Lanka. The study took place in the United States. I taught in California for two years almost 10 years ago. During that time, I held no leadership role in education. Today, I still do not hold any leadership role as a classroom teacher. In addition, I did not meet any of the teachers before the study. Also, I am teaching internationally and conducted the study via Zoom. Therefore, it is unlikely that I will someday meet the participants in person. As far as ethical conflicts are concerned, I do implement collaboration inside my classroom. Consequently, I am interested in the study's outcome because I am also looking to understand better what other teachers have done with collaboration in a mathematical classroom.

Methodology

Participant Selection Logic

I interviewed mathematics teachers who implement collaboration because mathematics is a subject that is likely to implement collaboration (see Buchs et al., 2017). The teachers for this study were secondary teachers in the US who specialized in mathematics. The inclusion criteria were to specialize in secondary mathematics and have

implemented, or currently implement, collaborative strategies to teach mathematics. These teachers could teach any mathematics level as collaboration is a teaching strategy that can be implemented at any level. In addition, they needed to be teaching in California, Oregon, or Washington. Although only three states were chosen, 41 states currently use the CCSSM. I determined via email whether participants fit the criteria before the interviews. I recruited participants by asking for volunteers from the social media groups and the Walden participant pool (Appendix B). Then an email was sent to confirm they met the inclusion criteria and were willing to participate. Once the participants had agreed to participate in the study, I scheduled a time to conduct the interview.

Instrumentation

This study used a basic qualitative approach. The data collection instrument chosen was interviewing. The study aimed to explore teachers' experiences and perceptions when implementing collaboration in a mathematical class. Jacob and Furgeson (2012) wrote a guide to aid in interviewing. Using the guide, I found articles that were similar studies to my own to use for the interview. Through this process, I narrowed down which questions would fit my study best while also making sure not to have too many questions. Therefore, I decided on 10 interview questions. I then arranged them based on the research questions they would aid in answering (see appendix A). The questions came from two different studies already conducted. Four questions came from the study by Gillies and Boyle (2008). For these questions, I changed the word

"cooperation" to "collaboration" and got permission to use the questions and make the alteration. The other six questions came from a study by Le et al. (2018). Although I got permission to use and alter the questions, I did not alter the questions in any way. This method gave the interview questions more rigor and credibility than those used in the previous peer-reviewed studies.

Procedures for Recruitment, Participation, and Data Collection

Procedures for Recruitment

For this study, I recruited secondary mathematics teachers who are or have implemented collaboration for interviewing and teaching in California, Oregon, or Washington. I started contacting participants once I got approval from Walden's International Review Board. As mentioned before, I recruited 12 participants. To participate in the study, the teachers needed to be secondary mathematics teachers who have or currently do use a collaborative strategy in their classes while teaching in California, Oregon, or Washington. I recruited by putting a message out on the Facebook groups for teachers and in the Walden participant pool (Appendix B). I offered a $20 gift card to the participants for participating. In addition, I asked if they know any teachers who meet inclusion criteria who might be willing to participate that they know, and if they would be willing to share my contact information with them. Once the participants had contacted me, and to ensure acceptance of their participation in the interview, I sent a consent form to them, to which they replied via email, "I consent."

If I was unable to recruit 12 participants through these means, I would have first looked to recruit from the other states that use CCSSM. If I still needed additional participants, I would have tried to recruit participants internationally by opening up the inclusion criteria to include teachers at international schools from around the world who come from the United States and teach at international schools that align with CCSSM.

For the participants to accept the interview, they needed to reply to the email containing the consent form with "I consent." Once accepted, I sent the participants the interview questions (see Appendix A) beforehand so that they could review them. I set up a time with each participant beforehand for a Zoom video call interview the lasted up to 60 minutes. The interview's audio was recorded, and permission to do so was in the consent form letter the participants reviewed and replied to the email with "I consent." I reminded each participant of the interview being confidential and thanked them at the end of the process for their participation in the interview.

Once I concluded the interviews, I transcribed each interview. After the interviews were done and the results analyzed, I sent the results of each interview to that participant. The results featured no identifiers of the participants. The results were sent via email, and the participants responded to the email or requested a meeting via Zoom call should they have any questions about the consistency of their results or the analysis of the data as part of member checking. Finally, the participants were sent the conclusions of the study to view.

Procedures for Participation

The participants met a few criteria for participation in the study. Teachers were teaching in California, Oregon, or Washington. The second criterion was that the teachers taught at least one secondary mathematics class. Any level of math course was accepted as the instructional strategy can be used at all levels of teaching. Lastly, they were currently or recently implementing collaboration as a teaching strategy in the mathematics classroom. All the teachers met all three criteria and could participate in the study.

Procedure for Data Collection

To collect the data, I used Zoom to record the audio of the interview. To qualify to conduct interviews, I completed The Doctoral Student Researchers Basic Course. I recorded the interviews to hear the audio again and get a more accurate transcript. Using Zoom also allowed me to interview people from all over the United States. To ensure the ethical practices of the interview, I explained via email precisely what the research study was about and my role in the study. After the participants agreed to participate in the study, I sent the consent form via email and waited for their confirmation of the consent given. This consent mentioned that I would conduct each interview by explaining to the participants that I would record the interview. Interviews did not exceed 60 minutes. I asked each participant all ten questions. During the interview, I repeated the main points for each question to the participants to clarify what they were trying to say. Paraphrasing back to the participant allowed the participant to reflect on their response to make sure

the participant said what they meant to say. If the point needed additional clarification, I would ask a follow-up question consistent with the original one. Afterward, I thanked the participants. After the first interview was concluded and transcribed, I sent the transcript (with identifiers omitted) to my Committee Chair and reviewed it before conducting any more interviews. Lastly, after the interviews, I emailed the participants the interview analysis to ask if there were any corrections they would like to make to their answers or a member checking. When there were no corrections needed, I concluded the formal interviews. I member checked by having the participants review the conclusion and provide feedback about the consistency of the conclusion I drew to what they said. Finally, I emailed the participants the results of the study for them to view.

Data Analysis Plan

For my approach, I made a transcript of the interview. I then reviewed the transcript along with the interview to make any corrections to the transcript so that it is a verbatim account of the conversation. Then, using the information from the article by Meyers and Avery (2008) as a guide, I used Excel to code my interviews. I used an inductive approach for data analysis. I first put the transcript into Excel by putting each sentence into each line and grouping them by each question's responses. I then used the next row in Excel to paraphrase the sentence into a few words. Afterwards, I used a data analysis table to guide my coding (see Table 1).

Table 1

Data Analysis Table

A priori Codes	Emergent Codes	Categories	Themes	Excerpts
Introduction				
Issues				
Set-up				
Needs				
Contribution				
Grouping				
Skills				
Effective Learning				
Learned from				
implementation				
Student response				
Support for				
implementation				

Before the data analysis, I identified a priori codes based on the questions and the theoretical framework of social constructivism, as shown in Table 1. After the interview, I identified emergent codes based on the participant's responses. Once I coded the interviews, I created categories to organize the information. Then, I developed themes based on the categories. Finally, I supported the themes by using excerpts from the interview that aligned with the themes. Any interview answers that deviate from the other responses were treated separately and considered during the conclusion. I mentioned the responses that deviated from the rest as part of the conclusion, as well as the discussion on why they might have deviated from the rest.

Trustworthiness

For the trustworthiness issue, I examined several parts during the process. Frey (2018) wrote that trustworthiness is when a study has the rigor, quality, and credibility to

be accepted. To show the trustworthiness of a study, the researcher would need to establish the credibility, transferability, dependability, and confirmability of the study.

Credibility

To establish credibility, I ensured that my findings were accurate (Amankwaa, 2016). To ensure the study's accuracy, I followed a few steps. First, I recorded the interviews, so I was able to play the interviews back several times. Next, I completed a member check after the coding by emailing all participants with the findings. I asked if any participants had any concerns or questions about the analysis of their interview data. The participants replied via email to confirm the results or add any information they felt I missed.

Transferability

Transferability is the ability to apply the study's findings to other contexts (Amankwaa, 2016). Therefore, I focused on explaining my process and outcomes. I described every aspect in detail throughout the process of writing the dissertation and conducting the study. The process started with ensuring that every participant was a secondary mathematics teacher in California, Oregon, or Washington who had or is currently implementing collaboration. This process will help other researchers determine the transferability of the study to other studies.

Dependability

For dependability, the results should be consistent and be able to be replicated (Amankwaa, 2016). For this, the focus was on the transcripts. I stored the recordings

securely, which will remain there for five years. I transcribed the transcript verbatim and will keep the audio records for five years should they need to be listened to again by myself to validate the transcript. Each participant reviewed their interview's conclusion for accuracy as part of a member checking. Also, I provided the codes and themes along with the transcripts, with identity identifiers omitted, in the dissertation should other researchers want to view them to support the results.

Confirmability

For the study to be confirmable, I maintained as few biases over the outcomes and interpretation of the results as possible (Amankwaa, 2016). To help the confirmability of the results of the study, I used my committee. My committee was able to view my transcripts and see if the codes are consistent with what the transcripts have. Also, I got a peer to debrief about the codes to help confirmability. Lastly, my codes and themes are part of the dissertation along with the transcripts, with identity identifiers omitted, should any other researchers want to confirm my results.

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Ethical Procedures

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While conducting the research, I followed ethical procedures. Using the Institutional Review Board approval (approval number 05-30-23-0659956), the data collection and review followed several steps. The recruitment of participants occurred through social media platforms and the Walden Participant pool. I constructed a post asking for participants. When the participants contacted me, I sent an email giving more details about the study, the expectations of the research, and their role in the study. I

communicated with each participant individually so that other participants did not know who else was involved. The participants had the right to withdraw from the study at any time. There was a second email about consenting to the study. Participants replied with "I consent" to the email to move to the interview portion of the study. We agreed upon a time, the interview took place via Zoom, and I recorded the audio. I conducted the interviews individually online so that no other participants heard the interviewee's responses. During the interview, I paraphrased the participant's main points after each question to ensure the accuracy of their answers. I also provided the data analysis to the participants for review at the end. I asked them to report back if they had any concerns or questions. Although I recorded the interviews, I stored the recordings in the Google Drive folder, which is only accessible to me through a password. Therefore, I will keep the recordings on the cloud with accessibility protection for 5 years. Thus, I have not stored the recordings on any particular device. I will delete the recordings in five years. Also, I am holding the documents with identifiers and codes in a separate area of Google Drive with a different password from the recordings. Thus, I stored the recordings and the participants' identities separately.

Summary

In this chapter, I wrote about what was required to conduct the study. I elaborated on the research design and rationale by discussing why I used a basic qualitative approach for the study. Next, I explained the role of the researcher as it pertains to my background and any biases I might have as a result. The methodology section is where I

describe how I conducted the study. I broke the methodology section into subsections: participation selection logic, instrumentation, procedure for recruitment, procedure for participation, procedure for data collection, and data analysis plan. The last section of the trustworthiness of the study focuses on how my results can be trusted. I examined the credibility, transferability, dependability, confirmability, and ethical procedures section. Now that I have established how I conducted the study, the next chapter will focus on my research and its analysis.

Chapter 4: Results

This study used a basic qualitative approach to discover mathematics teachers' perceptions and experiences when implementing collaboration. Data were collected to answer two research questions.

RQ1: What are mathematics teachers' experiences of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

RQ2: What are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

This section of the study will focus on analyzing the data that was found as part of the interview process. First, the setting where I found the participants and the demographics of the participants are discussed. Then, the trustworthiness of the study is laid out in detail. Finally, the results are presented by putting them into seven different themes that are individually considered.

Setting

I searched for open forums for the individual state's chapters of the National Council of Teaching Mathematics (NCTM) to find participants. This is an organization that mathematics teachers in the United States can join. In addition, they can choose to be members of their state chapter. I found an open forum in the California chapter that allowed me to post my study to recruit participants, and all 12 participants came from this open forum. Therefore, my study only has teachers from California.

Demographics

The teachers who participated came from a range of demographics. The

participants included teachers with less than 5 years of experience and teachers with more

than 30 years of experience, with many in between. The gender spread was seven females

and five males. The ethnic backgrounds also varied as well. The teachers taught a range

of grades from 6th-grade mathematics to 12th grade. The demographics are presented in

Table 2 below.

Table 2

Demographics of Participants

	Male	Female	Middle School	High school
Less Than 10 years of experience	2	2	2	2
Between 10 and 20 years of experience	2	3	1	4
Greater than 20 years of experience	1	2	2	1

Data Collection

I used a qualitative study method to collect data to investigate teachers'

perceptions and experiences when implementing collaboration. To conduct the study, I

first got approval from Walden University's IRB (approval number 05-30-23-0659956).

Once approved, a post was created on a forum for mathematics teachers in California to

recruit participants. When participants responded with their willingness to participate in

the study, the consent form was emailed back to them. Once consent was obtained, an

interview time was arranged, and the questions were sent to them. Twelve participants

agreed to be a part of the study. Each of the 12 participants was asked all 10 questions

and paraphrased each response. The interviews were done via Zoom and took place over

2 months. The interviews ranged from 35 minutes to 60 minutes. The audio for each interview was recorded using Zoom. All these measures for the data collection were consistent with what was presented in Chapter 3.

When it came to data collection, there were originally some issues. I mentioned in Chapter 3 that I would use social media sites such as Facebook to recruit participants. I first posted in a group for California teachers that was open for anyone to join. Within hours, I got several responses. However, I noticed the people responding were doing so at 2 am their time. I also noticed that all their email address were almost identical, and the English used was not strong. I presented my concerns to my Chair, and she told me there are scammers out there and that I should focus on closed forums. Therefore, I looked for teacher sites that had open forums but were more exclusive. After that, the only issue that came up was trying to get enough participants, as I could only find one open forum that fit the population I was looking for. My first post was during the summer, and thus, I got a few responses. Even though I only got a few responses, I started to collect the data.

To collect the data, I used Zoom and set up meetings that worked for the participants' schedules. As part of the Zoom meeting, I recorded the audio for reference. Initially, I scheduled one interview. Once the interview was done, I transcribed the audio. I then sent the transcript to my chair for review. Once the transcript was approved, I began to schedule the other interviews. After each interview, I transcribed the audio word-for-word and omitted any personal identifying information.

Once the end of summer came, I reposted on the discussion forum again, as I had only received seven participants at that time. More teachers responded, and I was able to get the other five participants I needed. I followed the same steps as before to collect the data and do the transcript. After the transcripts were done, I started to code the responses. After the codes were done, I grouped the codes into categories. Finally, I created themes based on the categories.

Data Analysis

This qualitative study explored mathematics teachers' perceptions and experiences when implementing collaboration in class. The problem being addressed was a lack of understanding of mathematics teachers' perceptions and experiences when implementing collaboration in their classes. A qualitative research study was conducted to answer the following two research questions:

RQ1: What are mathematics teachers' experiences of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

RQ2: What are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

All 12 participants who agreed to the study did the interview and the member checking. The study collected data through interviews, which were conducted and recorded using Zoom. The interview consisted of 10 questions in a semistructured interview. A verbatim transcript was created for each interview to analyze the data. Following the completion of the transcript of each interview, every line of the interview

was put into a separate cell in an Excel spreadsheet. Each line was coded using the a priori and emergent codes. Those codes were put into categories, and sentences were created to describe what was being said. For each question asked to each participant, multiple sentences were created to describe the response to the question. Then, a member check was performed when I emailed each participant and asked them to read the results of the finding in their interview to verify that they were accurate. Every participant confirmed the results, with only one participant changing a vocabulary word used.

All the findings were again put together in an Excel sheet to find the themes. Also, any responses that deviated from the themes were included. The main themes discovered were the procedure teachers use to implement collaboration, how to group students for collaboration, the issues teachers face when implementing collaboration, the support needed by teachers to implement collaboration, the group skills needed by students for collaboration, the environment that fosters collaboration, and the benefits of using collaboration. Each of the discrepant cases fell into the themes listed. To prevent myself from removing any data and, thus, not report on any particular idea, I have kept the discrepant cases in the data analysis under the theme. I keep the discrepant cases to be discussed regarding the research question. Therefore, each theme will be discussed in depth using the categories, and a separate section will be used based on the answers that did not fall under any of the categories.

Evidence of Trustworthiness

Credibility

To maintain credibility, I followed the steps that were approved by the IRB. I recorded each interview, which I played back several times to ensure the accuracy of the transcripts. Once the individual studies were coded, I conducted a member check by sending each participant their results and asking them to confirm if their results were accurate. Every participant confirmed their results with only one wanting to add a feature about their use of whiteboards being vertical, so the students needed to stand.

Transferability

For transferability, there was a slight change in the collection of the data. Although I reached out to teachers from the states of California, Oregon, and Washington, I only received participants from California. All the participants were secondary mathematics teachers who are currently implementing collaboration. For transferability, other researchers would need to take into consideration that the participants were only from one state.

Dependability

For the study's dependability, I was able to follow the steps laid out earlier. I transcribed each interview verbatim. I have all the audio recordings stored. The mA member check was conducted, and confirmation was obtained from each participant categories and themes were provided for my dissertation to be reviewed. Lastly, the

identifiers have been removed from the transcripts so they can be viewed by other researchers.

Confirmability

For confirmability, I sent the first transcript that I transcribed to my committee before I moved on to more interviews. Each was reviewed to ensure the quality of the transcripts and results. Once they were reviewed, I inputted categories and themes in the results sections to be reviewed by other researchers.

Results

Below, I have organized each section's research question by theme. There are 144 codes, first grouped into 31 categories and seven themes. There are two research questions, and each theme is under one of the two questions. Under each theme is a summary of that theme. There are two charts below. The first chart is all the codes that were found, the categories they map to, and quotes from the interviews that talk about the category.

Table 3

The Codes, Categories, and Excepts from the Interviews

Categories	Codes	Excepts
Accommodations	Translation; Individual needs; Check-ins; Monitor; Diverse needs; Nonverbal communication; Encouragement; IEPs or 504s; Opt out; Adjustments; Break-up task; Needs	5 "But I tend to like, hang around the groups more more minutes, more time with the students that I, with the groups that I know that have those students that are either special needs or specific behavioral issues, or what not."
Curriculum	Curriculum; Books; Textbooks	8 "the curriculum that we have chosen."
Roles	Roles; Group roles	4 "You know, by giving them each a title and a and a job to do."
Teacher check-in	Circulate; Questions; Monitor participation; Check-ins; Ensure contribution	6 "I push them and check them to make sure they are working as a group."
Task types	Multiple ways; Higher-order thinking; Challenging; Multi-solution; Multiple concept; Group Project; Group review; Allow collaboration	3 "The ones that I like the best are the ones that are more open-ended, especially as far as solutions to the problem."
Routines	Routines; Environment	5 "Once the system is established and they're good at it, and they have a routine it gets easier for me as an instructor, a teacher."
Grouping size	Smaller; Three	6 "And so I started going down to 3, because, because, as we said, social region, reasons, post pandemic sort of reasons. I think that's working out, okay, kids always want to go bigger."
Mixed groups	Mixed abilities; Mixed levels	3 "I kind of like working with or grouping kids more it a varied level group."
Needs-based grouping	Pair with someone; Have something to do; Careful grouping; Group support; Group with stronger student	11 "The students, they, well, I had them help each other a lot, so it doesn't, they don't feel like they left behind."
Rotating groups	Varying; Change; Switch	7 "And I do switch the groups for seventh grade every 2 weeks, and for eighth grade every chapter which ends up being about 2 and a half to 3 weeks."
Random grouping	Random	1 "But yes, it is random groups."
Experience	Became more comfortable; Started talking; Willing over time; Lack of experiences; Improved over time	8 "The other might be that they just haven't had experience doing this."
Reluctance	Difficult to talk; Buy-in; Preference; Introverted Social-anxiety; Refusing; Insecure; Hesitating; Relucent; Comfort Level	9 "So so I think initially, there's always a hesitation at the beginning."
Equitable participation	Not participating; Do all the work; Right answer Competitiveness; Do not work; Equitable participation	10 "There was a real free rider issue where you know, students could just not do anything but still get the credit from the group, write down solutions, or whatever."
Observations	Admin observations; Peer observations	5 "We get to go to each other's classroom and observe and monitor, and see how one teacher is teaching versus the other."

Table 3 cont.

The Codes, Categories, and Excepts from the Interviews

Categories	Codes	Excepts
School support	Embrace collaboration; Encourage collaboration; Support using collaboration	10 "But my administration is very supportive."
Teacher collaboration	Teams to discuss; Culture of collaboration; Cross-curricular collaboration; Amongst teachers; Other Teachers	2 "I do think it's important for the math department to see itself as a team that's working on its own group-worthy task."
Uniformity	School-wide; Between courses; Throughout the faculty; School culture; Whole school	7 "So that's in terms of like to faculty support like everyone does group work, and everyone teaches, you know, you to work with people."
Communication	Talking; Communication; Discussing	1 "communication skills"
Open mindedness	Willingness to consider; Respecting point of view; Listening; Openness; Active Listener; All contribution; Open-minded	8 "Tell them that everybody has something to contribute, and that you need to learn this skill."
Social skills	Socialize; Caring for each other; Socially engaged; Positive relationships; Trust; Friendliness; Mutual respect; Empathy	1 "Definitely, you know, the like socializing."
Learn from mistakes	Uncomfortable; Make mistakes	11 "An effective learning group, in my view, it's the group where the students are willing to be uncomfortable and willing to fail and learn from their mistakes."
Challenge peers	Challenge; Intellectual pushback; Point-out errors; Explain reasons	9 "a group that's challenging each other's thinking."
Collaboration willingness	Try collaboration; Voluntary; Wiliness; Encourage conversation; Participate	6 "So you know you have to get, you have to get them that certain level of comfort and respect and just social activity has to be at high enough a level for it to at work as a conversation."
Inclusion	Can succeed; Meet the needs; Multiple perspectives; Culture of values; Inclusive; Differentiated; Sensitivity; Respect diversity; All voices heard	10 "And so what I found in my short time teaching is that if I create my class environment in a way that addresses most types of different learners, whether it's reading deficiencies, language barriers."
Risk-taking	Try new things; Out of comfort zone; Risk-taking	11 "An effective learning group, in my view, it's the group where the students are willing to be uncomfortable and willing to fail and learn from their mistakes, and are not afraid of trying something that they've never seen before"
Student-centered	Teacher talks less; Facilitation; Honor student thought; Teacher ask more questions	5 "I've learned as a teacher that I actually have more free time as far as just walking around, listening to my students and letting them be in control and running the show instead of me constantly standing up for talking, talking, talking, talking, talking, talking, talking, talking, talking and exhausting myself and so forth."

Table 3 cont.

The Codes, Categories, and Excepts from the Interviews

Categories	Codes	Excepts
Grow intelligence	Partner learning; Each other; Student team teach; Reciprocal learning; Multiple students teachers; Check other's work	2 "shift kids sense of their own intellectual potential and their own intellectual place in the world. "
Positive feelings	Grow intelligence; Smarter; Fun; Want to; Joy; Enjoying; Pride; Love; Uplifting; Positive	3 "But they all they're enjoying it and join the process and really working together and communicating well."
Increased engagement	Engaged	10 "So it's it's it's really lifted the low-end because they're just they're just engaged. They're just active."

Table 4

The Categories and Themes from the Interviews

Categories	Themes
Accommodations; Curriculum; Roles; Teacher check-in; Task Types; Routines	The procedure teachers use to implement collaboration
Group size; Mixed grouping; Need-based grouping; Rotating groups; Random grouping	How to group students for collaboration
Experience; Reluctance; Equitable Participation	The issues teachers faced when implementing collaboration
Observations; School support	The support needed by teachers to implement collaboration
Teacher collaboration; Uniformity	
Communication; Open mindedness; Social Skills; Learn from mistakes	The group skills needed by students for collaboration
Challenge Peers; Collaboration willingness; Inclusion; Risk-taking; Student-centered; Peer learning	The environment that fosters collaboration
Grow intelligence; Positive feelings; Increased engagement	The benefits of using collaboration

Research Question 1

For the first research question (What are mathematics teachers' experiences of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?), I found six different themes that helped to answer the question.

Theme 1: The procedure teachers use to implement collaboration.

The theme of procedure focused on what teachers needed to have in place to implement collaboration in their experience. Participants 1, 4, 5, 7, 8, and 12 mentioned that the curriculum their schools use has collaboration as an essential component. Participants 1, 2, 3, 4, 5, 6, 7, and 10 discussed the importance of establishing roles for the students in their groups so that each student can contribute to the collaboration. While the students were doing the collaborative activity, participants 1, 3, 4, 5, 6, 7, 9, 11, and 12 talked about their role being to check in with groups or individual students to see if they are participating, understanding, or require some guidance. Participant 1 said part of the guidance is from asking questions or helping them get started. Participant 3 added that the check-ins should also be used to ensure that a group member is not dominating. Participant 5 discussed the teacher role being used to balance groups. Lastly, participant 9 mentioned that another aspect of the teacher's role was to teach collaboration.

Three participants (1, 8, 11) spoke about using standing whiteboards around the rooms for students to stand up and work on their collaborative activity. The type of task that the teachers used collaboration on varied between participants. Participants 1, 2, 3, 4, and 6 had open-ended tasks that allowed multiple ways of approaching the answer.

Participants 5 and 8 focused on using group work for assessments or assessment reviews. Participant 1 mentioned that the task is on slides the students use. Another aspect of the procedure for implementing collaboration came in how accommodations were handled. Some of the teachers give translators to their students (1 and 6). Other teachers allow students to work individually that day if they request it (4, 6, 7, and 10). Adjusting the task level or breaking it into smaller chunks helps participants 5, 6, and 11 accommodate their students. Participant 7 even mentioned that they frequently use non-verbal communication, such as hand gestures. Routines were mentioned by every participant in some way. Some participants (1, 4, 5, 7, 8, and 12) focused on the routines that were laid out in their curriculum

Under the theme of procedure, some of the responses varied according to the participant. Participant 1 said part of the guidance is asking questions or helping them get started. Participants 7, 9, 10, and 12 also mentioned getting started as part of the teacher roles. Participant 3 added that the check-ins should also be used to ensure that a group member is not dominating. The teacher used check-ins to formatively assess the students by asking them to check for understanding questions according to Participants 3 and 8. Participant 5 discussed the teacher role being used to balance groups. Participant 9 mentioned that another aspect of the teacher's role was to teach collaboration. Going over the problem at the end of class was another role, according to Participant 12. Participant 1 referred to that the task is on slides the students use. Participant 10 said their tasks had problems, and each was slightly harder than the previous ones. Participant 4 emphasized that the goal of the task should be to teach conceptual learning before introducing

vocabulary. Participant 4 went on to say that the approach to the class should always keep longitudinal goals in mind to focus on key concepts. Reporting out of solutions at the end to the whole class by each group was part of Participants 6's and 10's routines. Similarly, Participant 1 asked students to watch how other groups solved a problem when it was different from theirs. Participant 7 said they did not collaborate on the task the whole lesson. To solve the task, participant 11 talked about how there is only 1 marker that the group uses on the whiteboards. A class huddle was used by Participant 1 when the students were stuck. Participant 6 said something similar about doing mini-lectures during the class. Participant 2 likes to catch students "being smart" in different ways to empower the students. Participant 5 uses graphic organizers with teacher students having different colored pens to see how each member contributes to the task. For support, participants 11 and 6 voiced that they have instructional support from a peer who speaks the most common non-English language in the school. In groups, students are encouraged to talk to each other before asking the teacher for participant 6. So, there was a bit of variability between the participants regarding the procedures needed to implement collaboration.

This theme focuses on the procedures teachers use to implement collaboration. Using the procedures, teachers create opportunities for the students to build experience and knowledge through social interactions. The use of accommodations is consistent with the literature, as one of the teacher's roles is to meet students' needs during the collaborative process (Van Leeuwen & Janssen, 2019). The curriculum was a feature that made implementation easier. Liebech-Lien (2020) found that a curriculum that does not support

collaboration can hinder teachers' ability to implement the strategy. Therefore, without

that hindrance, implementation might have been more straightforward. Roles in groups

play a crucial role in students properly communicating with each other to make a more

positive group experience by giving structure to their interactions (Oluwatosin & Ajani,

2022). Teacher check-ins were a present category because teachers need to monitor

groups so that they can step in to make adjustments they can (Dzemidzic Kristiansen et

al., 2019). The type of task was found to be important because using tasks that do not

foster collaboration can lead to ineffective use of the strategy (Louie, 2019). The only

category not directly mentioned in the literature that emerged was the use of routines.

Theme 2: How to group students for collaboration.

During the interviews, a theme about how the teachers form groups and what the

teacher considers when creating the groups. Participants 1, 3, 5, 6, and 8 mentioned that

needs often determine the grouping. Students with language needs would be in a group

with at least one stronger student in English, which could help. Students with IEPs or

behavioral issues were either paired in groups with other students who could help or put

together so that the teacher could focus more on the group. Another grouping strategy

mentioned was mixed groups of students of different levels and abilities, as participants

3, 5, 6, and 12 noted. However, Participant 4 said they found that putting students in

mixed-ability groups led some students to defer to the others in the group, and thus,

grouping by class ranking was preferable. Participants 1, 6, 9, 10, and 11 discussed using

random grouping as the best strategy to promote working with many other students.

Participant 11 went on to say that teacher-selected groups were difficult to make and

often did not have the desired outcome. Participants 3, 6, and 7 further noted that they felt smaller groups, especially groups of 3, work better regarding student engagement. Participants 5, 6, and 7 added that the teacher should switch around groups regularly.

Several participants touched on what they considered when making groups beyond academic ability. Participants 2 and 7 looked for groups that would be able to accept everyone in the group so that they could have a shared sense of accomplishment when completing the task. Participant 7 tries to ensure each group has a strong leader and a good communicator. Participant 8 looks to group members who will challenge each other so that they are competitively motivated to prevent the groups from getting apathetic. Participant 3 discussed that part of the decision for the grouping was based on the learning outcomes.

The above were the main categories mentioned in the interviews, but there were other discussions around grouping that some of the participants mentioned. When it came to grouping, participants 2 and 5 spoke about how students wanted to be with their friends in a group, which they had to consider. Participant 5 said part of their use of groups is self-formed by the students, especially with high-performing students. Participant 7 said they sometimes struggled with how often to switch the groups as groups staying together can build chemistry.

The way in which the teacher groups students plays a significant role in the success of implementing collaboration. Groups are essential for students to learn from each other in a social constructivist way. If students have a negative group experience, the strategy is no better than using direct instruction (Ferguson-Patrick, 2018). It is also

essential to note how teachers create groups to maximize their effectiveness because teachers can create groups in order to collaborate (Van Leeuwen & Janssen, 2019). If teachers do not group students well, then the implementation of the strategy can slow down (Le, Janssen, & Wubbels, 2018). So, ensuring that the grouping facilitates positive collaboration is essential.

Theme 3: The issues teachers faced when implementing collaboration.

Although every participant in the study implemented collaboration, they all agreed that they encountered some issues when trying to do so. One of the main issues concerned equal participation, according to participants 3, 5, 6, 8, 10, 11, and 12. The reasons for this ranged from students not wanting to participate (participants 3, 10, 11) or some students wanting to dominate and get the problems done (participants 5, 6, 8, 11, and 12). Another issue was overall reluctance to participate in group-based activities (participants 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, and 12). Students were hesitant due to social anxiety (participants 1, 6, 8, and 10), whereas others preferred working individually (participants 2, 3, 4, 7, 9, 11, and 12). Participant 11 added that the most resistance to collaborating came from students who came from a more individualized approach to math before the class. In addition, participants 1 and 6 mentioned that the social anxiety might have come from just coming back to school following the pandemic. A third major issue with implementing collaboration, as noted by participants 1, 4, 6, 8, 9, and 11, was students' lack of experience with the approach. However, all of those participants mentioned that once the students had more experience using the method, they would be

more comfortable and willing. Thus, the three categories that were found for the theme of issues were equitable participation, reluctance, and experience.

Even though the participants identified three categories, they also mentioned other issues. Participant 6 talked about how there is less interest in math, so it can be challenging to implement a new strategy due to interest in learning the subject. Participant 6 also said that phones often distract the students and cause the group work to break down. Participants 3 and 7 talked about students who did not want to work with certain other students due to past histories and social dynamics. Participant 8 discussed how there was anxiety from all levels of students when starting collaboration due to a lack of control over the learning process. Participant 8 also said there was initially an issue with random grouping, but that got better over time. Lastly, as told by Participant 1, an issue was that it was difficult for students to get used to a new routine at first, but eventually, the students were able to adjust. Therefore, some of the issues participants encountered were unique to them.

When implementing a new instructional strategy, there are always issues. One of them is when students do not have experience with collaboration they tend to struggle at first, especially if other students do have experience (Dzemidzic Kristiansen et al., 2019). Equitable participation is another key feature of collaboration, as it allows each student to be heard and understood (Fujita et al., 2021). Also, although students can be reluctant to participate in collaboration, their attitudes toward the strategy improve as the teacher uses it more (Arlsan, 2020). Thus, the teacher should provide the experience for effective collaboration and equitable participation.

Theme 4: The support needed by teachers to implement collaboration.

Support was another theme discussed concerning how the teachers could be supported in implementing collaboration in their classrooms. According to participants 1, 3, 7, 8, and 10, school support was crucial. Participants 1, 7, 8, and 10 wanted admin support in the use of collaboration. Participants 1 and 3 would like more teacher support in embracing collaboration. Participant 1 also added the support of an instructional coach. Another category for support is support through observations (Participants 1, 4, 5, and 12). All agreed that the point of the observations would be to learn and grow. All four participants wanted teacher-to-teacher observations, whereas participant 1 also wanted admin observations. A third category came from teachers wanting more uniformity in the approach (Participants 1, 2, 3, 4, 6, 7, and 9). All five participants wanted consistent school-wide implementation of collaboration so students could use the approach in multiple subjects for years. Lastly, participants 1, 2, 8, 9, and 11 would like more teacher collaboration regarding the approach as a means of support. The support includes within departments (participants 1, 2, 9, and 11) and whole school collaboration (participants 1, 8, 9, and 11). Hence, the four categories to emerge for the theme of support were school support, observations, uniformity, and teacher collaboration.

Although the participants identified four categories for support, the participants mentioned other areas of support. Participants 1 and 4 would like more teachers to be willing to get started using collaboration. In addition, participant 1 would like more of a culture of peer-to-peer support for teachers trying to implement collaboration. Participant 3 would like more forms of feedback to improve the use of collaboration and the

student's experience with collaboration. Participants 5 and 12 would like more professional development with collaboration. Participant 7 discussed having support in obtaining proper furniture that would help facilitate collaboration. Participant 10 would like more resources that they can use to help implement collaboration. Finally, participant 8 would like the support of the district and school admin in balancing district demands with supporting the student's learning using collaboration. Thus, there are many ways in which teacher would like support to implement collaboration in their classrooms.

In order for teachers to adopt new strategies, they need support to aid successful implementation. Professional development with the support of the school is a key factor in properly implementing collaboration (Liebech-Lien, 2020). Besides that, access to resources such as observations and teacher-to-teacher collaboration also helps with the successful use of collaboration (Hortigüela Alcalá, et al., 2019). Therefore, teachers need continued support to implement collaboration properly.

Theme 5: The group skills needed by students for collaboration

Every teacher mentioned a wide range of skills students need to work effectively in groups, but four main categories emerged from the interviews. According to Participants 1, 3, 7, and 9, communication skills were vital as the groups worked better when the group members communicated effectively and respectfully. Participants 3, 6, 7, 8, 9, 10, and 11 felt that being open-minded was important as students must listen to each other and consider alternate opinions. A third skill mentioned by Participants 1, 2, 5, 6, 7, 8, 9, and 11 was social skills. The participants defined social skills as the willingness to engage socially with other students in a way that includes everyone. The last main

category discussed by Participants 1, 3, 10, 11, and 12 was the willingness to make mistakes and the skill to learn from the mistakes. The categories of communication skills, open-mindedness, social skills, and learning from mistakes were the four primary skills mentioned by the participants.

Even though the participants brought up four skills most often, they also said several other skills. Participant 6 talks about the need for problem-solving skills where the students can use different approaches and strategies to solve problems. Participants 8 and 10 mentioned the need for students to have the skills to come to a consensus on their work and answers. Organizational skills were one skill brought up by Participants 5 and 12. Participant 5 went on to say that the students should have math skills and the skills to manage routines. Participants 7 and 12 talked about how the students needed the skill of asking questions to both the group members and the teacher. Also, participant 7 said that at least one student in the group needs to have leadership skills to make the group work. Lastly, participant 11 felt it was necessary for students to have the skills to provide feedback to each other. These were the other hard skills that the participants discussed.

Although there were several hard skills that teachers felt were needed to work effectively in groups, there were some affective skills that the participants mentioned as well. Participant 1 talked about the need for students to have a positive attitude toward learning and being able to be adaptive. Participant 5 spoke about students needing to feel comfortable with having messy work. Participants 3 and 8 both expressed that students should have confidence. Participant 8 went on to talk about students needing to have curiosity for effective groups. Participant 12 brought up a growth mindset as a critical

affective skill. Finally, participant 6 thought that students were required to have overall social-emotional skills in order to handle being in and working in groups. Thus, several participants supposed affective skills were also essential for students to work in a group successfully.

As mentioned before, it is not enough to group students; a teacher must equip students with the skills needed to collaborate properly (Ferguson-Patrick, 2018). Teachers must explicitly teach the necessary skills and then help foster those skills during the process (Oluwatosin and Ajani, 2022). Teaching the skills will allow students to benefit most from learning through a social constructivist approach.

Theme 6: The environment that fosters collaboration

One of the most discussed themes concerning collaboration centered around creating an environment that allows collaboration to work at the highest level. Participant 8 said that a teacher needs an environment of collaboration before the students can complete any task. One way to do this is through reacting to a culture of inclusion, according to participants 1, 2, 4, 6, 7, 8, 9, 10, and 12. Participant 2 talked about how direct instruction did not meet the needs of all learners. All participants emphasized that they should meet all the student's needs and ensure each student felt seen by valuing multiple perspectives. Participant 1 went on to say that for students with English learning needs, getting the resources they need to feel they can contribute and be successful was an essential aspect of inclusion. Participants 6 and 12 discussed regular check-ins with groups and students to ensure everyone had the chance to contribute. Teachers must check on students with IEPs and behavioral issues to see that they are meeting their

needs, as Participants 6 and 8 mentioned. Participant 7 felt that students should care about each other as part of the collaborative process.

Another aspect of creating an environment for collaboration, as mentioned by Participants 1, 2, 4, 5, 6, 7, 8, 10, and 12, is for students to be willing to try collaboration. All the participants felt that if students were willing to try collaboration, they would be more keen on using collaboration. Therefore, they all agree that the teacher should encourage students to collaborate when implementing the strategy. Another category Participants 4, 5, 6, 7, 9, 10, and 12 discussed was reciprocal learning. All teachers value peer-to-peer learning, which happens as a result of students collaborating to solve problems. Participants 4, 7, and 10 added that the goal is for groups to gain more independence from the teacher by relying on each other more. A fourth aspect of a collaborative environment is peers challenging each other intellectually, as said by Participants 1, 2, 8, 9, 11, and 12. Participants 8 and 9 add that students must respectfully challenge each other to encourage deeper thinking. Participant 11 emphasizes students not giving up when challenged. Participants 1, 3, and 11 mentioned risk-taking as part of a collaborative environment. They all felt students should be willing to take risks by leaving their comfort zones and trying something new. The last major category discussed by Participants 5, 7, 9, and 12 is that the environment needs to be student-centered. They all talked about the need for teachers to give more control over the students in the learning process to promote autonomy and collaboration. So inclusion, willingness to collaborate peer learning, peers challenging each other, risk-taking, and student-centered were all critical parts of creating a collaborative environment.

The participants identified six categories to foster a collaborative environment, but these were not the only parts that participants found important. Participants 9 and 8 felt it was essential to establish an environment of structure and order. Establishing structure and order is consistent with what Participant 11 felt about how group structure and routines aid collaboration. They went on to say that formative feedback at the moment when working on the problems collaboratively as a check-in helps students work more collaboratively. They also added that they start the year with non-academic tasks that encourage collaboration before starting on content. Participant 8 mentioned that using formatives to give feedback and devalue speed was important for a collaborative environment. They also added that the desks in class must emphasize collaboration and that the teacher needs to set high expectations for their students. Participant 2 suggested that asking questions, making mistakes, and struggling must be normalized. Likewise, Participant 10 thought each should create an intellectually safe environment. Concerning social issues, Participant 7 says that the focus needs to be on math to encourage collaboration. Participant 12 said there should be an expectation that higher-performing students explain their thinking to lower-performing students as part of the process. They also mentioned that coming up with multiple ways to solve the problem should be encouraged. By doing this, Participant 12 felt that students would arrive at skills and content themselves. Participant 6 felt that the environment should promote social-emotional and academic learning as part of the collaborative process. Participant 4 emphasized discussing the benefits of collaboration with the students as one of the first

steps to creating a collaborative environment. Hence, establishing an environment of collaboration requires many factors to be considered.

It is not enough to implement collaboration as a strategy. Teachers should create an environment around the strategy. Students must engage and challenge each other's thinking (Oluwatosin and Ajani, 2022). Students also need to be willing to collaborate, which often takes time (Arlsan, 2020). Also, Teachers should include students in such a way that they are heard and understood, which is vital for a collaborative environment (Fujita et al., 2021). Another part of the environment needed for successful collaboration is that teachers need to move towards a more student-centered approach by allowing more interaction between students (Duran et al., 2019). Thus, establishing an environment of collaboration is an essential part of the successful implementation of collaboration.

Research Question 2

For the second research question, what are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington? I only had one theme that addressed the question.

Theme 7: The benefits of using collaboration

One theme the participants agreed on was the perceived benefits of using collaboration in their classrooms. Participant 1 said "Collaboration just works ." Participant 2 said they believed in collaboration so much they would not teach at a school that does not allow them to use collaboration. Participant 4 held that collaboration is their class's most powerful aspect of learning. Even with the participants' strong belief in the

benefits of collaboration, only three categories came from the interviews about the benefits of using collaboration. Participants 1, 2, 3, 5, 7, 8, 9, and 10 said collaboration increases the students' positive feelings toward learning. Participants 2, 3, 5, and 10 mentioned that students enjoyed learning and the class more after implementing collaboration. Participant 1 talked about students having more fun in their class after implementation. Participant 8 observed increased student pride in their work once they started using collaboration. Participant 9 felt that using collaboration fostered a love for learning in the students. Participant 7 believes the increase in positivity was due to the students liking the discussion and the autonomy of group work. Another category from the data was increased engagement according to participants 1, 7, 8, and 10. They all felt that students were more engaged in the learning and stayed engaged for longer. The third benefit is an increase in intelligence. Participants 1 and 9 agreed that collaboration helped students better understand the concepts. Participant 2 perceived collaboration shifts students' sense of intelligence and helps them grow. Thus, increased positive feelings towards the class, engagement, and intelligence were the agreed upon benefits of collaboration.

Even though participants agreed upon three benefits, they also mentioned other benefits. Participant 2 felt that class collaboration helps build a sense of community. Participant 4 saw that student collaboration often worked better than students getting tutors. Participant 6 discussed how students have diverse skills beyond academics and that collaboration allows some of those skills to be used in the class to add diversity to problem-solving. Collaboration was incredibly impactful for low-achieving students, as

mentioned by Participant 10. Participant 11 thought collaboration in their class increased

their ability to collaborate with their teaching peers to generate new ideas. Overall,

collaboration builds more skills than expected, according to Participant 7. However,

although they recognized the benefits of collaboration, Participants 3, 5, and 11 did not

think it was a strategy that should be used every time or even for a whole lesson. Even

with that, collaboration was a strategy perceived to have many benefits.

The main reason a teacher would choose to implement collaboration is the benefits to the

students. Using the strategy can help students improve in mathematics and translate that

ability to other subjects to improve (Kalaian et al., 2018). It also enhances students'

positive attitudes toward learning (Namaziandost et al., 2019; Tabach & Schwarz, 2018).

Lastly, the strategy helps improve students' engagement in class (Fujita et al., 2021).

These are the main benefits that teachers experience when implementing collaboration.

Summary

In this chapter, I wrote about the results of the interviews for this study. I started

by reiterating the purpose and research questions of the study. I described the setting of

my interviews, which took place only with California teachers. The teachers'

demographics were diverse regarding age, ethnicity, and gender. I went on to discuss how

I collected data and any issues I had. After that section, I moved into how I analyzed the

data using codes, categories, and themes. I moved into the section about the study's

trustworthiness by explaining how my study has credibility, transferability, dependability,

and confirmability. Lastly, I presented the interview results by introducing the emerging

themes and then discussing what each Participant said about that theme. In Chapter 5, I

plan to write about how I interpret the findings, the limitations of my study,

recommendations from my study, and the implications of my study.

Chapter 5: Discussion Conclusion, and Recommendations

This study focused on mathematics teachers' perceptions and experiences when implementing collaboration in the mathematical classroom in the US. This topic was addressed by doing a basic qualitative research study answering the following research questions:

RQ1: What are mathematics teachers' experiences of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

RQ2: What are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?

In this chapter, I interpret the findings that came from the previous chapter. I then discuss the limitations of those findings, followed by the recommendation of further studies based on the limitations. Finally, I write about how the study could contribute to positive social change.

Interpretations of Finding

Research Question 1

For research question 1, there were six main themes that teachers mentioned when it came to their experience with implementing collaboration. The responses varied, but some key features were important. The first was about the curriculum being used. The curriculum supporting collaboration made it easy for the teacher to implement collaboration. Establishing roles in the groups helps to facilitate collaboration. Having tasks that are open-ended or allow multiple approaches aid the student in using the approach. These tasks can be broken into smaller pieces or scaffolded to help students

needing accommodation. The teacher's role during the collaboration is to walk around and check in with the students to ensure progress and that all members are participating. Some teachers also use whiteboards for students to stand up on as part of the collaborative process. There is also often an option for students to occasionally opt out of collaborating once in a while. Lastly, regarding the teachers' experience, routines were important for students to know what they needed to do and how they needed to do it.

The next theme that teachers have gained insight into due to their experience is how to do the grouping. According to the teacher, the grouping should be based on the needs of the students. Therefore, grouping was normally a mixed level based on abilities. Certain teachers mentioned random grouping to mix up the groups and have students consistently working with other students. This is aligned with the teachers' suggestion that the groups should be moved around regularly. Finally, the teachers felt that groups of three worked the best for collaboration.

The third theme was centered around the issues the teacher had when implementing collaboration. The largest issue was about equal participation in terms of not allowing one student to dominate while also getting participation from other students who do not want to be a part of the group. There is also usually a reluctance to learn collaboratively at the beginning of implementing collaboration. Some of the reluctance came from social anxiety, while others came from a preference to learn alone. Also, the teachers mentioned that a large portion of the reluctance came from students' lack of experience using the approach, noting that once they are more comfortable collaborating, they are more willing to use the approach.

Next is the support theme, which is about the type of support teachers need to properly implement collaboration. The main support was support from the school and admin to implement collaboration in the first place. The level of support the teachers wanted was to be observed and observe other teachers to get feedback and discussion about best practices regarding collaboration. Teachers also wanted uniformity in the collaborative approach so that students are familiar with collaboration and how to succeed. Also, teachers want to collaborate with other teachers, both in their departments and other departments, about how collaboration is implemented.

Another theme that emerged from the teachers' experience when implementing collaboration was the type of group skills students needed to be successful in collaborative work. The first skill needed is communication so the students can discuss the task effectively and respectfully. Being open-minded was important so that students would consider alternate perspectives. Social skills are needed for successful collaboration because the students should be socially engaged in a way that includes everyone. The fourth skill was the willingness of the students to make mistakes and learn from them.

The final theme that emerged from the teachers' experience was about the environment that facilitates positive collaboration. The most agreed-upon element of a collaborative learning environment was inclusion. The class needs to have a culture of inclusion, so everyone feels safe and willing to both share their thoughts and listen to others. Students also need to be willing to collaborate so that they can get the most out of the time they have together.

Part of that collaboration involves students being keen to learn from peer-to-peer interactions. Part of that learning process is through students intellectually challenging each other. As mentioned before about the willingness to make mistakes, having a classroom environment that values risk-taking is vital to collaboration because students need to go out of their comfort zone to maximize their learning. The final element of a collaborative learning environment is that it needs to be student-centered so that the students have more autonomy over their learning. Thus, in the experiences of teachers who implement collaboration, the five main themes to consider are procedure, grouping, issues, support, group skills, and environment.

Research Question 2

For research question 2 (What are mathematics teachers' perceptions of the value of implementing collaboration in US classrooms, specifically from California, Oregon, or Washington?), the teachers' perceptions of the benefits of using collaboration were noted. There was a well-established belief that collaboration was work for the teacher to the point that some would change schools just to be able to use the approach. The largest perceived benefit was the positive feelings students had about the learner process after introducing and using collaboration. This was to the point that many students enjoyed the class and the learning. The other perceived benefit was the increase in engagement. Although these were the only agreed-upon benefits of collaboration, other benefits were mentioned, such as deeper understanding and intelligence growth. Therefore, all the teachers in the study highly valued the use of collaboration in their classes due, in part, to the many benefits of using the approach.

Limitations

In chapter 1, I addressed a few limitations I foresaw as I engaged with the study. The first limitation I thought I would face was in finding enough participants for the study, as I felt there was a narrow demographic to choose from. I initially struggled to find good, reliable participants. I first tried more open forums, such as Facebook, to recruit participants. However, I quickly learned that many were scams, and most appeared to be not authentic participants. Therefore, I had to search for more discussion forums that were meant only for certain people who could fit the description of the participants I needed. This is when I found out that there are individual state chapters of the National Council of Mathematics Teachers (NCTM) that I could join to recruit. Although I had to repost in the forum both before and after the summer, in the end, I could post in discussion forums and get replies from 12 California teachers. This allowed me to overcome the limitation of finding participants.

The second limitation came in the time difference between where I lived and where the participants would be. I could schedule each participant when they felt comfortable, but that always wound up being in the middle of the night for me. However, this was sometimes a positive as I did not have to worry about whether I would be available when the participants were available because it was in the middle of the night for me. Thus, I was able to conduct each interview using Zoom.

A limitation that arose from conducting the interviews came in the form of who responded to my post about participation. Although I was able to find the number of participants I needed, they were all from California. I would have liked to have recruited

participants from Washington and Oregon as well for a bit more diversity. In addition, I was able to recruit from a discussion forum. Therefore, all my participants were people eager to share about using collaboration and are also a member of the NCTM California Chapter.

Recommendations

The purpose of this study was to explore mathematics teachers' perceptions and experiences when implementing collaboration in a US classroom. The study results indicated many facets of implementing collaboration that should be taken into consideration, as well as the perceived value of implementing collaboration. Through the data analysis, there was shown to be a variety of ways collaboration was used in the classroom, which led to less agreement on how best to implement the strategy. Thus, an area for further research would be finding participants who implement a more similar style of collaboration to narrow the focus on what is required to implement collaboration.

Another area of further research came from the limitations of the study. I was only able to find participants from California. So, an area of further research would be to repeat the study in other states that have collaboration as part of their mathematics education standards. This would help improve the demographics to which this study applies.

Lastly, another limitation was the method I used to recruit participants. All the participants who replied to be a part of my study were a result of a post in the NCTM California chapter. This study could be conducted again to recruit participants through other means, which would contribute to more diversity in participants.

Implications

The study aimed to explore mathematics teachers' perceptions and experiences when implementing collaboration in a US classroom. This study was conducted to find out more about what teachers who have experience with using collaboration discuss those experiences and get their perspective on the value of strategy. Collaboration is a strategy that has the potential to help many students improve their mathematical ability (Erdogan, 2019; Kalaian et al., 2018; Voskoglou, 2019) and also develop many other skills that help them improve as students in general (Dzemidzic Kristiansen et al., 2019; Erdogan, 2019; Kalaian et al., 2018; Namaziandost et al., 2019, Voskoglou, 2019). However, teachers are still slow to adopt the strategy even when they know about its benefits (Abramczyk & Jurkowski, 2020). Therefore, the positive social implications of this study are to gain insight into how the strategy could be more effectively implemented and contribute to the perceived benefits of the strategy so that it could be added to other literature to improve professional development on the use of collaboration. Thus, if there is improved professional development, more teachers could implement the strategy and continue implementing it even after some issues are encountered.

Conclusion

In the exploration of the study, both research questions were answered. Teachers' experience fell into six themes. These themes were about the classroom procedures to implement collaboration, how to group the students, the issues with implementing collaboration, the support needed, the skills groups need to be effective, and the environment that needs to be established. The teachers' perceived value of collaboration

was focused on the benefit it had for the students and the overall social construct of their

classroom. Even with all the information that was gathered, there were limitations to the

study. The limitations came from getting reliable participants and the time difference

between myself and the participants. The other limitation was that the participants'

demographics were only from California. Based on the limitations, I came up with

recommendations for future studies. The recommendations are for further studies to focus

on teachers who use more of a similar collaboration approach, teachers from other states,

and the method used to recruit participants. Finally, I discussed how the study could

contribute to improved professional development surrounding the implementation of

collaboration in the mathematical classroom.

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Appendix A: Interview Questions

Hello, thank you for sitting down with me for this interview. I would like to mention that this interview will be recorded. It will later be transcribed. This is a study about the perception and experiences of mathematical teaching that implement collaborative learning in their class. At this point do you have any questions or concerns about participating in this interview for this study?

Okay let's begin:

- Tell me about the types of issues you've had to contend with when you've introduced collaboration in your classroom. What are some of the issues for you?
- How do you set up tasks for student collaboration? How do you set up task?
- How do you deal with students with diverse needs while using collaboration, such as linguistic, cultural, social, and behavioral?
- What do you do to ensure the contribution of each group member to accomplish a group task?
- Can you share your experience about what kind of grouping worked well? What didn't work well? Why or why not?
- What do you think about skills needed for students to work successfully in a group?
- In your view, what is an effective learning group?
- What have you learned from your experience of using collaborative activities?
- What are your thoughts on how students respond to working in small groups?
- What do you expect from your faculty to promote teacher's implementation of collaborative activities?

This concludes the question part of the interview. Thank you for taking the time to talk to me today. At this point do you have any questions for me? Also, are there any corrections you would like to make to any of your answers? Again, I appreciate it and please let me know if you think of any further questions or have any concerns. Have a great day.

Appendix B: Recruitment Letter

Hello Everyone,

I would like to introduce myself. My Name is Scott Cairney, and I am in the Walden

Ph.D. program as a Ph.D. Candidate. As part of the requirement to get a Ph.D. I will need

to conduct research on a topic of my choosing. My topic is the teachers' experience and

perception of implementing collaborative in a secondary classroom. I am recruiting

mathematics teachers who implement collaborative strategies in their classroom for a

study. Participants would need to be currently teaching in mathematics in California,

Oregon, or Washington state. Would you be interested in taking part in the study?

If you would like to participate a Consent statement will be emailed to you with more

details about the study and the time commitment.

For your time I will be providing a $20 gift card to Amazon for participation, upon

completion. Please let me know if you would like to participate. The research has

deadlines, so we'll need to begin the process by (date) and finish the interview by (date).

You can contact me by email ███████████████████ if you have any questions or

would like to participate.