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Teacher Perceptions of the Use of Cognitively Guided Instruction in Mathematics Classrooms

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Walden University
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Abstract

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MAT, National University, San Diego, 2012

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Dissertation Submitted in Partial Fulfillment

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Abstract

Elementary teachers in California were tasked to use cognitively guided instruction (CGI) strategies in mathematics classrooms, but it was uncertain if they had the self-efficacy, confidence, resources, and support to do so consistently. The purpose of this basic qualitative study was to investigate K-5 teachers' perceptions about their self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they felt needed to implement CGI strategies successfully. Bandura's social cognitive theory, which emphasizes four sources of self-efficacy, was used for the framework analysis. Research questions supported teachers' self-efficacy and confidence through research questions- What challenges are teachers facing in using CGI in K-5 classrooms? What support or resource was needed to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms? Data was collected through online interviews with 13 elementary mathematics teachers. The result indicated that participants were confident using CGI strategies in the classroom. Participants indicated that the strategies are effective in helping understand mathematical problems. This study contributed to social change by providing instructors and educational leaders with a deeper understanding of teachers' pedagogy in the classroom in implementing the CIG strategies.

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Dedication

I dedicate this dissertation to my family. My husband, Mosarrof H. Tulu, and my daughter Maliha Hossain who encouraged me to pursue my dreams and helped me persevere throughout the completion of my doctoral degree. Maliha, I am so thankful for your valuable edits, advice, and your unconditional love. Thank you for being my inspiration. I love you, ma! I also dedicate this work to my love for education and nurturing new minds in classrooms. I hope my work can be a ripple toward the waves of change we need to see in this field. I am finally done, and I look forward to seeing where this journey takes me next!

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Chapter 1: Introduction to the Study

Mathematics contains complicated concepts requiring students to think critically and understand each concept's intended aspects (Black et al., 2017; Candela & Boston, 2019; Myers & Cannon, 2018; Norton, 2017; Stoehr, 2017). Using cognitively guided instruction (CGI) helps teachers guide students in constructing a robust conceptual understanding of mathematics (Conowal, 2018; Diamond et al., 2018; Guerrero, 2014; Jacobs et al., 2017; Kirschner, 2017; Munday, 2016; Noviyanti, 2020; Walters, 2018). CGI is an approach to teaching elementary school mathematics in which classroom instruction is guided by what students previously know (problem-solving skills) and helps students with their understanding and thinking related to solving mathematical problems (Biolatto, 2019; Black, 2015; Carpenter, Fennema, et al., 2017; Conowal, 2018; Guerrero, 2014; Munday, 2016; Noviyanti, 2020; Unlu et al., 2017; Walters, 2018). Teacher perceptions about their ability to teach math can impact student learning. According to Ellington et al. (2017) and Conowal (2018), elementary teachers may not possess the mathematical content knowledge necessary to teach students in a CGI atmosphere. CGI requires teachers to have an in-depth understanding of the subject to represent it appropriately in multiple ways, increasing students' mathematical thinking abilities (Biolatto, 2019; Black, 2015; Fuentes, 2019; Iuhasz-Velez, 2018; Rishor, 2018). Teachers with a comprehensive understanding of a certain subject, self-efficacy, and confidence have been acknowledged as an important factor in their work, professional learning, and student learning (Biolatto, 2019; Conowal, 2018; Ellington et al., 2017; Guerrero, 2014; Zee et al., 2018). CGI helps teachers understand and monitor students' thought processes in mathematics and use this evidence to congregate students' requirements (Biolatto, 2019; Black, 2015; Ellington et al., 2017; Guerrero, 2014; Munday, 2016). Using CGI, teachers can guide students in constructing a strong conceptual understanding and flexible thinking of mathematics and provide students with an opportunity to build their mathematical thinking (Guerrero, 2014; Iuhasz-Velez, 2018; Marshall et al., 2007; Moscardini, 2014; Munday, 2016; Rishor, 2018; Walters, 2018). CGI has proven to be very effective in helping students grasp mathematical concepts. It capitalizes on their natural problem-solving skills by allowing students to practice multiple strategies when solving one problem. Eventually, students develop their paths to the solution (Baker & Harter, 2015; Black, 2015; Conowal, 2018; Guerrero, 2014; Munday, 2016; Walters, 2018).

Bandura (1986,1997) stated that the belief individuals hold about their abilities to complete a particular task influences the outcome. This outcome was used to understand how teachers' self-efficacies determine their confidence in their ability to teach their students and encourage students' learning. Teachers felt equipped and confident to implement CGI with enough experience and self-efficacy. A review of the literature related to CGI indicated a requirement for additional information on teacher's self-efficacy, confidence, and resources in CGI (Baker & Harter, 2015; Black, 2015; Conowal, 2018; Guerrero, 2014; Iuhasz-Velez, 2018; Moscardini, 2014; Munday, 2016; Noviyanti, 2020; Nurlu, 2015; Walters, 2018). Therefore, the exploration of teachers' self-efficacy, confidence, and experiences with CGI and their perceptions of the implementation of CGI was essential. CGI strategies require teachers to have enough implementing resources such as financial support, instructional materials, and an in-depth understanding of the subject to help students develop their mathematical thinking abilities (Black, 2015; Conowal, 2018; Guerrero, 2014; Noviyanti, 2020; Rishor, 2018). According to researchers, most elementary teachers do not possess the mathematical content knowledge necessary to teach students in a CGI atmosphere (Conowal, 2018; Jacobs et al., 2017; Moscardini, 2015; Moscardini, 2014; Walters, 2018). The success of CGI teaching strategies depends entirely on how confident teachers are when using them in a math classroom (Black, 2015; Conowal, 2018; Diamond et al., 2018; Guerrero, 2014; Nesrin, 2015; Sinquefield, 2016; Walters, 2018).

This study involved elementary teachers who use or want to use CGI in their classrooms. This chapter includes background information regarding teachers' perceptions and attitudes towards CGI, followed by the problem statement, the purpose of the study, and research questions. It included a conceptual framework through Bandura's (1977) self-efficacy theory, which I used as the theoretical framework. Then the nature of the study was followed by the definitions of key terms. The chapter concludes with an argument of assumptions, delimitations, scope, limitations, and significance, plus a chapter summary of the research.

Background

Understanding students' mathematical thinking processes and problem-solving strategies enable researchers to learn how these processes and strategies can link to students' conceptual knowledge; CGI capitalizes on the students' innate problem-solving skills (Carpenter, Fennema & Franke, 2017; Iuhasz-Velez, 2018; Medina, 2019;

Noviyanti, 2020). The teacher takes a step back from the leading role in the teaching process and becomes a facilitator of student learning (Guerrero, 2014; Iuhasz-Velez, 2018; Lopez-Agudo, 2017; 2016; Medina, 2019; Munday, 2016; Nesrin, 2015; Noviyanti, 2020). The students use natural problem-solving skills and what they already know about a mathematical problem to build their understanding of the related problem-solving concept (Carpenter, Frank, et al., 2000, 2017; Guerrero, 2014; Iuhasz-Velez, 2018; Munday, 2016; Nesrin, 2015; Phan, 2017; Walters, 2018). As a result, classroom instruction is often guided by the individual thought processes of the students. The teacher devised strategies or approaches that ensured a deeper understanding of a given mathematical concept by understanding how children think. CGI was introduced in the late 1970s and early 1980s when a comparative study was conducted to identify whether students' performance in mathematics would improve if teachers tried to understand how they think (Carpenter et al., 2000). In the beginning, Carpenter and Peterson (year) individually researched students' thinking and information process. At the same time, they focused on children's mathematical thinking by solving multiple mathematical problems besides students' and teachers' mathematical thinking processes during precise instructions (Carpenter et al., 1988). When teachers comprehend the ways or strategies that students use to seek solutions to mathematical problems intuitively, they can help them learn challenging concepts quickly and more effectively. Another beneficial aspect of CGI is that it allows students to actively get involved in the learning process by dictating teachers' approaches to teaching mathematical concepts in the classroom. Individual attention is given to students as their natural problem-solving skills guide the teaching process (Biolatto, 2019; Guerrero, 2014; Munday, 2016; Phan, 2017; Smith & Smith, 2007).

CGI is an approach to teaching elementary school mathematics in which classroom instruction is guided by what students naturally already know and bring to the classroom regarding their understanding and thinking related to solving mathematical problems (Black, 2015; de la Cruz, 2016; Guerrero, 2014; Iuhasz-Velez, 2018; Noviyanti, 2020; Phan, 2017). The research behind CGI began in the late 1970s. Carpenter and Fennema (2014) researched how children think and process information independently. Carpenter, Franke, et al. (2017) focused on developing children's thinking while solving mathematical problems, while Peterson focused on how children and teachers feel during mathematical lessons (Carpenter et al., 1996; Carpenter et al., 2000; Carpenter et al., 2014). Carpenter (2017) found that children begin school with a well-developed intuitive system of mathematical knowledge and can show reasonably sophisticated strategies for solving addition and subtraction word problems before receiving formal instruction (Carpenter, 1985; Carpenter et al., 1989; Carpenter et al., 2000; Medina, 2019; Moscardini, 2010; 2014). Teachers are often encouraged to introduce symbolic computations in their classrooms and try to get students to process this knowledge into fundamental problem-solving skills (Carpenter, Franke, et al., 2017). Carpenter (2017) indicated that instruction in mathematics in the early grades might be critical to assist students in being successful in math. He also believed teachers needed to understand how young children intuitively solve problems. Carpenter, Franke, et al. (2017) discovered a need to integrate what has been discovered about kids' thinking when learning math from a research environment into an actual classroom setting. Teachers were then studied, and it was observed that they were good at predicting if their students could answer questions correctly but were less successful at predicting what strategies the students would use (Carpenter et al., 1988, p. 398). Carpenter et al. (1999) stated teachers who had more knowledge about their students' thinking levels had higher levels of achievement in problem-solving skills than teachers who had less understanding of their students' thinking. CGI was then founded and based on this research.

In 1997, California adopted CGI standards in English Language Arts and Mathematics. CGI was developed to help teachers understand the conceptual thought processes of students learning requirements (Andrew, 2006; Baker & Harter, 2015; Black, 2015; Biolatto, 2019; Carpenter et al., 1996, 2000, 2014, 2017; Diamond et al., 2018; Myers et al., 2020; Rishor, 2018; Sinquefield, 2016; Zee et al., 2018). Using CGI, teachers can guide students in constructing a robust theoretical understanding of mathematics (Baker & Harter, 2015; Carpenter, Fennema, et al., 1996, 2014, 2017; Conowal, 2018; Guerrero, 2014; Moscardini, 2014; Walters, 2018).

The traditional approach to teaching places much emphasis on teacher-guided instruction. The teacher assumes the primary role of finding ways to help students understand a particular concept (Black, 2015; Conowal, 2018; Guerrero, 2014; Lopez-Agudo, 2017; Sutton, 2018; Rishor, 2018; Walters, 2018). The student's responsibility is to follow the recommendations and guidance of the teacher to learn how to solve a problem through multiple strategies (Carney et al., 2016; Conowal, 2018; Phan, 2017; Sutton, 2018; Turner & Drake, 2016). By contrast, CGI takes a different approach by granting the student autonomy and power to guide the learning method. In a CGI progression, after explaining the problem, the teacher takes a step back and allows the students to solve the problem on their own (Conowal, 2018; Diamond et al., 2018; Moscardini, 2014; Noviyanti, 2020; Phan, 2017; Schoen, LaVenia, Bauduin, et al., 2018). For example, students are given a mathematical problem and allowed to attempt to solve it independently through multiple strategies without any input from the teacher. Instead of guiding what the students should do, the teacher watches the students' strategies to solve or resolve the problem. The students use their natural problem-solving skills, what they already know about a particular mathematical problem, to tackle the problem (Biolatto, 2019; Guerrero, 2014; Munday, 2016; Phan, 2017; Polly, 2016; Polly, Wang, et al., 2017). The teacher's responsibility is to observe how students explain it and to use that explanation to identify student thought processes.

Observing students’ thinking during the problem-solving process helps the teacher understand each student’s thought processes (Biolatto, 2019; Phan, 2017; Sutton, 2018; Turner & Drake, 2016; Varajic, 2017). The teacher can then capitalize on the observed cognitive abilities to help students understand the mathematical concept better. Solving math problems in this way empowers students to think critically about the plausible solutions to the problem (Baker & Harter, 2015; Biolatto, 2019; Fuentes, 2019; Jacobs et al., 2017; Ruthven & Hennessy, 2002; Russo, 2017; Ruthven & Hennessy, 2002; Turner & Drake, 2016). CGI places the student at the center of the learning process (Yli-Panula et al., 2022). The teacher begins by providing the students with a mathematical problem. The students are then requested to go ahead and try to solve the problem using their methods. During this period, the teacher observes and notes the students' approaches and strategies to tackle the problem. The goal is to identify students' essential problem-solving skills as they attempt to solve a complex problem without guidance. Students analyze the various options available and apply previously acquired knowledge to find a resolution, which makes them very effective at solving mathematical problems on their own (Baker & Harter, 2015; Black, 2015; Berger, 2017; Fuentes, 2019; Iuhasz-Velez, 2018; Seah, 2018). The teacher then uses the information from the observation to help the students understand how they identify the solution to the problem (Carpenter et al., 2014). The students then capitalize on their previous problem-solving skills to teach mathematical problems (Iuhasz-Velez, 2018; Munday, 2016). Therefore, the teacher must pay attention to every student's cognitive ability and use them to enhance their understanding of mathematical problems.

CGI is not a curriculum but rather an approach to teaching mathematics, which requires teachers with strong self-efficacy and confidence in their teaching ability and administrators' support and resources (Conowal, 2018; Diamond et al., 2018; Nurlu, 2015). The success of CGI in the mathematics classroom depends on how enthusiastic teachers are about implementing it (Carney et al., 2016; Iuhasz-Velez, 2018). Teachers who are trained in CGI and express interest in applying CGI in the mathematics classroom regularly, even though teachers are not required by law or regulation to use CGI strategies in their classrooms (Guerrero, 2014; Phan, 2017). If there is a lack of interest, the outcomes may not be positive. Coercion and the requirement to use CGI by regulation did not yield the same results (Biolatto, 2019; Black, 2015; Guerrero, 2014; Phan, 2017; Wilson, 2014).

CGI is a fundamental instruction process, particularly in mathematics, where classroom instruction is arbitrated by the teacher's guidance and decision making, which emphasizes the student-learning process (Myers et al., 2020). Jacobs et al. (2017) stressed the importance of teachers' participation in implementing CGI strategies. Walters (2018) reiterated that this requires personal commitment and a genuine interest in using CGI to boost student performances in mathematics, irrespective of the challenges. Likewise, if teachers do not have strong not self-efficacy and are not confident with the knowledge that they have of CGI strategies, they cannot implement the strategies effectively and help students perform better in mathematics (Carney et al., 2016; Schoen et al., 2018; Sinquefield, 2016; Walters, 2018). Phan (2017) and de la Cruz (2016) also found that elementary teachers face challenges in associating the achievement gaps due to inadequate training regarding implementing CGI strategies in their classrooms. This issue matters today because teachers did not have enough resources and self-efficacy and expressed concerns about the lack of in-depth understanding and guidance on implementing CGI strategies, especially focusing on math instruction (Diamond et al., 2018; Sinquefield, 2016).

Teachers play a critical role in education because they directly involve students and their learning processes through instruction. Teacher efficacy in mathematics teaching is partly influenced by the resources and support available to help them implement CGI strategies in their classroom (Baker & Harter, 2015; Guerrero, 2014;

Schoen et al., 2018; Walters, 2018). The term teacher self-efficacy refers to the beliefs that teachers hold regarding their abilities to teach mathematics successfully (Anderson, 2017; Mongillo, 2016; Norton, 2017, 2019; Pajares & Schunk, 2002; Polly, Wang, et al., 2016; Schoen et al., 2018; Wright, 2017; Zee et al., 2018). If the idea is healthy and positive, there is a high likelihood of success. Believing in CGI is, therefore, essential and necessary to facilitate successful implementation in the mathematics classroom. Teachers' self-efficacy was modeled out of Bandura’s social cognitive theory, which states that any individual's belief about their abilities to complete a particular task affects the outcome (Bandura & Walters, 1977). A teacher must be prepared and confident to implement CGI if they have enough experience and expertise in its abilities to help mathematics students understand concepts. This study is essential because the conclusions of this study may be read by all teachers who are using CGI or want to use CGI. However, a lack of self-efficacy and confidence for this to occur and draw may make teachers much more confident by investigating their perceptions about their self-efficacy and determination towards their practice of CGI strategies in the elementary school mathematics classroom.

I addressed the research gaps in teachers' experiences implementing CGI in mathematical instructions in this study. Previous researchers found that teachers are often good at predicting if their students could answer questions correctly but were less successful at predicting what strategies they would use (Diamond et al., 2018; Myers et al., 2020; Rishor, 2018). Zee et al. (2018) and Conowal (2018) also indicated that most teachers often use a traditional teaching approach that emphasizes teacher-guided instruction. I also sought to produce extensive basic qualitative studies that conclusively lead to recommendations for teachers in the same circumstances. The results produced by this basic qualitative investigation may significantly improve teaching methods and overall satisfaction with work for teachers who practice CGI approaches. This study contributes insights that are applied to the mathematics field overall, which may ultimately add to the improvement of society in the bigger picture. Most importantly, the results may improve the quality of mathematics learning for K-5 students in which teachers believe in their skills and are confident that they satisfy the learning needs of K-5 students. This study was necessary to improve the learning experiences and quality of math education and the self-efficacy and confidence of teachers using CGI.

Problem Statement

The problem I investigated was that teachers are experiencing discomfort in using CGI in K-5 classrooms and identifying the support or resources they need to improve their efficacy in using CGI strategies. Previous literature indicated that it is uncertain if they have the self-efficacy, confidence, resources, and support to do so with consistency (e.g., Andrew, 2006; Biolatto, 2019; Black, 2015; Black & Harter, 2015; Seah, 2018; Walters, 2018). CGI assists students in how to think instead of requiring repetition and memorization (Carpenter, Franke, et al., 2017). However, building a conceptual understanding of mathematics can only happen if CGI strategies are implemented correctly (Carpenter et al., 2000, 2014, 2017; Black, 2015; Guerrero, 2014; Walters, 2018). Ikemoto et al. (2016) argued that it could be harmful if CGI is poorly implemented as an instructional method because it would limit the students' learning abilities. Ikemoto et al. noted that teachers would continue to lack prior experience with a strategy without proper implementation guidance. When teachers do not have essential elements and enough knowledge of a pedagogical method, they have low self-efficacy and confidence, which negatively affects student learning (Black, 2015; Carpenter, Franke, et al., 2017; Gerde et al., 2018; Kim et al., 2017; Iuhasz-Velez, 2018; Miller et al., 2017; Norton, 2019; Pajares, & Schunk, 2001; Sinquefield, 2016; Taşdemir, 2019; Unlu et al., 2017). The success of CGI teaching strategies depends entirely on how confident teachers are when using them in a math classroom.

From 2000 to 2019, researchers have conducted several analyses on curriculum, instruction, assessment, and CGI (e.g., Andrew, 2006; Black, 2015; Carpenter et al., 2000; Moscardini, 2014; Phan, 2017), but little academic analysis has been conducted on teachers' perceptions of using CGI. De la Cruz (2016), Biolatto (2019), Guerrero (2014), Munday (2016), and Sinquefield (2016) anticipated further research on professional development to assist teachers in employing CGI strategies successfully. Over the past decade, researchers have done numerous studies on curriculum, instruction, and assessment, but only little academic work has been done on CGI from teachers' perceptions of using CGI.

In this study, I addressed research gaps in exploring teachers' experiences using CGI or wanting to use CGI. Still, it was uncertain if teachers had enough confidence, resources, and support to do so consistently. I focused on teachers in Grades K-5 tasked with using CGI. It promoted positive social change by providing administrators and staff with information to assist them in making professional development decisions for teachers.

Purpose of the Study

The purpose of this study was to investigate K-5 teachers' self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they perceive necessary to implement CGI strategies successfully. The implementation of CGI may be challenging to accomplish if there is any lack of efficacy, confidence, and resources.

This research contributed to Bandura's (1977, 1986, 1997) social cognitive theory to understand teachers' self-efficacy and confidence in their use of CGI methods, which may positively affect engagement in math classrooms, improve academic progression, and increase conceptual understanding of mathematics. At the time of data collection, researchers have done numerous studies on curriculum, instruction, assessment, and CGI (e.g., Andrew, 2006; Black, 2015; Carpenter et al., 2000; Moscardini, 2014; Sinquefield, 2016; Walters, 2018), but little academic work has been done on teachers' perceptions of using CGI.

With this basic qualitative research, I addressed the research gaps concerning exploring teachers' experiences who implemented CGI approaches with math students but lacked self-efficacy and confidence. Current research indicates the need for additional investigation into the underlying reasons for inconsistencies in teacher confidence (see de la Cruz, 2016; Guerrero, 2014; Iuhasz-Velez, 2018; Moscardini, 2015; Walters, 2018). This paper contributed to the field of professional development for a better understanding of teachers' role in promoting CGI by investigating these issues further and filling the gap in the current literature.

Research Questions

Ravitch and Carl (2015) stated that the most basic qualitative research questions allow researchers to explore participants' inner experiences. Therefore, developing a basic research question should indicate the requirement to understand the lived experience of participants (Corbin & Strauss, 2008; Creswell, 2013; Merriam, 2009). A qualitative research question is a broad probe that guides the examination of the phenomenon shared by participants' personal experiences and my particular interest (Ravitch & Carl, 2017; Rubin & Rubin, 2011). Supported by scholarly literature, the qualitative research question serves as the cursory interrogative allowing me to capture unfiltered interviewee responses. A continual reflection on the research problem, applicable theory, and responses may dictate the research question's adjustment during the research process (Ravitch & Carl, 2017; Rubin & Rubin, 2011). Research questions for this analysis were established from the objective problem statement of the study and attached to the purpose statement, which followed.

RQ1: What are the challenges faced by teachers in using CGI in K-5 classrooms?

RQ2: What support or resource was needed to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms?

Conceptual Framework

Bandura's (1977, 1986,1997) social cognitive theory's idea of self-efficacy was used as the conceptual framework for this study. In his social cognitive theory, Bandura presented self-efficacy and explained how one's specific belief in their inherent ability to succeed within a situation is formed through mastery experiences, vicarious experiences, verbal persuasion, and emotional arousal (Bandura, 1997; Bandura & Walters, 1977). The idea of self-efficacy provides a better understanding of complex issues that are unexplainable regarding society and individual behaviors or to find out how organizations operate (Anderson, 2017; Gerde et al., 2018; Giles et al., 2016; Gulistan et al., 2017; Kim et al., 2017; Kizuka, 2019; Mukherjee, 2017). When the confidence of those tasked with using a strategy in mathematics is low, there is a guarantee that students may adopt the same negative perception (Alattin, 2015; Nurlu, 2015; O'Keeffe et al., 2019). If teachers have confidence in their abilities to implement a new mathematics strategy, students embrace a positive outlook toward them (Bandura & Walters, 1977; Kizuka, 2019; Steven & Gosia, 2019). This explanation is an appropriate framework for the proposed analysis because it shows the power of mastery experiences, vicarious experiences, and verbal persuasion and how it influences teachers' decisions (Bandura & Walters, 1977; Myers et al., 2020; Ravitch & Riggan, 2017). Teachers' self-efficacy specifies teachers' confidence in their teaching competencies to teach their students and promote students' learning and academic achievement to the desired level (Gulistan et al., 2017; Mongillo, 2016; Pajares & Schunk, 2001; Sinquefield, (2016). Teachers' self-efficacy is formed based on four sources: mastery experiences, physiological and emotional states, vicarious experiences (observations of others), and social persuasion (Gulistan et al., 2017; Mongillo, 2016; Pajares & Schunk, 2001; Sinquefield, (2016).

A variety of factors influence a teacher's self-efficacy. Likewise, the opinions shared by an individual about their aptitude rise above their determination. They are even more significant than their ability because they influence the decisions on whether the individual executed the task and at what level of expertise (Gulistan et al., 2017; Kizuka, 2019). One is mastery experiences, which encompasses teachers' actual experiences with a particular teaching strategy or intervention. Continued use with successful outcomes results in mastery (Bandura, 1986). For CGI, mastery experiences are vital because as teachers continue to use these strategies in their classrooms, they get more comfortable with them and eventually become masters of learning how students think to enhance comprehension of difficult mathematics concepts.

Another factor that influences teacher self-efficacy is personal experience (Gulistan et al., 2017; Kizuka, 2019). A teacher who has had a negative experience with CGI strategies can be more reluctant to use them in the mathematics classroom. These experiences determine teachers' perceptions of CGI strategies and influence their beliefs about perceived effectiveness when teaching mathematics and the confidence they may have when implementing them. Vicarious experiences are also impactful because teachers' observations of CGI strategies in other external environments shape their perceptions and attitudes toward them even before they try them out.

The teachers’ physiological and emotional state determines the self-efficacy levels toward CGI strategies in mathematics classrooms. The mathematical achievement of students impacts the physiological state of the teacher (Conowal, 2018; Jacobs et al., 2017; Kizuka, 2019; Phan, 2017; Trust, 2017). The primary goal of every mathematics teacher is to help every student understand mathematical concepts and excel in the subject.

Another essential source that constitutes self-efficacy is vicarious experiences (Gulistan et al., 2017; Kizuka, 2019). An individual can evaluate their ability as a result of observations. However, the information from the external environment is also useful in evaluating the behavior. For example, a teacher may learn from peer observation. Observing another teacher who successfully implements a strategy such as CGI would like to attempt to increase self-efficacy (Bandura & Walters, 1977). Because teachers' self-efficacy in using CGI in mathematics explores what they feel confident in doing and what they believe they are weak in doing, I used Bandura's (1977) theory to ask teachers about their perceptions of how they use CGI strategies. In the foundation of teacher self-efficacy, the information taken from the teachers' experiences is not as useful as the ones obtained from the individual's mastery experiences. However, if a teacher has no experience in the CGI area, they may not be comfortable enough to use CGI in the classroom. Since personal experiences have a positive impact on physiological and emotional states, so without their own experiences, teachers cannot select their support and resources for CGI implications.

Nature of the Study

In this basic qualitative analysis, I explored human behavior and illustrated how people decode their experiences (Corbin & Strauss, 2008; Merriam, 2009; Merriam & Tisdell, 2015). I developed an analysis of self-efficacy and confidence for teachers who are using CGI or want to use CGI but are not confident enough to implement it effectively. This basic qualitative approach was primarily preferred because I explored teachers' perceptions of self-efficacy and confidence in using CGI strategies to teach mathematics and identifying the resources and support they need to implement CGI strategies successfully. According to Erickson (2011), qualitative data consists primarily of peoples' experiences, beliefs, and opinions about social change. Consequently, I analyzed data using basic qualitative methods. I sought to explain why a phenomenon happens and record the magnitude of its effect on the subject. The interview process involved K-5 math teachers who use CGI or want to use CGI in their math instructions. The chosen approach for the interview was a basic qualitative inquiry with a semistructured Zoom interview. A sample size of around 13 participants was considered. I did not invite more than 20 people to this study who met the inclusion criteria. This approach allowed for the precise collection of more data. I analyzed experiences based on teachers' perceptions of CGI strategies and the support or resources they deem necessary.

Most schools in the United States began the school year with virtual learning because of the pandemic (Morgan, 2020). Therefore, the data collection instrument for this study was an individual virtual interview, and the invitation was sent through email. I used Zoom for the virtual interview. This method was an ideal platform that allowed participants of different studies to provide their responses in a convenient, interactive, and easy-to-use interface (Corbin & Strauss, 2008; Patton, 2015; Rubin & Rubin, 2012; Turner & Drake, 2016).

After getting approval from the Walden University Institutional Review Board (IRB), an email was sent to the superintendents of two local public-school districts explaining the research's purpose and asking for permission to collect data. From each school district, I selected three schools. Based on the IRB requirements provided by its

Office of Research and Compliance, the participants' criteria were the following: (a) all participants must be elementary math teachers, and (b) all participants either already used CGI or want to use CGI in their mathematics classroom. After getting IRB approval, an invitation for participation was sent to two local school district superintendents through email. The detailed purpose of the study was explained to them, as the importance of the outcomes, and they sought approval to collect data (see Appendix A). After getting permission from district superintendents, I used the school district's website to identify all prospective participants. An email was sent to the school principals asking them to support a list of teachers who met the requirements. I excluded the schools with which I have an affiliation. This analysis targeted a list of three to five teachers from each school. This target allowed the flexibility to reach data saturation.

This research included permission for an initial and follow-up virtual interview if needed. An interview guide was created to identify the perceptions of K-5 teachers on CGI strategies and the various resources or support they require to implement them in their classrooms. The purpose of the follow-up interviews is to provide participants with the opportunity to clarify their perceptions, verify the accuracy of the information they have provided, and obtain additional information as necessary (Corbin & Strauss, 2008; Merriam, 2009; Patton, 2015). All data were collected through interviews with 13 elementary mathematics teachers from three schools in each district. Notes of the data I collected determined the extent of support and resources teachers require when pursuing the effective adoption and implementation of CGI. In-depth probing virtual interviews are the primary data collection tool for qualitative analysis (Creswell, 2013; Merriam, 2009;

Patton, 2015). The initial and follow-up interview questions were designed so that they could be used to collect data from participants during individual interviews effectively. A panel of experts thoroughly reviewed these questions to ensure success (see Appendix C). Participants were asked to go through the tentative findings of the study through email and comment on their credibility to ensure the precision and accuracy of the research conducted. Initial virtual interviews lasted between 35–45 minutes. The final member review of the tentative findings was completed via email to ensure consistency with the participant's intent. The data analysis concerning the central and related research questions was interpreted in relation to the conceptual framework and the literature review.

For this analysis, the data collection tool was in-depth interviews conducted virtually. Web-based technology and audio recording were used for transcription. All the interview questions were well organized and aligned with the research questions. The interview questions and follow-up (if needed) questions were created to accomplish the depth of understanding necessary for this qualitative research approach (see Ravitch & Carl, 2016). Once the data had been collected from the 13 K-5 math participants, I analyzed them using NVivo computer software. NVivo is a qualitative data analysis software package produced by QSR International (Mortelmans, 2019). This NVivo software helps qualitative researchers to filter, organize, and analyze qualitative or unstructured data, such as data collected from interviews, observations, qualitative questionnaires, and focus groups (Mortelmans, 2019).

Definitions

Cognitively Guided Instruction (CGI): A student-centered approach to teaching math (Serrano Corkin et al., 2019).

Confidence: The feeling or belief that one can rely on someone or something. *Problem solving*: Involves being able to identify and define the problem, generating alternative solutions, evaluating, and selecting the best alternative, and implementing the selected solution.

Natural problem-solving skills: Knowing about a mathematical problem to build an understanding of the related problem-solving concept (Widodo et al., 2019).

Student-centered learning: Student-centered learning Student-centered has been expressed as a method of learning in which learners can choose not only what to study but also how and why that chosen topic might be of interest (Ikemoto et al., 2016).

Self-efficacy: Self-efficacy refers to an individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Tan et al., 2021).

Teacher self-efficacy: Teachers' philosophies in their capability to successfully control the tasks, responsibilities, and challenges associated with their professional movement plays a significant function in influencing important academic results (Luthans et al., 2019).

Assumptions

In this basic qualitative analysis, I explored mathematic teachers' self-efficacy and how the availability of resources and support impacts their perceptions of CGI strategies in the mathematics classroom. This analysis may increase current literature by gaining a deeper understanding of the experiences of teachers' self-efficacy and confidence toward CGI. This study made several assumptions about elementary math teachers using CGI, their beliefs about their ability to use CGI effectively, and their perceptions of the support they receive.

The first assumption was that the selection criteria used to recruit participants were appropriate. Teachers who are familiar with CGI or previously trained in CGI and use the CGI approach in their classrooms with little or no experience using CGI were the intended sample. The second assumption was that those being interviewed were open and honest about their perceptions of the adoption and implementation process, as they were fully assured of the confidentiality of any shared responses (see Merriam, 2009; Merriam & Tisdell, 2015). The complete data analysis emphasized teacher responses; therefore, the truthfulness of this research depended on the participants' honest answers. The third assumption was that teachers could reflect on their experiences as educators to help me answer all research questions using the interview questions. This assumption was significantly important to this research because teacher interviews were the only source of data collection.

Scope and Delimitations

I explored teacher self-efficacy in using CGI strategies in the mathematics classroom. The goal was to identify perceptions about their confidence when implementing CGI strategies. The study also determined what resources or support mathematics teachers required to improve their self-efficacy toward using CGI strategies more consistently in mathematics classrooms. The research population included K-5 mathematics teachers in public schools in the United States who implemented the CGI method to teach mathematics to students. This study sample included 13 teachers from three schools in two districts in southern California. The study was conducted during the 2021–2022 school year.

Transferability indicates the aptitude to simplify the findings to other circumstances (Merriam, 2009; Patton, 2015). According to experts, transferability can be improved by providing a detailed and robust description of experiences during data collection (Creswell & Poth, 2018). Researchers have argued that generalization is irrelevant in qualitative research because qualitative studies aim to describe a unique phenomenon or experience rather than generate broad generalizations (Kizuka, 2019; Seidman, 2006, 2013). The transferability of findings might be limited to school districts and regions like the teachers interviewed.

Another transferability was that the population had a specific background, interests, and experiences. The population studied are elementary mathematics teachers with at least 1-2 years of experience or no experience using CGI strategies in mathematics classrooms. The study's delimitation was that middle and high school teachers were excluded from the sample population.

Limitations

The purpose of this study was to investigate K-5 teachers about their self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they perceive necessary to implement CGI strategies successfully. Limitations identify potential weaknesses of a study that are generally not under my control (Shenton, 2004).

There were undeniable limitations of this study that need to be addressed. First and foremost, this qualitative study solely focused on teachers' views, experiences, and opinions on CGI strategies. No statistical data analysis was conducted, which may undermine the generalizability of the final findings. Secondly, the sample population being studied was extremely limited. Only K-5 mathematics teachers within the local school district were involved in this qualitative study, which means only their experiences were analyzed. This sample size was not large or geographically diverse. The sample size was already small, with a total possible pool of only 30 teachers. Thirteen participants who chose to participate in the interview portions were interviewed. The findings do not represent the collective interests or views of mathematics teachers in the region, state, or country. Moreover, this study was only focused on mathematics teachers, and CGI strategies can be used in all the subjects taught at schools. The fact that this study was only limited to mathematics teachers undermines applicability in other disciplines because of the resources and support required to vary from subject to subject.

The third limitation pertained to various CGI strategies used to teach mathematics. Teachers participating in this study were not all using the same components of CGI or interventions in their classrooms, and the resources available to them varied. The reason was that their perceptions of the level of support or resources required were influenced by the type of CGI strategies or components used in their classrooms. This lack of standardization undoubtedly affected the viability of the findings in the long term.

The fourth limitation was the inability to control honesty in the responses. Participation was voluntary, and there were no financial gains from participating. It was incredibly difficult to ascertain that the information provided by the teachers was accurate, truthful, and representative of their feelings toward CGI strategies in their mathematics classrooms. An assumption was made that all responses provided were honest and truthful, as no guarantee could be provided to confirm this irrefutably.

Significance

This basic qualitative study was significant because it provided information that educational institutions could use to implement effective CGI strategies in mathematics classrooms. For this purpose, I explored how teachers perform CGI with K-5 students and what resources they use to support better implementation of CGI. Understanding teachers' self-efficacy and confidence allowed schools to implement processes to gain more confidence for CGI strategies among their educators, along with essential equipment and support. Baker and Harter (2015) and Conowal (2018) found a need to understand better teachers' role in promoting CGI strategies in math education. The results of my study may empower teachers to implement CGI to advance students conceptual thinking in mathematics regularly.

This study may guide policymakers in pursuing professional development opportunities for teachers that could impact students' mathematics accomplishments (see Crowley, 2015). The findings of this study also supported professional teaching practice. Professional teaching practice made teaching mathematics in the classroom more productive and satisfying for teachers and identified what inspired their self-efficacy toward CGI strategies when teaching mathematics provided valuable pointers for what can be done to improve the teaching experience. Teacher views on what is needed to be done to improve their self-efficacy toward CGI strategies were identified and analyzed. Educational institutions could use this information to implement mechanisms encouraging teacher confidence in CGI mathematics strategies. The teaching practice would be better as schools would know exactly what needed to be done to motivate teachers when using CGI strategies in the classroom. The findings of this study could make learning more accessible and engaging for students while also improving their performance in mathematics. The conclusions could make CGI more comprehensible for teachers and provide positive social change among teachers by empowering them to teach mathematics more enjoyably through CGI.

Summary

This chapter introduced this study, incorporating the background of this analysis with a summary of the literature related to CGI and teachers' self-efficacy and confidence. This chapter also illustrated the problem, purpose, research questions, and the study's conceptual framework. The nature of the study was detailed; the definitions of terms and significance to better understand the context of the plot. The scope, delimitations, limitations, and assumptions of the study were briefly discussed.

Chapter 2 reviews selected literature on CGI and other constructivist approaches to teacher self-efficacy, confidence, resources, and support. Chapter 2 also addresses the literature search strategy and a more detailed analysis of the conceptual framework of self-efficacy. The literature on CGI and self-efficacy and confidence are described in the literature review, and Chapter 2 relates the literature review to the current analysis.

Chapter 2: Literature Review

Teachers with low self-efficacy in math have increased discomfort in the profession, and may affect their students' learning prospects (Conowal, 2018; Giles et al., 2016; Guerrero, 2014; Katz & Stupel, 2016; Walters, 2018). Recent research shows that math is an essential core subject; thus, it requires extensive examination and practical examples that can help the students understand the intended aspects of each concept (Black, 2015; Giles et al., 2016; Katz & Stupel, 2016; Mccullouch, 2016; Norton, 2017; Stoehr, 2017; Unlu et al., 2017). Understanding challenging mathematical concepts and using them to execute computations need revolutionary teaching approaches, such as CGI (Conowal, 2018; Jacobs et al., 2017).

CGI helps teachers understand students' thought processes in mathematics; therefore, teachers can guide students in constructing a strong conceptual understanding, flexible thinking, and arrangement of mathematics (Anantharajan, 2020). Some teachers are uncertain of how to best use CGI strategies in K-5 math classrooms to improve mathematical thinking and may not have enough self-confidence to do so consistently. CGI has proven to be very effective at helping students grasp mathematics concepts as it capitalizes on their problem-solving skills (Conowal, 2018; Diamond et al., 2018; Moscardini, 2014; Noviyanti, 2020). However, this can only happen if CGI strategies are implemented correctly (Black, 2015; Conowal, 2018; Giles et al., 2016; Guerrero, 2014; Jacobs et al., 2017). Researchers have determined that insufficient exploration has been done on teachers’ perceptions of their self-efficacy and confidence while using CGI strategies in mathematical instructions. Conowal (2018), Walters (2018), and Guerrero

(2014) expressed a need to determine what is essential for a math teacher to feel successful when implementing CGI. All the research questions stemmed from the current literature, and a series of interview questions (see Appendix C) related to efforts and implementation of CGI were used to answer the research questions.

The purpose of this basic qualitative analysis was to explore K-5 teachers' perceptions about their self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources they use to support better implementation of CGI. I focused on Bandura’s (1977b) social cognitive theory, which emphasizes four sources of self-efficacy. The data was collected with semistructured virtual interviews with K-5 math teachers who use CGI or want to use CGI.

Chapter 2 contains the literature search strategy and a more detailed analysis of the conceptual framework of self-efficacy. As a part of the conceptual framework, a brief description was presented of four elements of self-efficacy: (a) mastery of teaching experience, (b) vicarious experiences, (c) social persuasion, and (d) physiological and emotional states (see Bandura, 1977b). A review of the current literature on CGI and self-efficacy and confidence were described in this chapter. Chapter 2 relates the literature with the current analysis. I explored the lack of efficacy, resources, and support as some of the challenges experienced when implementing CGI strategies in mathematics.

Literature Search Strategy

Multiple databases were used in the search strategy: Academic Search Complete, Education Research Complete, ERIC, Education Source, and Google Scholar. The search was completed for the years 2016-2021using the following keywords: *Cognitively guided* *instruction (CGI), math education, mathematics teacher self-efficacy and confidence, teacher confidence in math teaching, perceptions of the use of cognitively guided instruction (CGI), mathematic achievement, perceived mathematics self-efficacy, professional development,* and *mathematics resources*. The search terms were combined in several ways to find the most relevant information for the study. Although current peer-reviewed journal articles were targeted, this research also included books, dissertations, and theses. This information was used to support existing data and explain previous research. This qualitative study reached saturation in the current literature on CGI and teacher self-efficacy for early literacy instruction, continued literature searches, scholarly reading, and material synthesis.

Conceptual Framework

With this basic qualitative research, I aimed to understand teachers' self-efficacy and confidence in using CGI methods, which may affect engagement in math classrooms, increase academic development, and raise conceptual understanding of mathematics. I relied on Bandura's (1977, 1986, 1997) social cognitive theory's idea of self-efficacy to accomplish that purpose. Self-efficacy suggests that teachers' physiological states create or strengthen personal efficacy, such as negative attitude, nervousness, concern, and lack of knowledge. The thoughts and perceptions an individual holds about a given issue ultimately determine their conviction about their ability to achieve a particular outcome (Diamond et al., 2018; Huang & Mayer, 2019; Mukherjee, 2017). There are logical connections between this theory's principles and teachers' perceptions regarding using CGI in the mathematics classroom. Bandura explained that increasing an individual's self-efficacy boosts their ability to execute a particular action (Gadge, 2018; Huang & Mayer, 2019; Katz & Stupel, 2016; Mukherjee, 2017; Nurlu, 2015). Teachers need to have self-efficacy because this can increase their enthusiasm toward CGI strategies when teaching mathematics in their classrooms (Gadge, 2018). Otherwise, the motivation may not be there. The success of CGI strategies depends on teachers' attitudes and perceptions. As Bandura (1977) stipulated, self-efficacy creates these positive attitudes and opinions.

Bandura's Social-Cognitive Theory

Self-efficacy originated from Bandura's (1977b) social learning theory, but it later evolved into the social cognitive theory (Bandura, 1986), which explains the processes of human learning and functioning. Bandura's (1977) social cognitive theory is discussed in four primary sources that shape individuals' self-efficacy through mastery experiences, vicarious experiences, social persuasion, and emotional and physiological states. Reflecting on this theory provided the foundation of this analysis and led the way to derive the methods used for this investigation. The following section focused on sources of self-efficacy.

Sources of Self-Efficacy

Self-efficacy is a central hypothesis highlighted in the social cognitive theory (Bandura, 1977, 1986, 1997). This concept is also articulated as self-efficacy perception, belief, or conclusion (Diamond et al., 2018; Huang & Mayer, 2019; Steven & Gosia, 2019). Bandura (1977, 1986, 1994) has expressed self-efficacy as individuals' self-beliefs about the capability to create determined behaviors on the actions that affect their daily lives. According to Bandura (1982, 1989, 1994), the philosophies of the persons, the outcomes of their actions on them, and their activities depend on what they believe rather than the actual situation. Consequently, the person's opinions about their aptitude may be more deterministic than their actual ability and play an essential role in deciding what they performed with the expertise that they possess (Gulistan et al., 2017; Gerde et al., 2018; Kim et al., 2017; Miller, 2017; Mukherjee, 2017; Norton, 2019). Bandura (1997) discussed the necessity of teachers' self-efficacy and how it impacts the confidence needed to accomplish anticipated learning goals.

If teachers believe that their efforts on CGI are successful, then the belief that they would be successful in similar or related tasks in the future increases (de la Cruz, 2016; Diamond et al., 2018; Black, 2015; Guerrero, 2014; Phan, 2017). If teachers fail to create the desired effect in the classroom, the belief that they can be successful in similar situations may decrease. Bandura (1994) defined four primary sources that shape individuals' self-efficacy: mastery experiences, vicarious experiences, social persuasion, and emotional and physiological states.

Mastery Experiences

Mastery experiences are a significant source of efficacy evidence since they are based on real experiences and offer the most authentic proof of whether one can master whatever it takes to succeed (Gardner, 2018; Katz & Stupel, 2016; Norton, 2019; Williams, 2019). Successes in a subject area increase self-efficacy, whereas repeated mistakes decrease them (Bandura, 1982). Mastery experiences become instructive only through the cognitive processing of efficacy information. If teachers believe that their efforts are successful, then the belief that they would succeed in similar or related tasks increases. Mastery experiences are the most important source that predicts an approach, such as CGI, for mathematics achievement (Clarke & Newberry, 2019). The perception that performance has been successful raises self-efficacy and confidence, contributing to the expectation that performance may be proficient in the future. However, not all successful experiences encourage efficacy. The perception that performance has been a failure lowers self-efficacy, contributing to the expectation that future productions can also be inept. The level of either anxiety or excitement adds to the feeling of mastery or incompetence.

Physiological and Emotional States

Physiological states hold positive and negative attitudes such as tension, concern, stress, burnout, and other emotions that affect teachers' self-efficacies to perform a task (Katz & Stupel, 2016; Williams, 2019). Physiological and emotional states impact how people interpret their physical and emotional reactions, and teachers often interpret them as signs of a lack of ability or poor performance (Gulistan et al., 2017; Mukherjee, 2017; Peker & Erol, 2018; Unlu et al., 2017; Williams, 2019). One's mood might motivate one to perform a task successfully or result in total failure. Physiological and emotional states are the most effective self-efficacy sources for mathematics achievement after mastery experiences. Physiological states show a curvilinear relation with mathematics achievement. The self-efficacy of teachers who can manage their emotions is higher than that of teachers who cannot control their emotions. As Bandura (1982) asserted, individuals' efficacy and confidence depend on their area of interest. My study related to mathematics teachers' self-efficacy in both aspects of teachers' self-efficacy and confidence.

Vicarious Experiences

Another critical source of self-efficacy is vicarious experiences. Teachers can evaluate their abilities from observations (Tseng et al., 2022). However, the information from the external environment is also useful in evaluating the behavior. For example, a teacher can learn from peer observation. Observing another teacher who successfully implements a strategy such as CGI would like to attempt to increase self-efficacy (Bandura, 1977; Mukherjee, 2017; Williams, 2019). In the formation of self-efficacy, the information taken from the experiences of others is not as useful as the ones obtained from the individual's own mastery experiences. However, if someone has no experience in the related area, they are deeply affected by others' experiences in self-efficacy (Gardner, 2018; Steven & Gosia, 2019). Others' skills are more effective if the person taken as the model shows similarities with the individual. If there are similarities between the individual and the model regarding demographic characteristics, such as age, education level, and gender, the model's success creates a sense of “I can do.” On the other hand, the model's failure may cause doubts about the capacity of the person's achievement (Peker & Erol, 2018; Mukherjee, 2017; Miller, 2017; Yildiz et al., 2019). If the model is very different from the individual, they cannot be affected very much by the model and its results (Bandura, 1994).

Social Persuasion

According to Bandura (1977), the ultimate source of self-efficacy is social persuasion. Individuals are changed by the reactions of other individuals while developing their self-efficacy. Social belief includes oral reviews of others about specific skills that the individual possesses. A verbal report from outside that they can accomplish or master a task positively affects their self-efficacy.

On the other hand, negative comments weaken the individual's self-efficacy (Gulistan et al., 2017; Steven & Gosia, 2019). Bandura (1994) suggested that weakening individuals' self-efficacy through social persuasion is more accessible than planting high self-efficacy. This fact causes individuals who are persuaded that they do not have sufficient capacity to flee from challenging activities and to give up quickly in the face of difficulties (Bandura, 1994).

CGI and Self-Efficacy

I explored the lack of teacher efficacy, support, and resources as some obstacles or challenges experienced when attempting to implement CGI strategies in the mathematics classroom. Mathematics teachers require support and resources for high confidence in using CGI strategies in their mathematics lessons (Candela & Boston, 2019; Schoen et al., 2017, 2018). Resources play a pivotal role in helping teachers use CGI strategies because they give guidance. When combined with high levels of support, there is a guarantee that the efficacy of mathematics teachers towards CGI strategies in their classrooms increases (Candela & Boston, 2019; Conowal, 2018; Lopez-Agudo, 2017; Walters, 2018). Students reap the benefits of using their natural problem-solving skills to enhance their understanding of mathematical concepts, irrespective of how difficult they seem. Therefore, I aimed to identify teachers' perceptions of CGI and the adoption and implementation of CGI strategies.

Self-efficacy influences the perceptions and attitudes held by teachers towards CGI strategies in the mathematics classroom. Tom (2019) and Berger (2017) identified that the personal beliefs adopted by teachers about their ability to use CGI or the efficacy of using CGI in their mathematics classroom ultimately determine whether they were open to implementing them. Diamond et al. (2018) affirmed the validity of honesty by explaining the main premise of CGI. The purpose of CGI is to create and nurture a belief of positive attitude among the mathematics teacher, enabling them to see the potential of capitalizing on children's cognitive skills to enhance their understanding of mathematical concepts. For this belief to be fostered, self-efficacy is required (Diamond et al., 2018; Francis, 2015; Jacobs et al., 2017; Nolan & Molla, 2017; Sinquefield, 2016). The teacher must have the conviction that they can achieve successful outcomes with CGI in the mathematics classroom to consider implementing the recommended strategies.

Bandura (1977) established two expectations that impact an individual’s decisions and attitudes when confronting changes. The first one is outcome expectancy, an individual's estimate of the certainty of a strategy to achieve a targeted outcome (Lazarides et al., 2018). Teachers' analysis of their potential successes dictates their self-efficacy (Nolan & Molla, 2017; Sinquefield, 2016). Secondly, there is an efficacy expectation. This is an individual's conviction about personal abilities to use a strategy to achieve a targeted outcome (Kavita et al., 2016; Kizuka, 2019; Suntonrapot, 2019). For mathematics teachers, this targeted outcome was their perceived ability to use CGI successfully to help students improve their understanding of tricky mathematical concepts. There is a direct relationship between outcome and efficacy expectations. Teachers must believe in CGI strategies and see their value in helping students improve their performance in mathematics, as this is the targeted outcome (Bobis et al., 2016; Sinquefield, 2016). Teachers must also believe in their abilities to successfully implement CGI strategies because teacher input is key to developing students' problem-solving skills and academic success.

CGI strategies in mathematics help students improve their performance by capitalizing on their understanding of concepts and fundamental problem-solving skills (Black, 2015; de la Cruz, 2016; Diamond et al., 2018; Moscardini, 2015; Sinquefield, 2016). However, as Iuhasz-Velez, (2018) and Berger (2017) established, teachers' beliefs about CGI ultimately determine whether the strategies are successful in the classroom. Conquering this belief cannot be achieved when teachers negatively perceive CGI strategies (Francis, 2015; Guerrero, 2014; Jacobs et al., 2017; Myers & Cannon, 2018; Sinquefield, 2016). In addition, students require inspiration from their teachers when dealing with challenges, and when teacher confidence is absent, motivation can be difficult to obtain. When teachers do not have essential resources and enough knowledge of a pedagogical method, they have low self-efficacy and confidence, negatively affecting student learning (Black, 2015; Moscardini, 2014; Nolan & Molla, 2017). The success of CGI teaching strategies depends entirely on how confident teachers are when using them in a math classroom.

When implementing and using CGI strategies in the mathematics classroom, teachers' confidence is impacted by the availability of resources. Having the resources required encourages using CGI strategies even when experience is lacking. Creating resources needed to implement CGI strategies successfully can be lengthy, complicated, and time consuming (Diamond et al., 2018; Myers & Cannon, 2018). Teachers are often discouraged by the unavailability of these resources when attempting to adopt CGI strategies. Moreover, the absence of printed materials to guide the implementation process or the instruction undermines teacher confidence and enthusiasm toward CGI strategies in the mathematics classroom (Black, 2015; Nielsen et al., 2016; Nolan & Molla, 2017). They need guidance in inspiring students to take the initiative and responsibility of learning mathematical concepts by capitalizing on their natural problem-solving skills. These resources provide this guidance, and whenever they are unavailable, the effectiveness of teachers using CGI strategies often diminishes (Nurlu, 2015; Phan, 2017; Seah, 2018). Even with thorough training, the provision of consultants to guide the implementation process, and other support mechanisms, the availability of resources is still a determining factor for successful outcomes.

Literature Review

This basic qualitative study aimed to investigate K-5 teachers' perceptions of their self-efficacy and confidence in using CGI strategies in the math classroom and what resources or support they feel they need to implement CGI strategies successfully. This section of the study described the research related to teachers' perceptions and confidence about CGI strategies in mathematics, followed by the availability of resources to use those strategies in mathematics and the availability of the necessary support required to implement CGI strategies in mathematics. This part of the study also addresses peer and administrative support, recommendations about using CGI strategies in mathematics, and adopting the CGI framework. In this section's last part, I present the perceptions that influence implementation and the CGI strategies used.

Perceptions and Confidence of Teachers About CGI Strategies in Mathematics

This section focused on teachers' perceptions and confidence when using CGI in mathematics classrooms.

Perception

Perception influences individuals' beliefs, attitudes, and actions (Lazarides et al., 2018; Nolan & Molla, 2017; Norton, 2017). Nurlu (2015) noted that teachers with positive self-efficacy and strong confidence in their instructional strategy are attentive to students' individual needs. Lazarides et al. (2018) further explained that positive teacher perceptions of self-efficacy and confidence help teachers to have greater enthusiasm toward a subject. When teachers have a positive attitude toward a proposed strategy or change, there is more incentive to accomplish a given task (Conowal, 2018; Gadge, 2018; Miller et al., 2017; Nolan & Molla, 2017; Schoen et al., 2017). The pleasure, excitement, and enjoyment derived from the teaching process motivate the teachers to embrace all changes or strategies that may increase teacher's self-efficacy toward the CGI (Diamond et al., 2018; Larkin, 2016; Munday, 2016; Sinquefield, 2016; Walters, 2018). Such essential requirements for educators determine how successful CGI strategies can be in a mathematics classroom (Conowal, 2018; Iuhasz-Velez, 2018; Schoen, LaVenia, Bauduin, et al., 2017). As Munday (2016) concluded, an urgent need exists for teachers to develop self-awareness of their learning, and this placed them in a better position to implement CGI strategies in the mathematics classroom. This awareness is determined by their perceptions of CGI, mathematics, students, and their abilities as teachers.

Confidence

Teachers must exude confidence in their practice to become effective. In their study, O'Keeffe et al. (2019) indicated that teachers' perceived belief directly influences how effectively they deliver culturally responsive pedagogies. This is the case with CGI, as the teacher's confidence guarantees successful outcomes (Larkin, 2016; Mccullouch, 2016; Nolan & Molla, 2017). Lazarides et al., 2018) quote the expectancy-value theory, which states that "the behaviors and beliefs of socializers (for example, teachers and parents) influence the motivation of adolescents. Socializers transmit their beliefs to adolescents through their support of behaviors" (p. 3). As a result, a teacher with low confidence and a negative perception of CGI can transfer the same energy to students, resulting in minimal academic achievement in mathematics (Conowal, 2018; Iuhasz-Velez, 2018; Lazarides et al., 2018). Confidence comes from having prior knowledge about a subject before teaching it to students in the classroom. If this is absent, teachers lack the confidence to move forward with new changes as the fear of the unknown takes over (Furner, 2017; O'Keeffe et al., 2019). Baker and Harter (2015) and Noviyanti (2020) strongly asserted that if teachers do not understand CGI strategies or see their value in helping students improve in mathematics, they may not be confident enough to implement them in their classrooms.

Confidence also impacts teacher knowledge about CGI strategies and how they can be used to boost student performance in the mathematics classroom. O'Keeffe et al. (2019) established that professional development for teachers goes hand-in-hand with their confidence. The more a teacher feels that they understand a particular subject, the more confident they are when teaching it in the classroom (de la Cruz, 2016; Nielsen et al., 2016; O'Keeffe et al., 2019). Confidence emanates from the knowledge of a given subject and the ability to relay it to third parties, such as students. The complexity of CGI strategies presents challenges for teachers, undermining their ability to relay them confidently to students in the classroom. In particular, Diamond et al. (2018) explained that the subjective nature of CGI strategies makes them extremely challenging to implement in a differentiated setting where each student requires an individual approach to be used based on their problem-solving skills. The teacher must possess impeccable skills that can help identify each student's unique strengths and capitalize on them to improve performance in mathematics (Conowal, 2018; Diamond et al., 2018; Jacobs et al., 2017; Norton, 2017**;** Noviyanti, 2020; Stoehr, 2017). The high standard that is required for CGI to impact students learning positively. The daunting task of doing this with absolute success might negatively impact the confidence of even trained and experienced teachers, especially if the necessary resources and support mechanisms are not available (Conowal, 2018; Jacobs et al., 2017; Lazarides et al., 2018).

Availability of Resources to Use CGI Strategies in Mathematics

One of the numerous factors identified by researchers to impact teacher perceptions and confidence in using CGI strategies in their mathematics classrooms is the availability of resources (Walters, 2018). After running a Math As Text (MAT) program that taught CGI strategies, Walters (2018) stated that "teachers, varying in experience level and initial mathematical perspectives, were impacted by their experiences in the program and became more reform-oriented in their teaching strategies and beliefs about teaching" (p. 5). Bailey et al. (2017) viewed lessons about CGI as a valuable resource for teachers to make them more effective at using these strategies in the mathematics classroom. When teachers are taught how to identify students' fundamental problem-solving skills, they can use them to understand better mathematics concepts (Bailey et al., 2017; Walters, 2018). De la Cruz (2016) affirmed this in a study where a teacher participated in a CGI professional development workshop, and her proportional reasoning changed for the positive. She believed in the abilities of CGI strategies after being provided training in a workshop that showed her exactly what she needed to do to understand her students' thinking processes (Bailey et al., 2017; Dixon et al., 2014; Nielsen et al., 2016; Walters, 2018).

Strategies

Resources also come in the form of strategies that the teachers can use in the classroom to facilitate the implementation of CGI strategies. Dixon et al. (2020) explored how the teaching technique that includes planning, preparation, applications, feedback, and re-teach steps impacts teacher candidates' beliefs regarding teaching mathematics in the classroom. These techniques not only improved their self-confidence levels when teaching mathematics in the classroom but also increased their teaching skills (Bilen, 2015; Dixon et al., 2020; Francis, 2015; Norton, 2017). Diamond et al. (2018) also echoed the same sentiments as they established that enhancing the noticing skills of teachers makes them extremely effective at implementing CGI strategies in the mathematics classroom. Noticing is a vital element of CGI because it allows teachers to identify unusual classroom activities or student traits that can be used as teachable moments (Black, 2015; Diamond et al., 2018; LaVenia et al., 2018; Nurul, 2015). When the necessary resources required to teach teachers these crucial strategies and skills are absent, implementing CGI strategies in the mathematics classroom cannot be successful. (Bobis et al., 2016; Diamond et al., 2018).

Teaching Aids

Manipulatives, pattern blocks, tiles, interlocking cubes, and even computers are additional resources that enable successful CGI implementation. In a comparative study by Knapp, Peterson, & Center for the Learning and Teaching of Elementary Subjects (1991) and Secada (2020), a group of teachers was able to describe CGI procedurally by relying on manipulatives successfully. Students' thought processes vary, and CGI's goal is to use their natural problem-solving skills to enhance comprehension of mathematical concepts (Secada, 2020; Turner & Drake, 2016). This process occasionally requires using physical objects, such as manipulatives, to help the student visualize the mathematical problem or concept (Abu Seman & Rosanti, 2019; Call, 2018; Secada, 2020). The same views on resources were also held by a teacher who participated in a study conducted by Abu Seman & Rosanti (2019), where the author explained that she always encourages her students to use concrete materials to explain mathematical ideas during the lesson. This allows teachers to construct the students' cognitive skills by observing how they interact with concrete materials to explain a mathematical concept (Abu Seman & Rosanti, 2019; Call, 2018; Secada, 2020; Turner & Drake, 2016). The absence of these manipulatives due to budgetary constraints can undermine the effectiveness of CGI strategies in the mathematics classroom.

Resources and support structures should be provided to facilitate the smooth usage of CGI strategies in the mathematics classroom (Black, 2015; Diamond et al., 2018; Munday, 2016). Walters (2018) noted that teacher support is necessary to help teachers decipher students' thinking skills in the mathematics classroom and use them to enhance the comprehension of mathematical problems. This is reiterated by Corbell, Osborne, & Reiman (2010), who explained that supporting teachers is vital to maximize their skills and minimize costs associated with hiring new teachers more often due to high employee turnover rates. LaVenia et al. (2018) recommended enhancing teachers' knowledge and skills to enable them to identify their students' mathematical thinking, which refers to aid in implementing CGI strategies. Another recommendation by Amador (2019) is to ensure that schools provide enough financial resources and support to implement CGI strategies in their classrooms successfully. Resources and support include manipulatives, the support of paraprofessionals, access to information, and avenues to collaborate with other teachers or professionals in the field of education to discuss ongoing issues (Amador, 2019; Bottge et al., 2018; Caniglia & Meadows, 2018; Hemmi et al., 2018; Kirsti et al., 2018; Lee et al., 2016; Nielsen et al., 2016; Seah, 2018), such as new strategies to make CGI more effective in the mathematics classroom (Jacobs et al., 2017). These resources make CGI easier, more convenient, and more favorable for teachers than a misunderstood and mysterious burden.

Availability of Support to Implement CGI Strategies in Mathematics

Besides resources, teacher support is another essential component that determines the success of implementing CGI strategies in the mathematics classroom (Candela & Boston, 2019; Cannon et al.,2020). CGI is extraordinarily complex and requires the teacher to possess compound skills that can allow accurate assessments of the student’s cognitive abilities (Black, 2015; Candela & Boston, 2019; Diamond et al., 2018; Munday, 2016; Cannon et al., 2020; Phan, 2017; Sutton, 2018; Turner & Drake, 2016). Support is necessary to ensure that they make the right choices, adopt the correct strategies, and, most importantly, maintain student engagement throughout the process to guarantee improvements in academic achievement (Phan, 2017; Sutton, 2018). Caparas & Boston (2019) conducted research in which 17 out of 20 teachers identified having time to talk regularly and on an extended basis with fellow teachers. They also used the same strategies in their classrooms as the most critical aspect of using CGI. Thus, having a robust support system, even from other teachers, encourages an understanding of how to navigate CGI strategies' complexities (Caparas et al., 2019; Phan, 2017). Phan (2017) also reiterated this by explaining that learning students' mathematical thinking processes can be challenging. The input of other professionals with experience using CGI is vital to help teachers get comfortable using these strategies in their classrooms.

Peer and Administrative Support

Support from fellow teachers comes through peer observation, peer discussion, and sharing strategies from the school (Black, 2015; Candela & Boston, 2019; Munday, 2016; Myers et al., 2020). Teachers require the administration's unconditional support to implement CGI strategies in their mathematics classrooms (Corbell et al., 2010; Fuentes, 2019). CGI does not recommend particular instructional materials for teachers (Black, 2015; Fuentes, 2019; Jacobs et al., 2017; Munday, 2016). Administrative support includes providing all of the necessary resources, such as manipulatives, and access to reading or writing materials required by the teacher in the classroom to teach mathematics (Fuentes, 2019; Munday, 2016; Myers et al., 2020; Rishor, 2018).

According to Black (2016), administrators need to arrange teacher peer learning or peer observation sessions so that teachers can help each other learn how a CGI style works and how approaches are integrated into a classroom setting. Myers et al. (2020) explained that "CGI was not a ready-to-go program with premade sets of problems, activities, and tests, but rather a body of knowledge from research which each teacher had to decide how to use in her particular situation" (p. 24) There is a great deal of reliance on the input of the teacher to make CGI a success. Without the necessary support, positive outcomes cannot be guaranteed. Candela and Boston (2019) explained that teachers could improve their implementation strategies when they have professional development opportunities in teaching difficult subjects such as mathematics and science. Thus, the role of the administration is, in part, to organize for such professional development to take place. Carney et al. 2016, and Iuhasz-Velez, 2018 and Conowal, 2018 recommended professional development as a key determining factor for boosting teachers' confidence and perceptions of CGI strategies in mathematics. They suggested that the teacher education program should provide pedagogical and mathematical training and retraining grounds for all future novice and experienced teachers. This was echoed by Munday, 2016, who insisted that teacher self-efficacy can be improved through the instruction process. Pre-service teachers must be guided in how they can use CGI strategies in their mathematics classroom right from the start.

The commitment to support teachers must also extend to the course, curriculum, and instruction. The importance of redesigning courses to help pre-service teachers improve their confidence and engagement when teaching mathematics in the classroom (Black, 2015; Candela & Boston, 2019; Guerrero, 2014; Larkin, 2016; Munday, 2016; Myers et al., 2020). Teachers given some autonomy by their school to adjust the math courses they teach can increase their confidence in a particular instruction process (Munday, 2016). These ideas can aid in implementing CGI by helping teachers create a customized environment to improve positive outcomes in the lesson (de la Cruz, 2016). Independence curriculum design is also a source of motivation for teachers as they can exercise their freedom in the classroom. Munday (2016) observed that paraprofessionals helped teachers use CGI better because they had additional help in the classroom to strategize the best approaches to use on different students in a mathematics lesson. This is echoed by Inns et al. (2018). They established that for mathematics support programs to implement CGI strategies successfully, teachers should be accorded all of the support they deserve making paraprofessionals available to them when the need arises.

Support for implementing CGI strategies in a mathematics classroom with a diverse student population creates an environment for various practices that resemble student-centered learning (Black, 2015; Candela & Boston, 2019; Guerrero, 2014; Munday, 2016). Candela & Boston (2019) explained that cognitive-based instructional systems could empower at-risk students to continue their education because they tap into their abilities, thought processes, and skills. They allow teachers to adopt different approaches to students based on their cognitive prowess since understanding mathematics is not a universal process. Stoehr (2017) and Munday (2016) stipulated that the level of comprehension varies from student to student. With CGI strategies, teachers can use unique teaching approaches to at-risk students that allow them to experience the subject and school at large (Diamond et al., 2018; Munday, 2016; Myers et al., 2020; Sinquefield, 2016). O'Keeffe et al. (2019) reiterated compliant support by emphasizing the importance of developing culturally responsive pedagogies. This consideration requires the help of the administration, students, parents, and other stakeholders to create an inclusive cognitive-based curriculum that caters to the individual needs of all students, especially those that are culturally marginalized and economically disadvantaged (Carney et al., 2016; Kirsti et al., 2018; Lazarides et al., 2018; Turner, & Drake, 2016). When the burden of creating such a cognitive-based curriculum falls on the teacher alone, the chances of success are extremely low, and student academic achievement can be minimal.

Recommendations About Using CGI Strategies in Mathematics

Scholars and researchers have provided several recommendations in their studies to help teachers improve their perceptions and confidence when using CGI strategies in their mathematics classrooms (Baker & Harter, 2015; Black, 2015; Diamond et al., 2018; Moscardini, 2014; Myers et al., 2020; Sinquefield, 2016). As Sinquefield (2016) stipulated, confidence helps teachers discover the value of CGI in assisting students in improving their mathematical skills by using their natural problem-solving abilities. CGI also helps develop inclusive pedagogies for the modern-day multicultural environment. Some elementary teachers have expressed frustration with the lack of clear guidance on implementing CGI strategies (Diamond et al., 2018; Myers et al., 2020; Sinquefield, 2016). Some teachers believe more in traditional instructional strategies and therefore find it challenging to adopt an exercise focused on CGI strategies. Therefore, putting in place mechanisms that provide teachers with professional development for teachers is an essential element of implementing CGI strategies in the classroom.

According to Black (2017), resources and support structures should be provided to facilitate the smooth usage of CGI strategies in the mathematics classroom. Rishor (2018) and Walters (2018) noted that teacher support is necessary to help teachers decipher students' thinking skills in the mathematics classroom and use them to enhance comprehension of mathematical problems. Walters (2018) explains that supporting teachers is crucial to get the best out of their services and to minimize costs associated with hiring new teachers more often due to high employee turnover rates. Iuhasz-Velez, (2018) and Munday (2016) recommended enhancing teachers' knowledge and skills to enable them to identify their students' mathematical thinking. Another recommendation Guerrero (2014) recommended was ensuring that the school provides enough financial resources and support to implement CGI strategies in their classrooms successfully (Berger, 2017; Walters, 2018). These include manipulatives, the support of paraprofessionals, access to information, and avenues to collaborate with other teachers or professionals in the field of education to discuss ongoing issues, such as new strategies to make CGI more effective in the mathematics classroom (Iuhasz-Velez, 2018; Unlu et al., 2017). All of these resources make the process of using CGI easier, more convenient, and more favorable for teachers rather than a misunderstood and mysterious burden.

Adopting the CGI Framework

Researchers and scholars continue to recommend adopting CGI strategies in the mathematics classroom, irrespective of the challenges teachers experience when implementing and using them (Baker & Harter, 2015; Black, 2015; Rishor, 2018; Sutton, 2018; Walters, 2018;). Rishor (2018) regarded CGI as a useful framework that can enhance students' understanding of mathematical concepts if implemented correctly by teachers. He conducted a qualitative pre-and post-intervention study that assessed how well teachers understood students' mathematical thinking after using CGI. Twenty-one primary teachers participated in the study (Rishor, 2018; Sutton, 2018). Their knowledge about CGI was tested before they underwent a professional development session. This equipped them with the necessary skills to implement CGI successfully. In the end, their understanding of their student's mathematical thinking was assessed. It was established that increasing awareness about their understanding of students' mathematical thinking allowed them to implement CGI better. The study was valid because it examined the literature, and its extensive nature is a major strong point. However, the qualitative study relied on subjective data presented by the participants, which can be a weakness. Nevertheless, the findings support using CGI in the classroom, as better-prepared teachers are more likely to experience success with these strategies.

Like mathematics, physics is another complicated subject that students struggle with. Assessing whether CGI strategies can successfully enhance student comprehension in this subject is an excellent indicator of their potential benefits in mathematics. Hofer et al. (2018) conducted a quasi-experimental study whose primary goal was to establish whether students who were taught using Cognitively Activating (CogAct) instruction understood Newtonian mechanics better than the rest who learned through regular instruction. The participants were eight 10th Grade physics classes (172 students in total) and an additional four teachers who came from Gymnasium schools (Hofer et al., 2018). In the end, the study established that students performed better under CogAct instruction, and their comprehension levels of Newtonian mechanics were higher than those taught using regular instruction. The same teachers were used for both tests to promote consistency. These findings were valid because of the assessments' accuracy and the study's extent (Hofer et al., 2018). No notable weaknesses were identified. The results affirmed that CGI strategies are more effective at promoting student comprehension of difficult concepts, whether in physics or mathematics classrooms.

Perceptions Influence Implementation

In most cases, the perceptions held by teachers and administrators about CGI strategies influence how they are implemented in any classroom environment (Diamond et al., 2018; Guerrero, 2014; Rishor, 2018; Sinquefield, 2016). Iuhasz-Velez (2018) conducted an exploratory case study analysis that aimed to establish the perspectives of teachers and administrators on CGI in the mathematics classroom across three elementary school sites. The goal was to assess, observe, and analyze how these schools were progressing with their initiatives of implementing CGI. Factors such as the definition of CGI, preparations for adopting CGI in the mathematics classroom, professional development provided to teachers to use CGI, and many more were analyzed (de la Cruz, 2016; Diamond et al., 2018; Iuhasz-Velez, 2018). The findings indicated a positive perception of CGI and its ability to improve performance in mathematics. However, this perception was based on the support that the schools received from the school district to aid in the implementation of CGI. Training opportunities boosted positive attitudes analyzed (de la Cruz, 2016; Diamond et al., 2018). The main weakness of this study is its reliance on subjective data. Interviews with teachers and administrators served as the primary source of data. Personal beliefs can bias these. However, the study proved that support and resources increase positive perceptions of teachers and administrators on CGI.

CGI Strategies Used in Implementation

The actual strategies adopted by teachers when implementing CGI matter a lot because they determine whether there can be positive or negative outcomes. They also affect how teachers plan their mathematics lessons. Fuentes (2019) conducted multiple qualitative case studies to establish how the implementation of the critical elements of CGI impacted the mathematics lesson plans. He also assessed how these elements were integrated into the instructional practices used by teachers in their classrooms. The sample population was comprised of five third-grade teachers. Notes, semistructured virtual interviews, and document analysis were used to gather data. The conclusions drawn indicated that it was more tedious for teachers to plan for CGI mathematics lessons than traditional approaches (Fuentes, 2019; Noviyanti, 2020). Customizing CGI to address students' needs required meticulous planning to execute successfully. The study also found that teachers used conceptualizing, articulating, questioning, and scaffolding as the primary strategies to plan their CGI lessons (Fuentes, 2019; Noviyanti, 2020). A combination of multiple strategies was also used sometimes. The main strength of this study is the specific details that it provides. However, it is weakened by its small sample size as these five teachers' views do not represent the entire profession.

Knowledge about CGI is vital as it shapes teachers' perceptions about its implementation in the mathematics classroom. When teachers thoroughly understand CGI strategies, they are more confident and better equipped with all the necessary skills to use them successfully. Caparas and Taylor 2019 and de la Cruz (2016) discussed CGI as one of the approaches that can be applied to enhance professional development for teachers allowing them to be more effective at teaching mathematics. The article's primary goal is to provide information about CGI and outline its benefits over the traditional approach. It also provides tips on how CGI can be implemented. There are no sample populations, participants, or results, as no study has been conducted. This article tells the reader about CGI strategies, how they can be implemented, and their benefits on students' mathematics performance (Caparas & Taylor, 2019). Unfortunately, this reduces validity as no sound study or data supports the author's claims. It is a significant weakness. However, as an informational article, it does an exemplary job of providing valuable information about CGI to educators and administrators.

Understanding mathematical concepts helped students perform better in other subjects, such as science. Robinson (2017) provided an informational article that showcases the importance of developing math confidence in the science classroom. This was important because science involves much mathematics. Science students get frustrated when they fail because of their limited mathematics skills and do not fail to understand scientific concepts. The article provided invaluable tips teachers can use to build math confidence among science students. One of them showcases the relationship between math and science at the beginning of the first school day. Students must understand that science success can only be achieved if they know mathematics (Robinson, 2017). Another strategy was to show the similarities between these two subjects to eradicate the notion that one is more complicated than the other. Integrating concepts from these subjects also helps students understand how interrelated they are (Robinson, 2017). All of these activities aimed to improve science students to gain a positive mindset and perception of mathematics. They are more willing to learn mathematical concepts when this positive attitude exists. The main weakness of this article is that it is expository, and no detailed study is provided to back up the author's claims.

The main takeaway from this examination of the research studies is that CGI strategies are incredibly effective at helping students understand mathematical concepts. All of the reviews analyzed attest to this (Fuentes, 2019; Secada, 2020). They support the use of CGI in the mathematics classroom. However, challenges associated with a lack of support and resources affect teachers' and administrators' perceptions when implementing CGI strategies (Fuentes, 2019; Secada, 2020). This information can be important in the dissertation as it may provide basic qualitative data. The information can be paired with more data from peer-reviewed journal articles and scholarly literature studies.

Additional assessments can be held on local and state school data to establish the gap in implementing CGI strategies and their root cause (Fuentes, 2019; Secada, 2020). Data collection can also be done through virtual interviews, and ten to fifteen elementary mathematics teachers from different school districts can be interviewed. Combining these data sets may guarantee findings that showcase how teacher perceptions of CGI strategies affect their implementation in the mathematics classroom and what can be done to improve them.

Gaps Related to the Current Study

This study addressed the research gaps in exploring teachers' experiences who use CGI or want to use CGI. Still, it was uncertain if they had enough confidence, resources, and support to do so consistently. In recent studies, teaching and learning gaps have been discovered concerning the experiences of teachers who implement CGI approaches with math students but lack self-efficacy and confidence. Fuentes (2019) and Noviyanti (2020) urged a need for research and exploration into the underlying reason for teachers' discomfort in using CGI in K-5 classrooms and identifying the support or resources teachers need to improve their efficacy in their use of CGI strategies in math classrooms, specifically at the K-5 level which is a crucial self-efficacy developmental period for adolescents. Existing research specifies the requirement for further investigation into the fundamental reasons for teacher confidence. Another gap in current research exists regarding teachers and their beliefs about the level of expertise when given math instruction through CGI (Gulistan et al., 2017; Kizuka, 2019).

Summary and Conclusions

Chapter two explored a review of selected literature on CGI and other constructivist approaches to teacher self-efficacy, confidence, resources, and support. The conceptual framework was presented, and Bandura’s (1977b) social cognitive theory emphasizes four sources of self-efficacy: (a) mastery of teaching experience, (b) vicarious experiences, (c) social persuasion, and (d) physiological and emotional states (1977b). Next, it addressed the literature search strategy and a more detailed analysis of the conceptual framework of self-efficacy. The current literature on CGI and self-efficacy and confidence has been described in the literature review. Chapter two has also reconnoitered the literature review to the current analysis and explored the lack of efficacy, resources, and support as some of the challenges experienced when implementing CGI strategies in mathematics. The literature review addressed the research as it relates to the perceptions and confidence of teachers about CGI strategies in mathematics, availability of resources to use CGI strategies in mathematics, availability of support to implement CGI strategies in mathematics, recommendations about using CGI strategies in mathematics, perceptions influence implementation, CGI strategies used in the implementation.

Chapter 3: Methodology

The purpose of this study was to investigate K-5 teachers about their self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they perceive necessary to implement CGI strategies successfully. Grounded on Bandura's (1977b) social cognitive theory, I examined four sources of self-efficacy. Self-efficacy and confidence in using CGI methods during math instructions, which may positively affect classroom engagement, improve academic progression, and increase conceptual understanding of mathematics, were described. Teaching mathematics can be daunting. It is a challenging subject, and many students often experience problems understanding some of the concepts taught in the classroom (Ashraf, 2021). It is the teacher's responsibility to ensure that the teaching strategies to teach this subject to enhance all students' comprehension levels, especially those that struggle in certain areas (Alqurshi, 2020).

In Chapter 3, I discussed the research design, the rationale behind the design, and my roles. I also explained the methodology, participant selection instrumentation, and interview protocols. The recruitment, participation, and data analysis procedures were addressed, and the ethical procedures and any trustworthiness issues to warrant further study analysis were also discussed. I summarized the main points to ease the transition into the next chapter.

Research Design and Rationale

The following overarching research questions guided the study.

RQ1: What are the challenges faced by teachers in using CGI in K-5 classrooms?

RQ2: What support or resources do teachers need to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms?

The research problem I investigated was that elementary teachers are tasked to use CGI strategies in mathematics classrooms. Over the past decade, only little academic work has been done on CGI from teachers' perceptions of using CGI, and it was unknown if elementary teachers have enough confidence, resources, and support to do so with consistency (Andrew, 2006; Black, 2015; Black & Harter, 2015; Seah, 2018). A basic qualitative research methodology was appropriate for researching this problem. The primary goal of the basic qualitative analysis was to assess the perceptions and attitudes of K-5 teachers regarding their confidence when using CGI strategies in their mathematics classrooms. A study was conducted where participants shared their experiences on the resources and support required to increase their enthusiasm towards CGI strategies, encouraging more consistent use in their mathematics classrooms. A quantitative research methodology was inappropriate for this study because I did not seek to test hypotheses about the relationships or differences among variables. In a quantitative study, a researcher expects to test theories by examining the relationship among variables (Hong et al., 2017).

I employed a basic qualitative design for several reasons. The goal of basic qualitative is to develop an understanding or belief of a particular person, or group that has experienced the phenomenon, to understand better and deduce that experience or phenomenon (Corbin & Strauss, 2008; Merriam, 2009; Merriam, & Tisdell, 2015). It serves to understand a person's beliefs, attitudes, or ideas to investigate actual experiences rather than provide a causal explanation of those experiences (Francis, 2015; Corbin & Strauss, 2008; Williams, 2019). On the other hand, Patton (2002; 2015) stressed that the importance of a basic qualitative research design is its ability to uncover participants' experiences and the meaning attributed to those experiences. Therefore, basic qualitative research does not break down the experience studied from the social phenomenon. Instead, it provides significant descriptions and interpretations that accurately describe what it means to be a person in their world. The basic qualitative researcher was committed to understanding the real-life experience of the phenomena before dissecting parts of that experience (Sawatsky et al., 2020).

In this basic qualitative analysis of human behavior, I analyzed self-efficacy and confidence in teachers using CGI but not in its implementation. In particular, I chose a basic qualitative approach to explore teachers' perceptions of self-efficacy and confidence in using CGI strategies to teach mathematics and identify the resources and support they need to implement CGI strategies successfully. According to Patton (2015), qualitative data consists mainly of peoples' experiences regarding social change, and therefore, this study analyzed data using basic qualitative methods. My chosen research approach was a basic qualitative inquiry with semistructured interviews (see Corbin, & Strauss, 2008; Merriam, 2002; Patton, 2015; Rubin & Rubin, 2012).

Other research designs were not appropriate for this study. Alternative qualitative research designs included grounded theory and narrative research (Merriam, 2009; Patton, 2015), but I determined that these designs would not fit this research. Ethnography deals with cultural groups or violence (Merriam, 2009; Patton, 2015), and cultural and social constructivism provide the model for data analysis. However, I discarded the ethnographic design for this analysis because elementary mathematics teachers are not a cultural group. Grounded theory was a more suitable choice for this investigation, but grounded theory aims to develop a theory rooted in analyzing the data collected systematically from participant input (see Merriam, 2009; Patton, 2015). I aimed to understand teachers' living experiences, beliefs, and opinions rather than develop a theory, so grounded theory was unsuitable for this study.

A basic qualitative research approach was chosen to guide this research because it helped me focus on a single process experienced by one category of participants at one institution in a specific location with a particular focus on a unique function in which the institution currently participates. Compared to the basic qualitative approach, a case study was not appropriate for this study because in a case study, I expected to record details about the context surrounding the case or cases of focus, including information about the physical environment and any historical, economic, and social factors that have a bearing on the situation (Creswell, 2013; Merriam, 2009).

On the other hand, a qualitative research question is a broad probe that guides the examination of the phenomenon shared by participants’ personal experiences and is of particular interest to me. This basic qualitative research was conducted to answer the research questions, and all interview questions were aligned with the two research questions of the study. The participants were free to provide accurate responses based on their experiences rather than select from limited options. This means that all the collected data were relevant to the research questions.

Role of the Researcher

The focus of this study was to explore and explain the experiences through how teachers perceive CGI strategies. The interviews were the only source of data collection instruments for this research. I was the sole and active participant in this study and collected all participants' data to understand their experiences regarding implementing CGI in the math classroom. I was the data collection instrument and had my own biases and perspectives. As most schools in California began the new school year with virtual learning because of a pandemic, I conducted interviews virtually. The targeted sample population was K-5 mathematics teachers in schools in two local districts.

To avoid all possible conflicts of interest, I eliminated the teachers with whom I have an affiliation. All participants in this basic qualitative analysis were selected very carefully because they have a similar background and are well acquainted with the topic (see Corbin & Strauss, 2008; Merriam, 2009; Patton, 2015). Once the selection of participants was completed, I reviewed the findings to establish authenticity and accuracy, and an audit trail was always kept.

A qualitative researcher must bear ethical responsibilities (Merriam, 2009; Patton, 2015). I adopted guidelines concerning research ethics and informed the participants of the possible risks and consequences of participating in the study, the extent to which the results are confidential, and their right to withdraw from the study at any point. I did not have personally identifiable information about the participants other than the relevant demographic data, such as gender, age, and educational level. Collaboration with the participating schools was needed to encourage participation in the study. However, no coercion was used that required teachers to provide data, which would be unethical. Participation was voluntary, and the collaboration was solely used to spread information about the study to teachers.

Participant Selection Logic

This basic qualitative research was conducted to answer the research questions. This basic qualitative approach was primarily preferred because I explored teachers' perceptions of self-efficacy and confidence in using CGI strategies to teach mathematics and identified the resources and support they need to implement CGI strategies successfully. I sought to find the ideal number of participants through purposive sampling to help generalize the findings. To add credibility, purposive sampling played an important role. A qualitative approach is concerned with understanding behavior from participants' views, while quantitative research is concerned with discovering facts about a social concern (Charmaz, 2004; Creswell & Poth, 2018). A qualitative approach allowed greater flexibility to explore participants' experiences and perspectives regarding retention support services and a greater depth of inquiry with fewer participants (Charmaz, 2004; Creswell & Poth, 2018). In contrast, the quantitative approach allowed me to gather data through statistical analyses using more extensive samples of participants (Charmaz, 2004; Creswell & Poth, 2018).

Participants were from the southern part of California. I chose California as the research area because California adopted CGI standards in both English Language Arts and Mathematics in 1997 to help teachers understand the conceptual thought processes of students learning requirements (see Andrew, 2006; Baker & Harter, 2015; Black, 2015;

Carpenter et al., 2014, 2017; Diamond et al., 2018; Myers et al., 2020; Rishor, 2018; Sinquefield, 2016; Zee et al., 2018). I made a list of school districts that were adopting CGI and selected two school districts; from each school district, I selected three schools. After selecting possible participants' schools that met the requirement, I emailed the school districts. To achieve maximum variety, I aimed to recruit teachers from two different school districts. As a result, an invitation for participation was sent to two local school district superintendents through email after getting IRB approval. I explained the purpose of the study and the importance of the outcomes and sought approval to collect data (see Appendix A). After getting approval from district superintendents, I collaborated with school principals to request permission and teacher emails from school administrators. The purpose of asking the school administration for the teachers' email addresses was because those email addresses might not have been on the school's website. Therefore, emails were requested when asking for permission to conduct the study from the school administration, and the administrator approved the request for the study by sending the email addresses of the teachers. For confidentiality, I used an initial code through school districts or the school's name to identify all prospective participants. I maintained the main list of the names of the participants and the initial matching code separate from other research records.

The inclusion criteria for the sample included K-5 mathematics teachers who (a) have over two years of teaching experience and (b) have implemented CGI in teaching or are planning to implement CGI in teaching. I developed these inclusion criteria because I wanted to collect the opinions and experiences of the teachers who use CGI and if they have self-efficacy, confidence, resources, and support.

The sampling technique for the selection was purposive sampling. The purposive sampling technique is a nonrandom technique that does not need underlying theories or a set number of participants; instead, I elected whatever requirements to be known and set out to locate people who can and are eager to provide the information by virtue of their knowledge or experience (Etikan et al., 2016). The purposive sampling technique is typically used in qualitative research to identify and select the information-rich cases for the most proper use of available resources, which involves identifying and selecting individuals or groups of individuals that are proficient and well-informed with a phenomenon of interest (Etikan et al., 2016). I used purposive sampling through email supplied by the school administration. Once the targeted sample of teachers met the inclusion criteria and was selected, I confirmed their interests before finalizing the list.

A sample size of 10 to 15 participants can be ideal (Creswell, 2013; Patton, 2015). Therefore, I sought a total of 10-15 participants. Creswell and Poth (2018) noted that approximately 12-15 interviews should be planned to ensure data saturation. This number of participants revealed enough data for this study. This number of participants was adequate and handled by me. However, to maintain confidentiality, the study included 13 participants. This number of participants was large enough to achieve data saturation. Merriam (2009) stated that saturation could be reached when participants provide all the required information. Merriam also indicated that saturation is not easy to obtain in complex settings. Data saturation was obtained by asking the participants the same questions and examining if any clarification was required. All participants were interviewed at least once; I arranged a follow-up interview when needed. Saturation was achieved when no new data or themes emerged. Interviews were the primary source of data collection and focused on the adoption and implementation of CGI in each school.

Instrumentation

This study's primary data collection instrument was virtual classroom teacher interviews. I considered in-depth interviews and follow-up interview (if needed) methods as the most appropriate data collection instrument for a basic qualitative approach (see Patton, 2015). According to Patton (2015), interviewing is an art form that requires practice and fidelity. Characteristics of a good interview include probing, depth, open-ended questions, and, most importantly, relationship building (Rubin & Rubin, 2012). The choice of interviewing as the data collection method was based on the purpose of the research (Ravitch & Carl, 2016; Rubin & Rubin, 2012). I was responsible for administering the interview to identify the participating K-5 teachers' experiences when it came to using CGI strategies in mathematics classrooms. All interview questions were grounded in Bandura's (1977, 1986) social cognitive theory. I relied on the central research questions to develop the interview questions. Interview questions were used to stimulate participant responses so they could disclose their classroom experience, professional development, and other factors that add to their self-efficacy and confidence during CGI implementation.

Stake (1995) outlined several steps that should be taken to guarantee a good interview. All steps were considered and implemented during the interview. First and foremost, I provided the participant with issue-oriented interview questions. Secondly, I anticipated probes and additional questions ready to gather more information from the participants along the way. Thirdly, I field tested the questions. Fourthly, I took notes of all the interview points and maintained control of the data-collecting process. The fifth step was to ask for clarification whenever necessary, with the main subject in mind. Finally, I created a transcript of the main ideas assembled during the interview on the same day. During this process, I ensured that key concepts were included in either the main interview questions or the corresponding follow-up probing questions (see Patton, 2009; 2015). As an investigator, I arranged for an appropriate recording device, transcription service, appointment times, note-taking materials, and practice time. All the interview sessions were recorded, and I took relevant notes on each question. According to Ravitch and Carl (2016), qualitative interviews help reconstruct events I have never experienced. Not only would this help to structure questions around a candidate's experience, but it would also show them that I am genuinely interested in what they have to say.

Researcher-Developed Instrument

After securing the institutional approval in accordance with the requirement of the IRB, I informed the participants of the possible risks and potential consequences of participating in the study, the extent to which the results are confidential, and their right to withdraw from the study at any point, which I addressed through an informed consent form. Each interviewee required a signature to signify that they agreed to participate and understand how the research would be used. The participants' data, including contact information, were secured in an encrypted file on my computer hard drive for a minimum of 3 years and then destroyed. Although, I do not anticipate any ethical issues in the study.

I developed a consent form and emailed it to the participant before the interview. After the possible participants replied to the email with an endorsement of their interest in participating in the study, the consent form was emailed to them. Electronic consent was achieved with the participant responding to the email with “I consent.” Before the interview, I assembled a consent form, and participants entered personally identifiable information. Each interviewee required a signature to indicate that they agreed to participate and understand how the research was used. The consent form indicated how I was known to the potential participants. I informed the participants that there were no possible risks and potential consequences of participating in the study and their right to withdraw from the study at any point, which was addressed through a consent form.

The interview guide for this study was designed based on what Merriam and Tisdell (2015), Castillo-Montoya (2016), and Jacob and Fergerson (2012) presented in relation to conducting effective interviews for qualitative research. According to Merriam and Tisdell (2015), the interview guide comprises a list of questions the I wanted to ask during the interview. An interview guide helped to establish the sufficiency of data collection to answer this study’s research questions because the focus is on ensuring CGI strategies’ effectiveness.

I designed an interview guide for this study as a single data collection instrument. Jacob and Fergerson (2012) stated that a successful interview guide should have research-centered questions, an interview script with open-ended questions, and prompts and probes that allow for a deeper focus on the research questions. In addition, Jacob and Fergerson (2012) recommended that a researcher practices with a friend before engaging in the actual interview with the participants. In this analysis, I used eight principles and followed the procedures according to Turner and Daniel (2016) : (a) choose a setting with little distraction; (b) explain the purpose of the interview; (c) address terms of confidentiality; (d) explain the format of the interview; (e) indicate how long the interview usually takes; (f) tell them how to get in touch with you later if they want to; (g) ask them if they have any questions before you both get started with the interview; and (h) do not count on your memory to recall their answers".

I created an interview guide following guidelines from Patton (2015) and Rubin and Rubin (2012). The individual interviews are completed in a responsive interviewing style. I contacted those who expressed interest via email or telephone to set up an interview. Participants scheduled an interview ahead of time and provided an opportunity for extended conversation between the interviewee and me. Also, the interview was subject to staying on track and not delving into personal issues and opinions. The body language, tone, and mood of the participants and the observer create a subjectivity that could be categorized as a weakness. The interviewee was encouraged to answer questions extensively and in detail. This appeared to take place individually, which would take longer to gather the data for research.

The interview questions were based on the basic phenomenon of interest and qualitative research methodology (Patton, 2015). I developed three interview questions to facilitate addressing RQ1 and four interview questions for RQ2. The interview questions pertaining to the selected teachers' experiences and perceptions of using CGI strategies, how confident they feel about implementing CGI strategies, what resources and support they need for CGI instructions, and what can facilitate them to enhance their self-efficacy further in implementing CGI.

I reviewed the literature according to the phenomena of interest. Acknowledged all crucial points for developing questions on CGI. Another fundamental focus of interview questions could be related to the conceptual framework, such as human behavior, self-efficacy, personal experiences, beliefs, confidence and resources, and support. According to Ravitch and Carl (2016), qualitative interviewing helps me analyze and understand events I have never experienced. This approach helped structure questions around a participant's experience and showed that they were genuinely interested in what they had to say. During these interviews, participants were allowed to analyze, reflect, and respond to various questions about their perceptions of CGI's adoption and implementation process in math classrooms. The primary aim of the analysis was established, and how the results benefited the schools. The results could provide insight for schools on how to support mathematics teachers in ensuring CGI strategies' effectiveness. Participants volunteered to be in the research.

I planned an in-person interview, but because of COVID-19, I did virtual interviews with all the K-5 teachers who agreed to participate in the study. I then emailed the teachers to thank them for their willingness to be part of the study and let them know that I scheduled an interview time based on their availability. The interview was conducted before or after the classes, and the teacher selected an ideal time to attend the interview. I scheduled a 45-minute time slot within which to conduct the interview. As soon as I had 13 consenting participants, I changed the letter of consent link to a page that reads, “Thank you for your interest. However, I currently have all the participants I need for this study. Thank you for your time”. I emailed the participants a reminder 24 hours before the scheduled interview to remind them of the date and time, with the link to the Zoom room and the interview questions, should they want to look at them before the interview. At the time of the interview, I collected data from each participant using semistructured interviews via one 30-45-minute Zoom virtual conference. I conducted all interviews via Zoom using audio recording.

Participants received a link to this virtual meeting in their outlook calendar. I anticipated completing interviews during a single trimester, but if there were a limited number of participants, I would lengthen the data collection period to 2 trimesters. Suppose I did not get enough responses to the initial emails to teachers. In that case, I used snowball sampling and asked the participants to forward the emails to colleagues they thought might be interested in participating in the study. Debriefing procedures were implemented as participants exited the study. Participants were asked if they had any additional comments or questions before the conclusion of the interview. Once the interviews were completed, I exported the audio file and transcribed the data using Kaltura software to create a Word document with the text of the interview. After the interview, participants reviewed the transcripts as part of the member checking and trustworthiness protocol.

The research used open-ended questions in a semistructured interview. The semistructured interview design was adopted because it allowed me to present questions in an open-ended fashion (Ravitch & Carl, 2016). All questions were aligned with the two research questions of the study. The participants were free to provide accurate responses based on their experiences rather than select from limited options. The open-ended questions allowed them to explain their responses further and provided even more information beyond what they were asked. In this case, I was stringent in finding out the experiences of the participating K-5 teachers with CGI strategies in their mathematics classrooms and their self-efficacy and confidence levels when using this teaching approach. With open-ended questions, it was easy for the participants to explain their unique experiences without any restrictions whatsoever. In addition, I requested participants to define what level of support or resources they are required to aid in implementing CGI strategies in their mathematics classroom. The openness allowed for genuine responses to be provided without any prompts.

The central premise of all the interview questions presented to the participating K-5 mathematics teachers was to identify their experience with CGI strategies when teaching this subject. The goal was to identify responses that touch on these teachers' interest and passion for using CGI strategies in their mathematics classroom, the process used to adopt and implement them, and background information they had about CGI before adoption. Also, their overall experiences with this teaching approach, especially regarding their students' performances. This approach provided a thorough overview of how CGI has either benefited them or caused more misery in the teaching process than anticipated. All these questions allowed them to outline some of the barriers they feel are necessary to understand and overcome for a CGI program to implement successfully.

There were some follow-up questions that participants must answer to participate in the study. A few adjustments were made to the questions based on the expert review. They were ready to be administered to the participants of the study. So, the participating K-5 teachers could not misunderstand the questions and offer differing responses. All the interview sessions were audio recorded, and I took relevant notes on each question. These field notes contained the initial code through school districts or the school's name as identification of the participants. I maintained the main list of the names of the participants and the initial matching code separate from other research records. The note-taking process began by recording the most critical responses provided by the participant. The non-verbal cues exhibited by the participant were also recorded. Once the interview concluded, the audio recordings of each interview were transcribed. All this was done on the same day as the interview to keep my memory fresh. The participants were requested to go through the transcriptions and the notes to ascertain that they reflected their responses accurately.

I maintained privacy for the participants and that data collection needs to be random sampling. I took additional precautions to ensure that no breach of confidentiality could cause harm or pinpoint the participants. How the data was analyzed and who had access to the data were essential factors in respecting shared experiences and maintaining privacy. The presentation of the data in the final study and publication is also essential. Overall, from beginning to end, I must be conscientious of every piece of data, every word of the interview or other data collection method, and the handling of each piece of information that goes into the study and the results and publication of the information. Without being considerate and accountable, I placed the entire study and the participants at risk, resulting in dire consequences for the research and those who have informed the research.

Procedures for Recruitment, Participation, and Data Collection

The procedures, recruitment, and data collection interval were in the 2020-2021 school year. This analysis took place in two public school districts in southern California. As mentioned above, an invitation to participate in the study was sent to the schools in the local school district after IRB approval. Three to four participants were recruited from two different school districts. They must be K-5 mathematics teachers teaching in a local school district participating schools who use CGI approaches in their math classroom or want to use CGI. I collaborated with school principals. Collaboration with the schools ensured that this criterion was met, and only K-5 mathematics teachers provided the invitation to participate in this study (Appendix B). After the participants replied to the email with an endorsement of their interest in participating in the study, the consent form was emailed to them. Electronic consent was achieved with the participant responding to the email with “I consent.”

This approach allowed for the collection of more data. I drew irrefutable conclusions on the perceptions of teachers in the school district towards CGI strategies and the support or resources they deem necessary. It is also an ideal sample size based on the saturation of mathematics teachers in the school district. I collected data from each participant by using semistructured interviews. Participants were asked if they had any additional comments or questions before the conclusion of the interview. I took important notes from her observations (if needed) during the interview. Once the interview was completed, I exported the audio file and transcribed the data using Kaltura software to create a Word document with the interview text. After the interview, participants reviewed the transcripts as part of the member checking and trustworthiness protocol.

The interview participants' responses were collected and used in the data analysis. The research questions and answers aligned with the two research questions of the study. This means that the collected data was relevant to the research questions. For example, data about teachers' enthusiasm toward CGI strategies helped address the first research question. In contrast, the collected information about their preferred resources and support answered the second research question. The data analysis was done via the NVivo qualitative data analysis software. NVivo is ideal for helping researchers analyze qualitative data (Elliott, 2018; Smith & Firth, 2011).

Data Analysis Plan

Qualitative data analyses were used to address each research question collected through semistructured interviews. Semistructured interviews were used to develop open and axial coding techniques to identify themes. I looked for themes that show relationships between two concepts (Rubin & Rubin, 2012). I created a codebook that emerged from the first cut of the data analysis (Patton, 2015; Rubin & Rubin, 2012). After completing the interviews, I transcribed each recorded semistructured interview verbatim and coded them by NVivo. Charmaz (2004) and Elliott (2018) suggested using the NVivo computer software package for data analysis in qualitative research. La Pelle (2004) used Nvivo to code interviews using macros, tables, sorting features, find, and comment, even with a study with 200 codes (La Pelle, 2004). La Pelle (2004) also suggested using Microsoft Word computer software for data analysis in qualitative research. Verbatim transcription is a tedious process, but according to Adamy et al. (2018), Charmaz (2004), and Creswell and Poth (2018), it allowed me to review participants' words in the initial coding process mentally. The Microsoft Word software system might be used to analyze unstructured text from note-taking and audio from interviews.

Furthermore, this analysis was completed in a framework approach that follows Ritchie and Lewis's (2003) steps for data analysis: 1) Read data enough to be familiar with and identify initial themes and codes; 2) Summarize and synthesize to get connections between themes; and 3) Interpret and explain the patterns while keeping individual cases in mind (Smith & Firth, 2011). This iterative process of data analysis should ensure accurate coding of data. The responses provided by the participants dictated the coding sub-categories. However, there were three main coding categories influenced by the research questions. These were the perceptions and attitudes of teachers towards CGI strategies used in teaching mathematics and the support they need to improve their self-efficacy. Finally, they require resources to use CGI strategies more consistently in their mathematics classrooms. The data collected determined the coding subcategories under these three main categories. Incomplete, irrelevant, or inconsistent data were exempted from the data analysis. Discrepant cases with incorrect and correct coding can give rise to unexpected findings, strengthening the emerging theory. This study actively sought responses that were contradictory to other participants.

Issues of Trustworthiness

Trustworthiness consists of the following components: (a) credibility, (b) transferability, (c); dependability, and (d) conformability (Shenton 2004). Credibility contributes to a belief in data and triangulation trustworthiness, and member checks are primary and commonly used methods to address credibility (Merriam, 2009; Miles et al., 2014). Transferability is the generalization of the study findings to other situations and contexts. Reliability depends on validity; therefore, many qualitative researchers believe that if credibility has been demonstrated, it is not required to establish dependability (Merriam, 2009; Miles et al., 2014) individually. However, if a researcher permits the parsing of the terms, then credibility seems more related to validity, and dependability seems more related to reliability.

Because of the level of intimacy necessary in this qualitative research, the thoroughness of this study differed from those of quantitative studies (Merriam, 2009; Rubin & Rubin, 2012). The reliability of qualitative studies was ensured by conducting research ethically (Merriam, 2009; Miles et al., 2014; Rubin & Rubin, 2012). The criterion that should be used to establish trustworthiness includes credibility, transferability, dependability, and confirmability (Merriam, 2009; Miles et al., 2014), further elaborated upon in the following text.

Credibility

Credibility knows that I have accurately recorded the study findings and the information received during interviews (Shenton, 2004). I controlled the research for credibility to produce trustworthy, ethical research of the highest quality. Ravitch and Carl (2016) explained that quality and trustworthiness are based on the credibility of the process used to collect data. Similarly, Raziyeh and Sudabeh (2017) discussed the relationship between trustworthiness and credibility. A detailed check ensured that only K-5 teachers participated in this study. This process guaranteed credibility because the entire research was based on their perceptions or attitudes toward CGI strategies. The best way to establish trustworthiness in a qualitative study is by staying credible consistently (Merriam, 2009; Miles et al., 2014; Raziyeh & Sudabeh, 2017). Collaboration with the participating school guaranteed that only K-5 mathematics teachers received the invitations to participate in the study. To increase credibility, I conducted individual interviews so teachers' could comfortably share their opinions. In this study, credibility was ensured after the interview when the participants reviewed my notes detailing interpretations of their thoughts and ideas (Merriam, 2009; Shenton, 2004; Raziyeh & Sudabeh, 2017). Using the Microsoft Word table qualitative data analysis software also improved credibility. It ensures that the collected data is analyzed accurately and adequately. In turn, this process resulted in substantial, irrefutable conclusions on the perceptions or attitudes of K-5 teachers towards CGI strategies and the support or resources they require to implement them successfully in their classrooms.

Transferability

Transferability indicates how well the research outcomes can employ in future studies (Merriam, 2009; Miles et al., 2014; Shenton, 2004). Transferability impacted this study significantly because it is another way of establishing substantial trustworthiness in qualitative research (Merriam, 2009; Miles et al., 2014). This analysis transferability was potentially limited to sample participants with a specific background (Merriam, 2009). For transferability, the study strived to have a high population of participants. A large sample population enhances the transferability of findings or conclusions to other school districts, regions, or nations (Patton, 2002; 2015; Raziyeh & Sudabeh, 2017). Admittedly, the sample population remained relatively small because of the constraint within one school district. However, having more schools participate increased the generalization of the findings. The conclusions reflected teachers' views and perceptions of CGI strategies within the school district. One strategy to encourage participation was sending additional invitations to schools a couple of weeks after the initial invites. This process swayed more teachers to participate in the study.

Dependability

Dependability refers to the reliability of the context (Merriam, 2009; Miles et al., 2014; Shenton, 2004). Reliability was dependent upon validity; therefore, many qualitative researchers believed that if credibility had been demonstrated, it was unnecessary to demonstrate dependability (Merriam, 2009; Morrow, 2005; Patton, 2009; 2015). Since reliability and validity are rooted in a positivist perspective, they should be redefined in a naturalistic approach (Merriam, 2009; Patton, 2002, 2015; Raziyeh &

Sudabeh, 2017). The IRB reviewed the entire research process to ensure it was dependable and avoided any issues affecting the findings' reliability. Before the interview, a field test for the interview questions was scrutinized by CGI experts. This analysis incorporated a standard data analysis method and interview protocol to ensure dependability. To ensure dependability, this study assessed the methodology, the data collection procedures, the analysis conducted to deduce conclusions, and other relevant aspects of the research process. This process improved my dependability as a professional with experience in qualitative studies and oversaw its execution.

Confirmability

Confirmability refers to my objectivity ability (Miles et al., 2014; Shenton, 2004). I observed the differences in individual information that the participants shared during their interviews and addressed the confirmability. Confirmability ensured that I did not derive collected data (Raziyeh & Sudabeh, 2017; Shenton, 2004). My values, experiences, and opinions did not influence the research outcomes because I followed an established protocol; that guaranteed confirmability. My mentor and Walden's research authority checked at the end of each interview, which also enhanced the confirmability of this study (Merriam, 2009; Miles et al., 2014).

Triangulation can enhance the validity of a study by proving consistency throughout the collected data (Creswell, 2013; Merriam, 2009; Patton, 2002). Ravitch and Riggan (2017) defined triangulation as taking different perspectives to form more than one vantage point and then using the information to develop themes. Ravitch and Carl (2016) cautioned researchers that it was essential to acknowledge that engaging in triangulation did not necessarily make a study valid. This study considered an in-depth interview and possible follow-up interview methods as the most appropriate data collection tool.

Ethical Procedures

Before collecting this academic research data, approval was received from the Walden IRB. This analysis took place in the southern part of California. I contacted schools in the districts and extended an invitation to participate in the study. This researcher study aimed to recruit teachers from two different school districts and two to three schools from each district, plus ethical concerns for all participants to achieve maximum variety. I made a list of possible participants who met the requirement and emailed the school district. Depending on teachers' content areas and willingness, two to four teachers were selected from each school, and all teachers were K-5 mathematics teachers. The only consideration was establishing whether the participating teachers had prior knowledge or experience with CGI instructions. Therefore, an invitation for participation was sent to two local school district superintendents through email. It explained the purpose of the study and the importance of the outcomes and sought authorization to collect data (see Appendix A). I also sent an email explaining the purpose of the study and how the study's positive impact on math teachers. I emailed the teachers requesting their permission to participate in this study. I used an initial code through school districts or schools' names to identify all prospective participants. I also maintained the main list of the names of the participants and the initial matching code separate from other research records. However, there were procedures to protect the integrity of the data collected and the participants' identities.

Before conducting this academic research, IRB confirmed that participants were mindful and protected by federal guidelines. Informed consent was required earlier than any enclosure mathematics teacher contributing to this research to understand their function in CGI and their agreement to participate. Before the interview, I arranged a consent form, and participants did not enter personally identifiable information. This way, I could not trace the responses to a particular teacher in a given school. Ravitch and Carl (2016) discussed the differences between anonymity and confidentiality by closely relating confidentiality to the participants' privacy, and anonymity, creating a study that did not identify the participant. Participants were also informed that their participation in the analysis would not impact their future valuations or assignments. The K-5 teachers had the right to accept or refuse to participate at any time. Ravitch and Carl (2016) also discussed research boundaries and how the observer must consider the participants' body language and emotional distress and work to provide the most comfortable environment for data collection while still being considerate. Therefore, before processing any interview method, I informed the participants of every aspect of data collection that involved them, including providing a scenario that helped them better understand what was to happen throughout the interview or other data collection methods. I managed this potential ethical issue by reminding each participant that I asked the questions only for research purposes and not to evaluate their teaching performance on CGI

I saved the audio version of the interviews on an external memory card, which is also locked in the same file with paper documentation from the interviews. The data pertaining to the participants, including their contact information, was locked and kept in my filing cabinet for five years, after which I would destroy them. All other electronic data were secure on my computer or phone, which has updated security and can only be opened by passwords approved by me. No incentives, such as payments, were used to encourage study participation. The reason was that they could result in dishonest responses, as some participants would participate in the study solely to gain the promised rewards. This study relied on input from willing participants because they saw the value of doing so. More honest and heartfelt responses were provided in the interview, especially about their perceptions or attitudes toward CGI strategies. No other ethical issues were projected to emerge in the study.

Summary

The primary purpose of this basic qualitative study was to investigate K-5 teachers' perceptions of their self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they perceive necessary to implement CGI strategies successfully. I discussed the research design, the rationale behind the design, the possible methodologies, and my roles. In this chapter, I also explained the methods with an explanation of the participant selection and instrumentation, including interview protocols, location, and interview questions. I also addressed the recruitment, participation, and data analysis procedures. Lastly, I discussed the ethical procedures and issues of trustworthiness in detailed discussion, including credibility, transferability, dependability, confirmability, and data triangulation, which would warrant further analysis in the study.

Chapter 4 detailed the data collection and analysis process and placed it into different categories. It is followed by an explanation of how to process a demographic setting. This chapter also focused on the targeted sample population K-5 mathematics teachers' self-efficacy towards these CGI. Participants in the study could be sharing sensitive and personal information through interviews. Therefore, this chapter also included a detailed description that ensured the trustworthiness issues. The end of chapter four presented the result of the study and the summary.

Chapter 4: Results

In this basic qualitative study, I aimed to explore K-5 teachers' self-efficacy and confidence in using CGI strategies in the mathematics classroom and what resources or support they perceive necessary to implement CGI strategies successfully. I emphasized Bandura's (1977, 1986, 1997) social cognitive theory to understand and improve teachers' self-efficacy and confidence in their use of CGI methods, which may provide appropriate learning engagement in math classrooms, improve academic progression, and increase conceptual understanding of mathematics. This study emphasizes how inclusively CGI methods affect their self-efficacy in teaching mathematics. The study results may impart school officials about teachers' perceptions of their instructional self-efficacy fulfillment of recommended requirements. The research questions used to guide this study were based on Bandura's (1977, 1986, 1997) social cognitive framework and literature reviews. This chapter begins with a discussion of the setting and the participants' demographics. Detailed information about the data collection process and analysis methods and addressed issues of trustworthiness, including all the methods used to ensure dependability, confirmability, credibility, and transferability, are discussed. The data results using open coding analysis concerning systematic theory construct and themes are also presented. Furthermore, the chapter determines the clarification of the outcomes and a concluding summary.

Two main research questions guided the interview protocol, as well as sub-questions and probing questions used in the interview protocol for this study. The research questions that guided this study are as follows:

RQ 1: What are the challenges faced by teachers in using CGI in K-5 classrooms?

RQ 2: What support or resources do teachers need to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms?

Setting

The study took place in a school district in southern California. This district has 13 elementary schools, four middle schools, three high schools, and an adult school. This district is committed to developing all students to be self-motivated learners and productive, responsible, and compassionate members of an ever-changing global society. It has a qualified staff of approximately 1,500 teachers devoted to fostering meaningful relationships with over 14,000 students, parents, and the community while providing a relevant and rigorous curriculum in facilities that advance teaching and learning. It offers a full range of programs for students with individual needs, including GATE, AVID, and Title I, with careers in STEAM (Science, Technology, Engineering, Arts, and Mathematics). Additionally, it offers a before and after school enrichment program. This district is unique because it actively implements CGI in K-5 classrooms and is recognized as a state and national leader in implementing Career Technical Education (CTE) and Project Lead the Way (PLTW).

During the study, teachers prepared for the end of the school year activities and summer vacation. This made the data collection process very challenging as teachers prepared their final reports and worked with time constraints. Despite these challenges, 13 teachers agreed to participate in the study. Interviews were conducted between and after instructional times, and participants were given the option to choose a time and date that was most convenient for them. All participants met the inclusion criteria, which stated that participants selected who was currently employed as a teacher in the chosen district, who have experienced classroom teachers teaching in K-5 mathematics, who have over three years of teaching experience, and who have implemented CGI in teaching or are planning to implement CGI in teaching.

All interviews were done through Zoom conferencing software, a collaborative, cloud-based videoconferencing service offering group messaging services, online meetings, and secure recording. Archibald et al. (2019) indicated that digital technologies like Zoom offer various benefits over traditional methods when handling interviews of participants within the district. These advantages include convenience, flexibility, and cost effectiveness, which are more appealing for interviews and can complement and improve traditional methods. I conducted every interview and implemented the initial and follow-up questions created for online Zoom interviews to enhance information gathering. I conducted the initial interviews for 25 to 40 minutes to ensure adequate concentration. Furthermore, I relied on emails to perform the final member assessment of the preliminary findings to ensure they were consistent with the participants' intentions.

The interviews went well, with a few instances of unusual circumstances. In one instance, the participants forgot to turn on the microphone, which prolonged the interview as all the questions had to be repeated. In another instance, two participants had poor-quality cameras and microphones, making it difficult to collect the data effectively. Another unusual circumstance during the study involves family interruptions. One participant was constantly distracted, which prolonged the interview past 2 hours.

Given the few unusual circumstances, there do not seem to be any individual or organizational conditions that might affect participants' experience and the interpretation of the study results. Participants were briefed about the study and its expectations and were prepared with their responses as they were given an invitation to participate and a consent form. The school location and time commitment influenced the decision to participate.

Demographics

Recruitment of participants and data collection occurred during the 2021-2022 school year. The participants were 13 teachers from eight schools who provided CGI instruction in the math classroom. The classrooms are in eight elementary schools in a public school district located in California. To achieve maximum variation in the sample, as Merriam (2009) and Moustakas (1994) recommended, a researcher should recruit 12-15 participants. I recruited 13 participants from two public school districts in California. I sent the invitation to two school district superintendents but received confirmation from only one, after which the assistant superintendent sent over some principals' email addresses, which was very helpful. Out of three of the principals contacted, one was very helpful and sent a list of teachers who could participate. The school year activities and summer vacation ended and slowed the data collection.

To secure enough participants, the snowballing strategy was applied. Participants were asked for contact information of their friends and colleagues they felt would be interested and met the inclusion criteria. As shown in Table 1 below, all 13 participants were female educators teaching in the school district, with classroom experience ranging from 3 to 31 years.

Table 1

Participants' Identification and Length of Service in the School District

Participant Identification		Length of service
Participant	(001)	15 Years
Participant	(002)	31 Years
Participant	(003)	7 Years
Participant	(004)	6 Years
Participant	(005)	3 Years
Participant	(006)	20 Years
Participant	(007)	10 Years
Participant	(008)	16 Years
Participant	(009)	23 Years
Participant	(010)	29 Years
Participant	(011)	23 Years
Participant	(012)	31 Years
Participant	(013)	22 Years

Data saturation was reached after interviewing eight teachers. The inclusion criteria for the targeted sample included K-5 mathematics teachers with at least three years of teaching experience who have implemented CGI in teaching or are planning to implement CGI in teaching. The exclusion criteria were who chose not to participate in the research study and those who did not meet the inclusion criteria. Purposeful sampling was used to select participants who had unique abilities to answer the research questions

Participants responding to the emails received a letter of participation and the consent form explaining the study's purpose, background, procedures, sample questions, the nature of the study, risks, and benefits of being in the study, payment, privacy, and contact information. I intended to seek participants from across two school districts to provide a holistic view of the study. However, participants were recruited from four of the school campuses within one of the school districts.

Personal information was not used for any purposes outside this research project, nor have participants' names, school identities, or anything else been identified in the study report. Doing so jeopardizes participants' anonymity. Pseudonyms were used to safeguard the identity and keep participants' information confidential as I am required to protect the participants' privacy. There were more than 500 emails sent out, and 13 participants consented to join the study.

Data Collection

Upon receiving IRB Approval Number 01-20-22-0429535 to complete the research, school principals within the district were immediately contacted to find the best way to reach out to participants. Out of three of the principals contacted, one was very helpful and sent a list of teachers who could participate. It was challenging to get started with collecting data as participants were unresponsive. More than 500 individual emails were sent out to prospective participants with no response in the first week. After the second week, emails were resent to participants, after which four participants were recruited. The snowball sampling strategy was applied to obtain additional participants. Participants provided their colleagues' names and contact information who met the inclusion criteria, after which the consent letter was emailed for their review. After the consent form was sent back, an interview was scheduled with each participant. This procedure continued until 13 participants were recruited.

At the beginning of the interview, I built a rapport with a brief introduction to my study. Participants were thanked for agreeing to participate in the research study. Participants permitted the interview to be recorded and notes to be taken in my journal during the interview. Per the consent form, the participant was assured that the school's identity and the participants' names and responses would be kept confidential. The participant was also informed that I would not use personal information for any purposes outside of this research project. I did not include names or other information that could identify the study reports' participants. It was anticipated that the interviews would take 45 minutes; however, some interviews took approximately 30–45 minutes, and one exceeded the 2-hour limit. Participants were friendly and cordial and presented themselves professionally as they appeared to answer questions honestly. All questions were asked in the same manner and order for all participants and allowed for open discussions throughout the interviews. Probes were used, which helped to clarify or requested participants to elaborate more in eliciting additional responses.

The data collection process was completed within eight weeks. After conducting interviews, they were transcribed and reviewed by listening to the recordings for clarity. Notes I recorded in my journal were also used to clarify information. A copy of the transcribed interviews was sent to each participant to obtain transcript validation. They were asked to respond with any corrections or comments they may have from the interviews. Three participants responded and agreed that the transcripts were accurate. The other 10 participants did not provide any feedback as they did not respond.

Data Analysis

I started by reading and rereading the transcripts to understand each interview's content and confirm insights recorded in the research’s journal, after which manual coding of the data where text segments were identified and labeled. The transcripts were then uploaded into the NVivo 12 plus software, a qualitative and mixed-methods research software specifically used to analyze the unstructured audio, text, image, and video data from surveys, interviews, or focus groups. The NVivo 12 software was helpful in the organization, analysis, and visualization through the classification, sorting, and displaying data to identify patterns and themes. The transcripts were subsequently auto-coded based on a paragraph style, organized in heading styles, and a numbered code was generated for each paragraph. The interview questions were formatted into heading style one and answers in ‘Normal’ font before importing the documents for organization purposes. Nodes were created from connections in the transcripts. Nodes were examined several times for similarities, after which they were labeled according to categories. Each node was placed into a category based on relationships. Table 2 below displays the categories of essential and redundant nodes after coding. These categories and nodes are aligned with the research questions.

Table 2

Categories of Essential and Redundant Nodes

Research Question 1 Categories	Research Question 2 Categories	Redundant Nodes
Strategies	Coach	Grade

Number	Math	Question
Word Problem	Time	Classroom
Level	School	Research
Student	Professional Development	

From RQ1, I used the category “Strategies’ to develop the theme of Cognitively Guided instruction Strategies in the Classroom. This theme answered Question 1: "Can you describe your experience using the CGI strategies?” and Question 4 “Can you describe some of the specific strategies in CGI that you have used to develop students' mathematical thinking abilities?” One subtheme emerged: Cognitive. For the second theme, “Guided Instruction Effectiveness,” I used the category “Number” and “word problem” for this subtheme and the follow-up question: How effective do you think the CGI strategies are on student success? For Theme 2: Teachers Self-Efficacy, I used the categories “Self” and “Experience” for this theme. I used Questions 2 and 3, which asked, “Would you describe how your self-efficacy was different (if at all) from using the CGI strategies to not using the CGI strategies?” and “How confident do you feel when you implement CGI strategies in your math instructions?” For this Subtheme: Improving Confidence, I used the category “level” for this subtheme. I used Question 3 and the follow-up question, “What elements can help improve your confidence in CGI?” For Theme 3: Challenges with Cognitive Guided Instructions, I used the categories student. I used Questions 5 and 6, which asked, “What do you observe as challenges, concerns, or obstacles that you face as you implement CGI in your classroom? Can you describe why?" and "How did you overcome potential challenges as you implemented CGI in your classroom?"

Theme 4 emerged from RQ2: Cognitive Guided Instructional Resources. For this theme, I used the category "Coach" and Questions 7 and 8, which asked, "What kind of resources and support do you think might be beneficial for you?" What resources and support did you use during CGI instruction? As well as the follow-up question: "Are there other resources and support that can help you improve CGI instructions?" Theme 5: Expanding Cognitive Guided Instruction Implementation, I used the categories "Math, Time and School" and Questions 9 and 10, which asked, "What challenges are you facing because of a lack of resources?" and follow ups "Do you think having enough resources and support can enhance your self-efficacy of CGI implementation?" And "What kind of resources and support do you recommend expanding CGI implementation?" as well as follow up question: "Why did resources and support impact your practice?" Theme 6: Professional Development. I used the category "professional development" for this theme. This theme answers Question 11, which asked, "Do you think having frequent professional development enhanced your self-efficacy and confidence in the use of CGI methods?" as well as the follow-up question: "How often do you think you should receive professional development?" The categories "grade, question, classroom, and research" were not used.

Evidence of Trustworthiness

According to Miles et al. (2014), trustworthiness in qualitative research is determined through the ethical evaluation of credibility (internal validity), transferability (external validity), dependability (reliability), and confirmability (objectivity) of the sources and data collected. Below is a detailed discussion of the four criteria of trustworthiness.

Credibility

The first criterion for establishing trustworthiness in qualitative research is to ensure the credibility of data collected during the study. According to Merriam (2009), credibility is the degree to which the research results represent the participants' actual and accurate experiences. To ensure credibility in this study, I established a relaxing and friendly atmosphere that encouraged all the participants to provide honest and truthful information during the interview. Data triangulation, reflexivity, interview probes, and member checking were used to provide accuracy and establish credibility to ensure the research study was conducted ethically and that the findings would adhere to trustworthiness. Participants reviewed and evaluated the interview transcripts to ensure that transcribed information represented their opinions as recorded during the interviews. Additionally, I identified and noted all personal perspectives that could create biases and recorded them in my journal to ensure that the information and final data presented in the study were free from preconceived ideas and biases.

Transferability

A way to guarantee trustworthiness when conducting qualitative research is to ensure transferability. According to Tracy (2013), transferability is the capacity for research findings from one study to be applied to other contexts. Merriam (2009) indicated that using vivid and rich descriptions when presenting participants or when defining settings and the study findings is an effective way of establishing transferability and increasing the trustworthiness of the research. In connection with the results of this research, the results may be transferrable to other schools within the state with similar student populations because the 13 participants represented different genders and grade levels and had differing teaching experiences. Also, researchers can compare their results with studies conducted in different contexts, regions, or populations and position their findings with other theoretical frameworks (Geschke et al., 2019). The study showed its applicability and transferability to the larger context while maintaining its purpose. My journal notes connoted thick descriptions to understand and build a clear picture of the participant in the context of their setting, describing the circumstances, meanings, intentions, strategies, and motivations that characterize the participant's role during the interview sessions.

Dependability

According to Merriam (2009), the dependability of qualitative studies depicts the consistency and reliability of data collected to the results. In this study, dependability was enhanced by ensuring that the research process was logically conducted with traceable variables and participants and that all the research steps were documented. This enhances how well the readers can examine the research process. Triangulation included an ongoing data analysis using my journal and interviews to cross-validate to increase credibility. Too the data collection process and analysis procedures were explained in detail, and the data analysis and synthesis were followed in the same manner throughout the research. Furthermore, I relied on an inquiry audit involving an outsider examining and reviewing the research process and data analysis to create dependability.

Confirmability

Miles et al. (2014) define confirmability as the neutrality of a study that guarantees that data and findings are the results of the data collected and not the figments of my imagination. To achieve confirmability, I must strive to eliminate all bias during research or acknowledge when impossible to eliminate. As an educator for many years, and the primary instrument in the research, I brought a unique perspective to the study. Therefore, it was important to achieve confirmability in referring to my journal and engage in self-reflection, eliminating the bias that surfaced. Interview notes were reviewed to confirm the data. A consent form was provided to each participant to ensure their willing participation in the interview process. Participants were informed of their role in the interview and were free to withdraw from the interview for any reason deemed important to them. I also achieved confirmability in this study through an audit trail, which involved the detailed documentation of the research processes, including the data collection, analysis, and interpretation.

Results

Thematic Findings

The analysis of the findings from the study is discussed in this section. Codes were identified using a thematic data analysis approach to indicate a data segment's meaning. It was revealed that some participants responded to interview questions interconnected to other interview questions. It was necessary to follow the flow of their thinking rather than stick rigidly to the order of my interview questions. The research questions used in this study were:

What are the challenges faced by teachers in using CGI in K-5 classrooms? And

What support or resources do teachers need to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms? Probing questions also allowed participants to get back on track with the interview flow.

Themes and Subthemes Aligned with the Research Question One

Five themes and two subthemes were identified in analyzing the data and aligned with the research purpose, research question, and interview protocol. Three themes and two subthemes were aligned with research question one, and two were aligned with research question two. The first three themes and three subthemes are portrayed in Table 3 below. These themes and subthemes are in alignment with the first research question. Also included in Table 4 are the codes connected to the first three themes and subthemes in the first research question.

Table 3

Themes, Subthemes, and Codes Aligned to Research Question One

Themes	Subthemes/ Question	Codes
Theme 1		
Cognitively Guided Instruction Strategies in the Classroom	Cognitive Guided Instruction Effectiveness	different strategies, strategy use, kids strategies, book, teacher strategies, study strategy, successful strategies, sharing strategies, overall strategies,
	Question # 4	Number: sense, talks, routine, number, building activities, digit, string books, set,

		line, pieces, choices, strong numbers, open number line, whole numbers word problem today, word problem math, posing word problems, keywords, sample word problems
Theme 2		
Teachers Self-Efficacy	Improving Confidence Questions #2 and #3	self-efficacy, teacher self-efficacy, self-value, teacher experience, student experience, ongoing experience, math experience, support teacher experience, grade level, fourth-grade level, normal level, confidence level, certain level, success level
Theme 3		
Challenges With Cognitive Guided Instructions	Questions # 5 and #6	Student success, Ph.D. student, student experience, student names, student engagement, whole student, telling student, student kinds, student needs, student work, struggling student

Theme 1: Cognitively Guided Instruction Strategies in the Classroom

The first recurring theme that emerged after coding and categorizing the data was Cognitively Guided Instructions Strategies in the Classroom. This first theme portrayed teachers' different strategies when teaching guided, instructed math in the classroom. To answer this question, participants were asked to reflect on the various strategies used when imparting instructions in the classroom. Probes were used when necessary, which helped solicit, clarify, or request more elaboration, allowing for a more open discussion. There were different views from participants on strategies used in the classroom. For example, participant (003) mentioned initially reverting to the CGI method was frustrating. However, after much patience and hard work, everything fell into place and made sense. Participant (003 spoke about the strategies used in the classroom.

> I think one of the main ones is a share-out. Picking students that have maybe not as a sophisticated strategy. Still, it is the one most kid use, and then pick a kid with a more sophisticated strategy or just a different one. And then, we compared the two. It gives confidence to the kids I picked because their strategy was used; moreover, all the kids know that any way somebody wants to solve it is acceptable. Sometimes when they see one student do something, they think of a different way to do it, like a little bit in their way to create new strategies. I think that helps them learn strategies, but also helps them learn that there are, how can I say, like, respected, and they are important to the math learning in the classroom.

Participant (013) stated that cognitively guided instruction is life-changing for students and teachers because it improves mathematical thinking and can be applied to multiple areas. Participant (006) adopted a daily routine where the day starts with a 10 to 15 minutes oral discussion. The children would do a presentation of their choosing, after which a discussion would be held. Participant (006) also mentioned that the students are encouraged to participate as there are no right or wrong responses. Every child adapts to the classroom culture where they are free to express themselves. The children develop a rapport with each other as they interact while doing their classwork. It is very important that the children feel comfortable and free to ask questions. The teacher then becomes the guide on the side. Participant (002) also gives children time to collaborate while doing their classwork. Children turn and talk as they share t strategies. Another strategy used by participant (002) is to get the children away from the traditional classroom environment and take them to sit elsewhere. Participant (002) feels that a more informal environment allows the children to connect and be more effective with their work. Participant (009) embraced CGI and loved everything about it. Participant (009) said:

> I first learned about CGI strategies when I took it as a voluntary program our district provided. So, learning about CGI makes so much more sense for me because instead of telling students this is how to do it, I was shown that, you know, figure out your way to do it. If I have to draw pictures, that is okay, and if I have to use tally marks, that is okay.

Participant (009) continued to say that the basic CGI lesson starts with some real-world problem centered around food or dogs. The children eventually either figure it out or get good at doing it where they do not need a standard algorithm. Participant (010) routinely starts math class with an independent number routine with no pencil, paper, or whiteboards. This session is done in groups and is all about numbers. Participant (010) also used lots of number sense and number building activities as a warm-up for about 15 minutes each morning. After a problem is posed, children use different strategies to make the connection and solve it. Participant (008) commented.

> It was a huge mind shift with CGI when districts switched to CGI from our traditional math books. Not just because it was having the students go deeper with their understanding but making sure that they understood what they were doing and why they were doing certain things. Now with CGI, we are focusing on word problems and getting them to understand and unpack that word problem, so they understand what the questions are asking them and what they are supposed to do. They learn multiple ways that they could go about solving that problem. They are

> also able to discuss this as a class. When they go up to the higher classes, they can see that they can use repeated addition when multiplying. Yes, the teacher as a guide is great, but we want them to come up with it themselves, so they have that strong understanding.

Participant (011), like one of the other participant, also do partner turn and talks. The children can share their strategies. They discuss, and the teaching aids in the discussion to try and make sure that they understand. The children understand that all answers are important. Participant (007) used number strings and friendly numbers like the friendly number 10 in the number strings. The children can see the relation of numbers and can solve problems quickly. Participant (011) also uses counting collections or number bonds. While it is not as popular as before, participants (011) found it helpful for students as they are comfortable with that method. Participant (011) felt that this method benefits children as they move on to more challenging tasks. Participant (004) stated:

> A lot of it has to do with building number sense. They start by counting one by one. It builds a sort of part cardinality when they can see how many items there are and then, in the end, be able to name how many are in the pot in a pile in the collection, but also because for most of the first grade, that is where they sort of start at the beginning of the year. But as we move into the year, you start to hit other standards. For the most part, they start to group things by 10s. In groups of 10, build numbers and base 10. However, they can also count by twos and fives as they move on and want different ways of counting. A big part of the CGI

classroom is to give students the time to explore how numbers are combined because that translates to the second huge prong of CGI.

Participant (004) stated that other strategies are playing with toys or sharing toys, getting stickers, and other things they are interested in. Children are also exposed to problem-solving in an interdisciplinary way. This is done with a story where they would have to read and engage in discussion, a form of problem-solving. In response to the questioning participant (012), it becomes tricky when CGI strategies are mentioned because sometimes the understanding can get mixed up and be confused for observing, questioning, and posing word problems. Participant (012) continues to say that these are teachers' strategies. In terms of CGI strategy, participant (012) stated:

> For me, as far as, you know, strategies that I use daily, I guess I just mentioned them, you know, I have to think about what problem I am going to pose to have the kids solve, so then I get to get a window into their thinking as they are solving it. Another strategy would be unpacking the word problem because that would be another CGI strategy. Unpacking the word problem means we discuss the problem, not focus on keywords. None of my board problems have keywords in them. So, a true understanding, like what is the context of the word problem math, like, if I do not give them a word problem? They are sad. They are like, Oh, you are going to provide us with a word problem today. Yeah, so, like, every day is a word problem. They love it. So, the idea of even like them sharing how they solve the problem, they notice as they solve it, either in a similar way or maybe something completely different. Sometimes they realize one like they made a

mistake, and sometimes they made a mistake, and they still think they are right. You know, and see how the other students are saying no, but I love that discussion, you know, so yeah, I do not know if I am answering your question.

Subtheme 1: Cognitive Guided Instruction Effectiveness

This subtheme Cognitive Guided Instruction Effectiveness derived from the first theme and is aligned with the first research question. Participants were asked to share their experiences with the effectiveness of the CGI program. Most participants believed it was beneficial and effective in developing a new thinking strategy. It gives children autonomy as they can use different strategies to solve problems. Participant (001) mentioned that it is especially effective for children at grade level because when teachers ask the right questions, you hone the students' skills. Therefore, students make sense of the word problem when they understand what you are asking. Sometimes they might not solve it right away, but they begin understanding the problem with practice. They feel successful even though they did not solve it with whatever strategy. Participant (013) was amazed by the progress made with the children using the CGI strategies. participant (013) commented

In all my teaching years, I was barely going a mile wide, but now I am going a mile deep. Learning is such a big difference. The children know about discovery, play, sharing strategies, and doing their own things. There is so much more that comes out. I do not need to see my posters behind me. It is completely different from a textbook. I do not have a textbook because I know my standards. The places these kids go are unbelievable. They end up doing things that are like

> sixth-grade level. It is very natural for them to go in these certain ways. I see so many amazing things.

Participant (010) believed that the CGI strategies are effective at the fourth-grade level because the children learn how to add as they need to have a strong number sense. Participant (010) continued to say that to be successful with CGI. Some students may need extra support or intervention to help build a stronger sense to support with CGI Participant (010). Participant (009) said it was so effective that she used it with her son, who was in middle school and struggling in math. So, she would sit down at home and look at the problems. She would ask him questions about it. She used the CGI strategies with him at home and saw everything change. So, from that one case, she knows intimately how well CGI works. She just knew it had to work in her classroom, so CGI has become a great part of her teaching. She mentioned that children are coming to her, and they are so much more open to sharing and talking about their strategies and admiring each other's strategies. she always agreed with whatever strategy they use and asked them to tell her more about them. She felt that not only is it helping them build their math skills, but it is also improving their collaboration skills. It improves their creativity and their social skills because they must learn how to interact with one another. Participant (009) and participant (006) also said that it would be very effective with the lower kids because it allows them to demonstrate different strategies, especially with children with disabilities. Participant (012) believed that the children are becoming stronger in their skills because they have an opportunity to be flexible. They do not feel compelled to do math in a set way but can explore and develop different strategies to do the math, which is a success. Participant (004) said, “it is very effective. However, you do always have to look at best practices as well. So, you have the time for students to solve, but when they are working independently, it is also a time that you need to pull students. When example, I mentioned having students share a strategy. That is all well and good, but you also have to make sure that the students have a chance to implement that strategy and collect data. They understand it so, once you have seen how they can implement that strategy and explain it to you, you are going to have students who still do not. And so, you have to make your groups then and differentiate small group instruction using the data provided by the students. Because at the end of the day, even though you have these teaching practices, and it is, you know, really a pedagogy, you are still accountable to the standards. So, by the end of first grade, your students still need to be at or above the standards expected for first grade, and CGI for me is just a way of getting there”.(004). When asked the question about the success of CGI, the participant (008) said that it is beneficial for children to understand why they are doing things and to know that there is more than one strategy because, in the past, all they knew was how to drill and kill. With this strategy, however, children get an even balance that drives them to success. Participant (007) believes that success comes in a timely manner. She commented:

> I would say still accept that; you must be patient. You cannot expect immediate results. You have to keep doing it, and you have to do it throughout the school year. The kid must also build on it at the next grade level. Now that we are teaching it, the possibilities for being mathematicians or having people be passionate about math are endless. I think CGI is a very friendly approach to

teaching and teaching kids to learn math. When they feel comfortable with something, they succeed at it. I think CGI is necessary because the kids feel like they can make mistakes. They can use their strategies, but the teachers do not tell them what to use. They come up with their solutions. I think that gives them much confidence and makes them feel valuable, especially when you call them out to share their strategy in front of the class, knowing they came up with it. That gives them a boost, so they become more confident, and math is not that scary anymore. I think that is where success lies in giving them that value.

Theme 2: Teachers' Self-Efficacy

The second theme, “Teachers Self-Efficacy,” is aligned with research question one. The question asked how teachers improve their self-efficacy using CGI strategies in the classroom. Participant (003) stated that it is the same because she is pretty competent in her math skills, and it was just a new way of looking at it, which she thinks is better because it provided a better conceptual understanding of math. It is especially beneficial. She added that when the children go to higher-level math. They will understand more about what they are doing and why they are doing it, not just following a procedure. Participant (006) responded by saying:

That is all I use. 100% I am very comfortable with it. I have been using it for probably 13 years now. I am very confident that I do not teach math any other way. I know that some of the teachers on my team are not comfortable or confident enough. They feel like they need control. As I said, they need to be the stage on the stage where I am the guide on the side. I said here is the problem. Here are some. You figure out how you would show you do best, then share your strategies, and then they teach the class. So that is shared is a very important component. Explaining their thinking is very important because we want to hear how everyone thinks differently yet arrives at the same solution.

Participant (012) said that "there was much resistance from teachers because obviously, we all grew up with the standard algorithm, learning strategy, and so initially, I think I was reluctant to employ these types of strategies. However, as I was trained more and more on them, their validity became apparent, and I think then I got more comfortable with it, and now I cannot see myself teaching math any other way". Participant (009) believed that she is a more effective teacher using CGI. Participant (008) also resisted change because the procedures were different. Still, because of the district's support, she could adapt and change to the new strategies. Participant (007) responded:

> When I started, I felt I would fall back into my old routine. And, of course, I returned to tell them what to do once I started working with the word problem and unpacking it with the kids. I had to stop myself from doing that because I was telling them how to do something again. (007)

Participant (004) was asked how her self-efficacy was different, and she replied that the district's curriculum was different because student engagement is much higher than CGI's. She believed that CGI should not be seen as the lens through which math is taught. However, she thought that it was tactile for them because they could touch things and explore and manipulate numbers in the way they could see in front of them. She believed that having a lot of just numbers they have to add together without necessarily having a context for it might not all be beneficial, especially to a younger child. Participant (011) stated that she feels comfortable using the CGI strategies. Participant (009) also responded to the question by saying:

> We are the product of the past of our education, and we have only been taught that there is one way to do it. And now we are teaching kids that there are many ways we do not understand math ourselves. So, because of the many standards associated with the curriculum, many of us do not understand the language of it, and it makes us feel uncomfortable because we were never taught to think outside the box. So, we need professional support on how to implement it and need content support to understand mathematics.

Subtheme 2: Improving Confidence

This subtheme, *Improving Confidence*, derived from the second theme, is also aligned with research question one. Participants were asked how confident they felt in implementing the CGI strategies. Most participants indicated that they are very confident, and this could be because participants have many years of teaching experience. When asked the question, participant (001) said that:

> I feel very confident right now, but this is my sixth year, so I am confident. In my first year, I had no idea what I was doing, and I had to trust the process. I was very frustrated at first, but now I know how the students think before they think, and so as long as I know my goal, whenever I teach math. If I have that goal in mind, I know where I want them to go. I feel very confident, plus I have seen the various ways that students think after six years, so I can start making connections

> between solving problems with area models or the standard algorithm. So, I show the progression to students and show them what t their goal is. I am confident in knowing my standards.

Participant (003), on the other hand, thought there had been no change in her confidence level and that it was the same because she has always been confident in her math skills. She understood the math and all the different strategies even when kids make up new ones. The only thing she would say is that she does not know everything about CGI, so she is not competent that she knows everything, but whatever she does use, even if it is new, she feels confident in using it. To her, it was just a new way of looking at it, which she thinks is better because the children get a better conceptual understanding of math. Participant (013) responded by saying that she became very passionate about CGI after losing her confidence in teaching math some years ago. However, learning the strategies that come with CGI created a complete turnaround and built up her confidence again. She feels as though she knows math and can teach it.

When asked about her confidence level, participant (002) stated that she constantly reaches out to her math coach whenever she feels she needs guidance. She tries her best to implement the strategies. She tries to follow her CGI training by practicing good listening skills. She feels I am confident with CGI, and I would encourage everyone to get the training. Participant (009) was not enthusiastic about the CGI strategies, and she thinks it is one of the most student-centered programs. She feels that making daily adjustments is challenging and one reason the newer teachers find it difficult to follow the program. She said she has to trust the process, and the support you know cannot build confidence.

Participant (010) responded to the question by saying that she was not feeling confident because she was not getting support from her specialist in the district. But seeing that all teachers were buying in and giving 100%, we could work as a team, have meetings, talk about it and look at student work together, talk about outcomes, and things like that, which increased my confidence. Participant (008) commented:

> Because I have been doing this for a long time, that built my confidence. The more I work with the children, the more I get used to it. I have done it with kids. In the beginning, it was not easy because it was based on the children's needs, so you could not plan your work. The result is based on the children's needs and what they come up with in their strategies. So, in the beginning, it is the unknown because there are many unknowns from the teacher. You do not know what your kids come up with or what strategies they use. Just being exposed to and knowing now, because I have done it for so long, I have a hint of what my kids might come up with. They still sometimes throw me off because they would devise some new strategy. But I am more confident now because I have been doing it for so long.

Participant (012) enthusiastically responded, “I am 100% confident now, yeah. Oh, yeah, definitely. Yeah. I do not have any problem with implementing the CGI strategies”. She continued to say that the biggest element was the district because the district has a fabulous math lead. Participant (004) stated:

I feel pretty confident for the most part, and it is something I have been doing for a while, and I have seen other teachers do it. And I think a big part of my confidence comes from knowing that I am on a learning journey as I am in CGI and that there is always going to be a new practice that that might work better for students that I am always going to have students in my classroom that you know, this particular strategy might not work for and but that there is also resources for me to tap into to support that student. I must say that my confidence has improved greatly.

When asked about her confidence level in teaching CGI, participant (011) said she is still learning because there is so much more to do. She feels that every year there is a new bunch of students, and you start over. She continues to say that it is exciting every time a new concept is introduced to a new set of students. She still believes that more coaching is needed to offer support, like a math coach, to talk through and observe the lesson.

Theme 3: Challenges with Cognitive Guided Instructions

The third theme is Challenges with Cognitive Guided instructions. This theme provided insights into the challenges faced by participants in the classroom when implementing CGI strategies. Participants' responses were mixed as some did not feel there were challenges while others did. For example, participant (008) mentioned that she no longer feels challenged. However, when she started, it was different just because of the unknowns and not knowing because no one could tell what the kids came up with. A teacher who always wants to know the next step can have difficulties dealing with this. She continues to say that planning cannot be done in advance because it is dependent on the day's lesson with the children. She incorporates engaging games to develop their math skills. Participant (001), on the other hand, stated that she does face some challenges. She said:

> There are always those students who are not making sense of the problem, which can be challenging. I have students making sense of it and those who do not understand it all. For example, this year, one of my students kept cutting everything in half with fractions. And so that is a challenge when there are those little gaps. But for the most part, in terms of my teaching, what can be challenging is that we do not have a curriculum. We have to develop everything, including word problems. This is done daily. So, I would say the challenge is that the fact that you know, there are no curriculums. We kind of have to create our own on a day-to-day basis, see what the successes and what the needs are.

Participant (005) also agrees that there are challenges. She said that sometimes working with parents can be challenging. Also, now that there is Covid, it is difficult to work with the children because they, too, seem confused and do not know how to attack the problems. Some students would sit there and do not know how to attack the problem, while others move on to other CGI strategies. This caused some students to be left behind with no assistance. She continues to say that it is challenging when there are children who are very high achievers and those who are low achievers. Participant (006) took a more upbeat approach and said that she challenges her children in fun ways when they play classroom games, and the children have to devise a strategy. However, she mentioned that the real challenge comes when the children come to school at the beginning of the year, more so now because they are coming from virtual classes. Children lack the math skills needed for their grades, skills like counting numbers.

Participants (009) and (007) also felt that parents are a huge challenge because parents know the standard algorithm. So, they expect us to follow the standard way of teaching but fail to understand that this is a different teaching method. So, the parents would teach the children the standard algorithm before they are ready to learn it. So, to alleviate this problem, she talked to the parents about the program and asked them not to confuse them by introducing other strategies to the children. Participant (010) commented, "The biggest challenge I have faced is when the students have a weak understanding of place value, but especially if they do not have a certain level of automaticity with their facts. That can slow down their thinking, and they get stumped". Participant (012) believed that the biggest challenge is management. She feels that management does not provide adequate seating arrangements for the children and that children learn best in a non-traditional classroom environment.

Participant (007) felt that there is a challenge in oral communication as children are often unable to explain aspects of their work in detail. Because CGI has its strategies, children would come up with the answers using the standard algorithm taught by their parents. When asked to explain their strategy, they are unable to do so. Participant (007) takes the opportunity to address the issue with parents during parent conferences. Participants (004) response to the question:

> I think that administrators can support you when you are in a district that teaches CGI strategies. I believe that children should use their textbooks some days and

do word problems the other days. I think there is there is a way to maybe have two days where you do the math textbook and then three days where you are either doing a math problem that's just based on student experience and having that trajectory of sharing the strategy—or doing those collections for those three days so that students have a great foundation for their number sense. And I think for the other one, you are in a CGI district and wondering how to teach the measurement standards. The geometry standards are working with your team, then working with your administration on how to do that. If you have a math coach versed in CGI, tap into what resources they might have available. So not trying to reinvent the wheel and see what is out there for you. (004)

Themes and Subthemes Aligned with Research Question Two

The second research question asked what support or resources teachers need to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms. From this question, three themes were developed. Below in Table 4 are the Themes, Questions, and Codes Aligned to Research Question.

Table 4

Themes, Questions, and Codes Aligned to Research Question Two

Themes	Subthemes/ Question	Codes
Theme 4		
Cognitive Guided Instructional Resources	Questions # 7 and #8	math coach, elementary coach, instructional coach, coaching piece, class coach, instructional math coach
Theme 5		

Expanding Cognitive Guided Instruction Implementation	Questions #9 and #10	Math: classroom, class, talk, problem, time, coaches, experience, specialist, routine, book, facts, skills; teaching math, word problem math, traditional math, entire math book, elementary math coach, district math team, hating math, fifth-grade math
Theme 6		
Cognitive Guided Instruction Professional Development	Questions #11	professional development

Theme 4: Cognitive Guided Instructional Resources

The first theme for the second research question is Cognitive Guided Instructional Resources. Participants were asked what support and resources they needed to teach and needed to improve their self-efficacy or confidence in using CGI strategy in the classroom. Most participants agreed that they received lots of help from the district, while some felt that the support was inadequate. Participant (001) commented:

> Wow, I mean, we receive a lot of support. So, I think that is part of why I feel comfortable and trust in the process. Because here at our district, they support you overly support you. Someone from the district came and showed me what I needed to do and then observed me doing it. I appreciate that now. But it was not like that before. They never used to tell you what you did wrong. But it is different now. We even did CGI through zoom. It was amazing. I did not think it was going to work, but it worked. Once we figured out how to maneuver all these apps and have the kids share their work and breakout rooms. I have gotten much support, so I think I have trusted the process and appreciate it.

Another participant (003) answered the question by saying that there are apps that can help to meet struggling children. She said she enjoys watching people teach different strategies, whether a video or otherwise. She continued to say that the district has a support person who assists with questions if needed. She added:

> They are good at providing resources or creating little things we can use, like slide decks with number talks or number strings. And then, if they find something new, they share it with us, but it takes us as a teacher. The willingness to look for that stuff. (003)

Participant (006) constantly reaches out to her instructional coach, sometimes in person and virtually. The district provides the resource, and some teachers take advantage of it while so do not. Participant (006) always reaches out to other teachers for teaching ideas. Participant (002) also said she has many resources and support. Back. She has a lot of help and support. She has several books and has developed a book club. The books are based on CGI kind of strategies. Participant (013) believed that the district does not have enough support coaches. The district was downsized from three to one coach that served 13 schools. Instead of waiting until she can see the coach, she uses outside resources to assist her. Participant (009) also believed that there was not enough support. She indicated that not all teachers are teaching CGI strategies. She commented that:

> I would like the support of other teachers who knows about CGI. It would also be great to have our math coach. I think it would be nice if it were more of a mandatory thing. I know it is hard to make teachers do something they do not want to, but I force people to use help. Because it is not only CGI is not open up

> the math book to the next page. It is planning, questioning, and knowing your kids, and I think some of our newer teachers may not know how to know their kids. So definitely some support and not just what is CGI and what are the steps and strategies that support that planning piece and where do

Participant (008) finds it helpful that the district has provided Google Drive. She appreciates that because it is very helpful because she used it for her math routine and teaching her units. She believes there are enough resources for teachers to like sample word problems that teachers have done or slide decks they have created to go with word problems to build that background knowledge for kids to understand the problem. She believed that just having all of those was super helpful and not having to recreate the wheel every year.

Participant (012) says there is lots of support when asked about the resources and support given by teachers. She also has a book club that she uses. She appreciated the support, especially at the beginning, because the concepts were difficult to understand. But by meeting and reading books and with the help of the district units, it became easier. Participant (007) mentioned that it is challenging at times, but the district does make it a point to give CGI refresher training every year. Participant (004) stated:

> We have a math coach and team day for looking at the strategies, so having that coach come in with your entire grade level team is great. So that everyone is on the same page, and even when that person that coach is not there, you can learn from your colleagues to see how it is going and where they have made breakthroughs, maybe where they need support and be able to work as a team.

> I can talk to my admin a lot about what is working in the classroom, and if I need materials, I can reach out to the administration and the families in my room. There they were able to donate things. Participant (004)

Theme 5: Expanding Cognitive Guided Instruction Implementation

The findings from this theme indicated that teachers with manipulatives work well with children in the classroom. They also mentioned using online resources as supplementary resources to assist them when implementing cognitively guided instruction in the classroom.

Participant (005) mentioned that teachers collaborate to develop best practices for their children. They would put together books and other supplementary materials to use when they needed them. Participant (003) also work with other teacher to implement the CGI strategies in her class. She compiled math problems and other number sense materials from online websites. Participant (013) implement the CGI strategies using the state standards.

> Yeah, I am number one when it comes to standards. That is where I start. That gives me help because specific standards lend themselves to certain activities. I also use lots of books and amazing websites with materials to help teachers.

Participant (006) stated that she used many manipulatives and links given to her where she could find the necessary resources needed for her class. She mentioned that CGI is very important for children struggling, and it is nice to see new teachers coming into the program using the CGI strategies. She mentioned:

> I noticed there are a lot of new incoming teachers already come CGI trained. So, kudos to the universities with credential programs because many teachers come in that way and come in strong with those strategies. It is the existing teachers who have not gone through the training and only go through just the PDS.

Participant (009) used online resources to help implement CGI In her classroom. She also has the support of other teachers who can bounce ideas off each other. She believes that if you are creative, you don’t need a lot of tangible materials, and the most important would be a whiteboard and a document camera. Participant (010) said:

Our teachers' specialists not only provided us with professional development, but she brought in other experts from UCLA to talk with us. The district purchased several books for us. We have a district math team with a teacher from each school and each grade level that works on the pacing guide each year. They look at assessments and both summative and formative assessments and work on those each year, bringing together input from all of the school sites and making modifications as needed.

When asked how cognitively guided instruction is implemented, participant (008) noted

> We use lots of word problems for the instruction, and when we give a word problem, we always unpack it and provide them with the background information before I even put it up. I set the scene for them so they can start thinking about the word where the word problems are and get them thinking about that. And then, I'll introduce the word problem without the numbers. And then, have them talk with their neighbor about what the word problem is and what they think they are going

> to need to solve the word problem. And then I'll introduce the numbers; they always have three choices, three, or four choices of number choices that they can plug in for their problem. They solve the word problem independently. And then, as I'm walking around, I'm checking to see the different strategies that they're using. So then, after the share-out, I can call on searching students based on their strategy.

Theme 6: Cognitive Guided Instruction Professional Development

The findings from this theme indicated that teachers would appreciate some professional development training within the year. Participants (005) and (003) stated that they like the CGI training the district provides, and they feel that the training should be at least once per year and that it should be more intense and informative. Participant (013) recommends professional development concerning CGI, and she stated that it is important even though some teachers do not like to attend. She also stated that having professional development about four or five times a year would be beneficial. Participant (006) said:

> We have quite a bit of professional development already, but they are after school, and teachers are not required to attend because they are not paid to do so. To add to this, they are done on zoom, and this becomes problematic because they are not aware when there is something new then.

Participant (002) also corroborated that professional development was held regularly, but due to the pandemic situation, they are now held on zoom but are not mandatory. She continued saying that she would like to go back in person and have the math coaches that were previously available. She reiterated that professional development and having enough resources always impact your teaching practice. Participant (009) believed that professional development is essential, and she believes that some one-on-one coaching should be provided. She added:

> Yes. Some basic professional development is where I can see teachers' recordings and have someone else see my kids and watch me teach lessons, and it helps me understand where to go and how we get to the next level. So professional development is great, but there needs to be that coaching piece where I can talk face to face with someone, and they can come into my room and help me specifically with my needs in my classroom.

Participant (010) stated that in her district, there is a cohesive team at the district that evaluates resources. There is lots of professional development, support, and videos of successful teachers performing it, which all made her feel confident. She continued to say that before Covid, her district gave three yearly professional development training. However, because of Covid, it's been a little different. Participant (008) stated that she feels that professional development should be done as often as possible. Before, her district used to have it every other month, but the hope would resume after the pandemic. Participant (012) felt that professional development is needed, and she continued to say that the program cannot be implemented effectively without it. Participant (007), however, had mixed feelings about professional development training. She said:

> I don't know if it will be more frequent because teachers are already bombarded with a lot of stuff that's not happening in the classroom. I mean, our plates are full

> every day. So, I don't know if more professional development would be beneficial. Our district is already doing two or three a year, and you may go or may not. They offer many incentives for teachers to participate because this is done outside of instructional hours, and I believe having it recorded for teachers to watch later would help.

When asked the question, participant (004) said that professional development training would be beneficial if it is done over the summer holidays or even during instructional times where you could have a math coach come in to observe one teacher's class and have the other teachers in that grade level be there with them. There could then be a time of debriefing. There should be varied opportunities for professional development and ensuring that part of the variation is that teachers can receive that professional development opportunity within their contract hours. However, if a teacher is starting, it could be done once per month.

Summary

Chapter 4 described the themes that emerged from the data analysis. Data were analyzed using recorded interviews via zoom with teachers from the same school district. Chapter 4 explained the setting, demographics, data collection, data analysis, evidence of trustworthiness, and results, as well as presented the findings of each research question. In response to RQ 1, the findings of this data analysis were related to teachers' perceptions and experiences towards CGI strategies used in teaching mathematics.

The findings indicated that participants are dedicated to implementing CGI strategies in the classroom. Despite feeling challenged at the onset, they are now confident in using the CGI strategies in the classroom. Findings revealed that participants viewed using the strategies as effective due to the visible progression of the children. In relation to RQ 2, the results indicated that participants are given adequate resources and support from their peers and the district to implement the CGI strategies in the classroom. Participants also reverted to supplementary resources to assist with materials needed through online sources. Findings also showed that some teachers do not actively participate in implementing CGI strategies in the classroom.

Finally, results revealed that professional development is needed to implement the CGI strategies. They agreed that professional development specific to implementing CGI strategies would assist them in developing additional strategies and provide guidance in lesson plans and best practices. Chapter 5 discussed the interpretation of the research findings. Also discussed are the limitations of this study and recommendations for future studies. Additionally, the recommendations for action and implications for social change are presented along with the study's conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative study was to examine teacher perceptions of the use of CGI in mathematics classrooms. This chapter covered the interpretation of the findings, the study's limitations, future research recommendations, action recommendations, and social change implications. This section addressed the study’s major findings related to the literature review and themes discovered. The study’s findings depicted six major themes and two subthemes that emerged from the two research questions.

Interpretation of the Findings

The essential findings emerged from participants’ descriptions of implementing CGI strategies. Findings were developed from six themes and two subthemes aligned with the research questions. The interpreted findings of this research were viewed from the perspectives of Bandura's Social Cognitive Theory of Learning Theoretical framework. Bandura's social cognitive theory was discussed in four primary sources that shaped individuals' self-efficacy through mastery experiences, vicarious experiences, social persuasion, and emotional and physiological states. The key findings also led to recommendations for actions in collaboration with participants’ knowledge and pedagogy employed in their classrooms.

CGI Strategies in the Classroom

According to Black (2015), de la Cruz (2016), Diamond et al. (2018), Moscardini (2015), and Sinquefield (2016), CGI strategies in mathematics can help students improve their performance by capitalizing on their understanding of concepts and fundamental problem-solving skills. Participants revealed that reverting to the CGI method was frustrating. However, after much patience and hard work, everything fell into place and made sense. This corroborated that of Dixon et al. (2020). They suggested that teaching techniques that included planning, preparation, applications, feedback, and re-teach steps impacted teacher candidates' beliefs when teaching mathematics in the classroom. Participants stated that cognitively guided instruction is life changing not only for students but for teachers because it improves mathematical thinking and can be applied to multiple areas

Findings revealed that participants used various strategies to develop problem-solving skills. For example, one participant created her problem-solving skills using real-world type problems centered on dogs. Some used a number routine involving games and other number-building activities, while others used to turn and talk, where children took turns to share their strategies. Executing these strategies involves thorough preparation and planning. While it is sometimes unpredictable to determine what strategy children use to solve their mathematical problems, participants take pride in planning their math routines and developing daily lesson plans. However, this can only happen if CGI strategies are implemented correctly (Black, 2015; Conowal, 2018; Giles et al., 2016; Guerrero, 2014; Jacobs et al., 2017).

Children develop a rapport with each other as they interact while doing their classwork. They are exposed to problem solving in an interdisciplinary way. This is done with a story where they would have to read and engage in discussion, a form of problem solving. When teachers are taught how to identify students' fundamental problem-solving skills, they can use them to understand better mathematics concepts (Bailey et al., 2017; Walters, 2018). The findings revealed that participants use many resources to reach children at their abilities when implementing the CGI strategies in the classroom. These include manipulatives, pattern blocks, tiles, interlocking cubes, and even computers are additional resources that enable successful CGI implementation. This supports Secada (2020) and Turner and Drake (2016). They indicated that students' thought processes vary, and CGI's goal is to use their natural problem-solving skills to enhance comprehension of mathematical concepts.

CGI Effectiveness

CGI has proven to be very effective at helping students grasp mathematics concepts as it capitalizes on their problem-solving skills (Conowal, 2018; Diamond et al., 2018; Moscardini, 2014; Noviyanti, 2020). Participants believed that CGI is beneficial and effective in developing a new thinking strategy. It gives children autonomy as they can use different strategies in solving problems. As Iuhasz-Velez, (2018) and Berger (2017) established, teachers' beliefs about CGI ultimately determine whether the strategy can be successful in the classroom. Conquering this belief cannot be achieved when teachers negatively perceive CGI strategies (Francis, 2015; Guerrero, 2014; Jacobs et al., 2017; Myers & Cannon, 2018; Sinquefield, 2016). One participant reported that the CGI strategies were so effective that she felt confident enough to use them with her son, who was in middle school and was struggling in math. Another participant said that the strategies are very effective with the lower kids because it allows them to demonstrate different strategies, especially for children with disabilities. This supports Diamond et al.

(2018). Diamond et al. explained that the subjective nature of CGI strategies makes them extremely challenging to implement in a differentiated setting where each student requires an individual approach based on their problem-solving skills.

Findings revealed that participants believe using CGI strategies in the classroom benefits children because they understand why they are doing things and know that there is more than one strategy for getting the result. With this strategy, however, children gain an even balance, which drives them to success. Participants believe that success comes in a timely manner. Teachers' analysis of their potential successes dictates their self-efficacy (Nolan & Molla, 2017; Sinquefield, 2016). Secondly, there is an efficacy expectation. This is an individual's conviction about personal abilities to use a strategy to achieve a targeted outcome (Kavita et al., 2016; Kizuka, 2019; Suntonrapot, 2019).

Teachers Self-Efficacy

Participants shared that they are very comfortable implementing the CGI strategies. Even at first, it was frustrating because they were introduced to a new concept and way of teaching. However, a few participants said there was a lot of teacher resistance because they all grew up with the standard algorithm learning strategy and were initially reluctant to employ these strategies. Teachers with low self-efficacy in math have increased discomfort in the profession, and may affect their students' learning prospects (Conowal, 2018; Giles et al., 2016; Guerrero, 2014; Katz & Stupel, 2016; Walters, 2018). Teachers need to have self-efficacy because this can increase their enthusiasm toward CGI strategies when teaching mathematics in their classrooms (Gadge, 2018). Otherwise, the motivation may not be there.

There is a direct relationship between outcome and efficacy expectations. Teachers must believe in CGI strategies and see their value in helping students improve their performance in mathematics, as this is the targeted outcome (Bobis et al., 2016; Sinquefield, 2016). Teachers must also believe in their abilities to successfully implement CGI strategies because teacher input is key to developing students' problem-solving skills and academic success.

Tom (2019) and Berger (2017) suggested that the personal beliefs adopted by teachers about their ability to use CGI or the efficacy of using CGI in their mathematics classroom ultimately determine whether they are open to implementing them. My findings revealed that participants believed that teaching CGI strategies is a more effective way of teaching and is just a new way of teaching math. Most participants welcomed a change from the standard way of teaching and adapted to the new CGI strategies. CGI is used to create and nurture a belief in a positive attitude within the mathematics teacher. CGI enabled the mathematics teacher to see the potential of capitalizing on children's cognitive skills to enhance their understanding of mathematical concepts (Rodriguez et al., 2022). For this belief to be fostered, self-efficacy is required (Diamond et al., 2018; Francis, 2015; Jacobs et al., 2017; Nolan & Molla, 2017; Sinquefield, 2016). Teachers need to have the conviction that they can achieve successful outcomes with CGI in the mathematics classroom to consider implementing the recommended strategies.

Improving Confidence

According to O'Keeffe et al. (2019), mathematics teachers require support and resources for their confidence levels towards using CGI strategies in their mathematics lessons to be high at all times (see also Candela & Boston, 2019; Schoen, LaVenia, Bauduin, et al., 2017, 2018). Findings revealed that participants are very confident in implementing the CGI strategies. The teacher must possess impeccable skills that can help identify each student's unique strengths and capitalize on them to improve performance in mathematics (Conowal, 2018; Diamond et al., 2018; Jacobs et al., 2017; Norton, 2017**;** Noviyanti, 2020; Stoehr, 2017).

Teachers must exude confidence in their practice to become effective. One participant revealed that she has always been confident in her math skills. The more a teacher feels that they understand a particular subject, the more confident they are when teaching it in the classroom (de la Cruz, 2016; Nielsen et al., 2016; O'Keeffe et al., 2019). The more a teacher feels that they understand a particular subject, the more confident they are when teaching it in the classroom (de la Cruz, 2016; Nielsen et al., 2016; O'Keeffe et al., 2019).

Confidence also impacts teacher knowledge about CGI strategies and how they can be used to boost student performance in the mathematics classroom. Findings showed that participants work as a team, have meetings, talk about strategy, look at student work together, and talk about outcomes which increases confidence level. If teachers believe that their efforts on CGI are successful, then the belief that they would be successful in similar or related tasks in the future increases (Black, 2015; de la Cruz, 2016; Diamond et al., 2018; Guerrero, 2014; Phan, 2017). Findings showed that participants are resilient, determined, and willing to go the extra mile in gathering resources to succeed. This is the case with CGI, as the teacher's confidence guarantees successful outcomes (Larkin, 2016; Mccullouch, 2016; Nolan & Molla, 2017).

Challenges With Cognitive Guided Instructions

Findings also revealed that participants mentioned reverting to the CGI method was frustrating; however, after much patience and hard work, everything fell into place and made sense. This validated the work of Tom (2019) and Berger (2017), who identified that the personal beliefs adopted by teachers about their ability to use CGI or the efficacy of using CGI in their mathematics classroom ultimately determine whether they are open to implementing them. Findings revealed that most participants felt challenged at the onset of the new program; however, with adequate resources and support, they could feel more at ease working with the children. When teachers do not have essential resources and enough knowledge of a pedagogical method, they have low self-efficacy and confidence, negatively affecting student learning (Black, 2015; Moscardini, 2014; Nolan & Molla, 2017).

The success of CGI strategies in teaching depends on how confident teachers are when using them in a math classroom. Participants agreed that there are challenges and working with the parents can be challenging, and the finding also found that participants felt challenged because of the language barrier. The participants felt that there is a challenge in oral communication as children often cannot explain aspects of their work in detail. Bailey et al. (2017) suggested that lessons about CGI are valuable for teachers to make them more effective at using these strategies in the mathematics classroom. One participant, however, used her challenge positively by challenging her student in math games. Nurlu (2015) noted that teachers with positive self-efficacy and strong confidence in their instructional strategy are attentive to students' individual needs. Lazarides et al. (2018) further explained that positive teacher perceptions of self-efficacy and confidence help teachers to have greater enthusiasm toward a subject.

CGI Resources

When participants are combined with high levels of support, there is a guarantee that the efficacy of mathematics teachers towards CGI strategies in their classrooms increases (Candela & Boston, 2019; Conowal, 2018; Lopez-Agudo, 2017; Walters, 2018). Findings showed that participants felt they were given adequate resources and support from their districts. Participants also make use of apps to help those children who are struggling. Amador (2019) suggested that schools provide enough resources and support to implement CGI strategies in their classrooms successfully. Resources and support include manipulatives, the support of paraprofessionals, access to information, and avenues to collaborate with other teachers or professionals in the field of education to discuss ongoing issues (Amador, 2019; Bottge et al., 2018; Caniglia & Meadows, 2018; Hemmi et al., 2018; Kirsti et al., 2018; Lee et al., 2016; Nielsen et al., 2016; Seah, 2018), such as new strategies to make CGI more effective in the mathematics classroom (Jacobs et al., 2017). Findings also showed that participants always find supplementary resources to use in the classroom.

Abu Seman and Rosanti (2019) suggested that teacher is encouraged to make use of concrete materials in the explanations of mathematical ideas during the lesson. Results revealed that participants constantly reach out to instructional coaches and other specialists provided by the district for support and best practices ideas in the classroom. They mentioned that some teachers take advantage of it while some do not. Results also revealed that participants always reach out to other teachers for ideas. This supports Walters (2018), who noted that teacher support is necessary to help teachers decipher the thinking skills of students in the mathematics classroom and use them to enhance the comprehension of mathematical problems

Expanding CGI

The input of other professionals with experience using CGI is vital to help teachers get comfortable using these strategies in their classrooms. For this belief to be fostered, self-efficacy is required (Diamond et al., 2018; Francis, 2015; Jacobs et al., 2017; Nolan & Molla, 2017; Sinquefield, 2016). The teacher must have the conviction that they can achieve successful outcomes with CGI in the mathematics classroom to consider implementing the recommended strategies. Findings revealed that teachers gather best practices for their children and put together books and other supplementary materials to use when they need them.

When implementing and using CGI strategies in the mathematics classroom, teachers' confidence is impacted by the availability of resources. Having the resources required encourages using CGI strategies even when experience is lacking. Creating resources needed to implement CGI strategies successfully can be lengthy, complicated, and time consuming (Diamond et al., 2018; Myers & Cannon, 2018). Findings revealed that teachers use manipulatives regularly to work with children in the classroom. They also mentioned using online resources as supplementary resources to assist them when implementing cognitively guided instruction in the classroom.

Findings also indicated that participants use their state standards to assist students with the CGI strategies in the classroom. Conowal (2018), Walters (2018), and Guerrero (2014) expressed a need to determine what is essential for a math teacher to feel successful when implementing CGI. Findings revealed that teachers find CGI very important for children struggling, and it is nice to see new teachers coming into the program using the CGI strategies. This is reiterated by Corbell et al. (2010), who explained that supporting teachers is vital to maximize their skills and minimize costs associated with hiring new teachers more often due to high employee turnover rates

CGI Professional Development

Findings indicated that participants overwhelmingly agreed that professional development connected to using CGI strategies in the classroom is essential. Results revealed that districts halted the professional development training when schools were closed due to Covid-19. Candela and Boston (2019) explained that teachers could improve their implementation strategies when they have professional development opportunities in teaching difficult subjects such as mathematics and science. Findings showed that most teachers welcome professional development once or twice during the year, some would like to see it done four or five times and others want to see it done during the summer or instructional time.

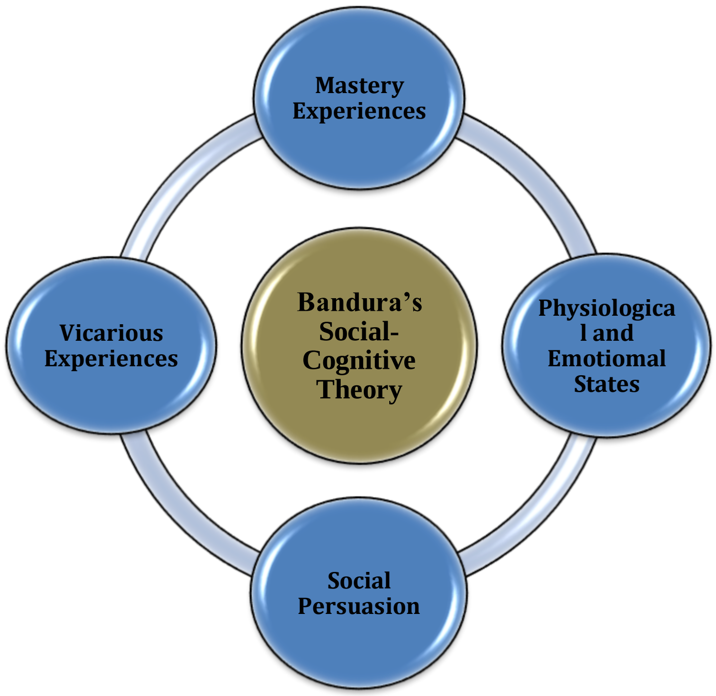
Findings revealed that even though participants differ on the occurrence of professional development, Black (2016) suggested that administrators arrange teacher peer learning or peer observation sessions so that teachers can help each other learn how a CGI style works and in what ways approaches are integrated into a classroom setting. When teachers thoroughly understand CGI strategies, they are more confident and better equipped with all the necessary skills to use them successfully. Caparas and Taylor 2019 and de la Cruz (2016) discussed CGI as one of the approaches that can be applied to enhance professional development for teachers allowing them to be more effective at teaching mathematics.

Theoretical Framework Alignment

Bandura’s (1977) social cognitive theory of learning looks at learning from the experience of others rather than strictly requiring the individual to receive reinforcement or punishment. Bandura believed that direct reinforcement alone could not account for all types of learning. Bandura’s social cognitive theory is discussed in four primary sources that shape individuals' self-efficacy through mastery experiences, vicarious experiences, social persuasion, and emotional and physiological, as depicted in figure 1 below. Each source provides the foundation of this analysis and leads the way to deriving the methods used.

Figure 1

Bandura's Social Cognitive Theory of Learning



The results from this study can be applied to these sources, emphasizing the support for teachers to implement CGI strategies in the classroom. Findings indicated that participants follow the learning theory as they allow the student to develop their strategies for solving mathematical problems. Results also revealed that children could engage in free appropriate classroom speech through discussions. Findings revealed that children are free to express self-efficacy as individuals' self-beliefs about the capability to create determined behaviors on the actions that affect their daily lives.

Limitations of the Study

While the purpose of my study was accomplished, the following limitations could affect the interpretation of the results. The first limitation ensued because of the Covid-19 pandemic, which allowed for limited in-person visitation to the school compound. Therefore, interviews were done on zoom. These interviews were done between lunchtime and outside instructional hours; therefore, home responsibilities sometimes distracted teachers.

The second limitation resulted from recruiting participants from only four schools in the district. Participants who responded to the email were recruited through the snowballing procedure. Participants recruited through the snowballing procedures were mostly from the same school campuses. Therefore, they had similar experiences when answering the research questions. The third limitation was conducting this research with a small group of participants. There are over 1,500 teachers in this district, and interviewing 13 participants may not be a valid representative of the schools in the district as qualitative interview studies have typically reported a minimum participant sample size of 20.

Finally, I was limited to my personal bias as an educator as I have experience in observation and classroom teaching management. I allowed my experience as a teacher to help to understand the teachers' perspectives and referred to my researcher's journal to record my biases as I redirected my focus. I reflected on my recordings to ensure that my bias did not affect the research findings.

Recommendations

Numerous authors of recent research concerning cognitive learning identified deficiencies in using Cognitively Guided instruction in teaching and learning mathematics in K5 classrooms, as shown in the literature review. As established in previous chapters, challenges when implementing CGI in K-5 mathematics classrooms still require buy-ins. They are linked to a drop in teacher self-efficacy, affecting the overall system's efficiency. American Psychological Association (2022) establishes that self-efficacy is the individual’s ability to carry out the necessary characteristics concerned with the required performance outcomes. In this regard, perceived self-efficacy is one’s capacity to effectively control motivation, social environment, and behavior (American Psychological Association, 2022). In connection with this, it has also been established that teachers implementing CGI in teaching mathematics have specific support requirements necessary for their optimum input that ensures students benefit from the program to the maximum. In this regard, the numerous recommendations below are necessary to help boost teachers' self-efficacy as they apply CGI in teaching mathematics in K-5 classrooms. I concluded with several recommendations.

I recommend that future qualitative research studies should ensure that they apply a wider sampling size to provide more inclusive and transferable data findings. To achieve this, Dell, Holleran, and Ramakrishnan (2002) present four factors that must be identified when calculating the sample size. These include the population deviation for the continuous data, the effect size, the difference between two groups, the study's significance level, and the study's desired power to detect the postulated effect of findings.

I recommend that it is paramount for all researchers to establish a more conducive timeframe that is achievable for both the participants and me alike. In this regard, all researchers conducted a preliminary field study and contacted all relevant individuals to identify the best research time. In connection with this basic qualitative study, future research should conduct research during the mid-school season when the teachers are not bogged down by too much work and responsibility.

Recommendation For Future Research

Conclusively, the results and the overall findings of this qualitative research on using Cognitively Guided instruction in mathematics teaching are highly beneficial in K-5 classrooms. This is evidenced by the fact that most students significantly improved their mathematics performance. This was also emphasized by the fact that almost all students in the participating classrooms reported improved attitudes concerning learning mathematics (Becker, 2021). Additionally, numerous teachers showed improved self-efficacy toward their overall teaching attitudes. In essence, many participating teachers had positive remarks about using CGI in teaching mathematics. A common perspective among the 13 participants of this study was that CGI was beneficial and offered much direction and planning support to students in K-5 classrooms. Amidst these positive remarks concerning CGI, I recommend that future research widen the scope of the study to establish if CGI could be as effective in other levels of mathematics learning. Finally, future research should examine if Cognitively Guided instruction could be applied to other fields of education and not just focus on its application in teaching mathematics. Findings from such future research could also help determine this phenomenon's transferability in other fields.

Furthermore, I would conduct research to explore the impact of CGI on learning in other subject areas. Although the study concentrated on mathematical strategies, it would be interesting to see the implementation in other subject areas. I recommend that the research be extended to include a larger population of representatives from each school in the district. This study's findings represent participants' views of the four schools represented only and may not be that of the entire district. The results of a study of this nature could be beneficial to schools as students constantly struggle with math which is a recurring dilemma in the classrooms.

I recommend that research draws attention to teachers to maintain a collaborative effort in organizing meetings, get-togethers, or other opportunities to share classroom best practices. As we live in a changing world, strategies can become obsolete, and applying new strategies can make a difference in the lives of children. I recommend that attention be drawn to the relationship between the teacher, parents, and students. These relationships change over time, and the student might play a small part in those changes, which can affect the values and opportunities in life. Parents are an integral part of the children and school lives. Understanding these relationships can create a positive teacher-student relationship, promote academic success, help to develop self-worth, and improve interpersonal and professional skills.

Implications

The implications for positive social change include building on our strengths to create much better results. This research study helped to fill the gap in bringing awareness to teachers' attitudes and pedagogy employed in the classroom. Teachers' perceptions of the use of cognitively guided instruction in mathematics classrooms are important in bringing awareness to the classroom strategies employed by teachers to create an atmosphere for learning. Results have shown that teachers are genuinely interested in their children's progression and use various strategies to assist children. Results also found that teachers seek supplementary resources such as surfing the web for available activities, crate book clubs, and some team meetings to collaborate on classroom strategies. It was revealed that although most teachers would apply CGI techniques and consciously work with students to develop mathematical skills, some would not apply the strategies in their classrooms.

Mathematics has been a significant problem across the school campus, and it is one of the most challenging subjects within the curriculum. It has become an essential issue in schools and created nationwide concern and the lack of effectiveness within educational programs in addressing the issue. Teachers are not prepared with the knowledge required for appropriate interventions. To help students and schools conquer the problem, the implementation of CGI strategies can prove successful in doing so.

The result of this study recommended that teachers engage in professional development specific to CGI strategies. This may enable teachers to become more aware of classroom strategies and work with students in developing mathematical skills adequately. They would collaborate on ideas and create consistency with the staff when implementing CGI strategies.

The benefits of this study may also contribute to the existing classroom initiatives used by participants. The results suggested that most participants apply CGI strategies and find ways to address children's needs in the classroom. While the results revealed that most participants welcome the new strategy, some do not apply it in their classrooms. Participants revealed that the strategy benefit students and would hope for buy-in for all teachers.

Findings revealed that participants use the internet and other technology to provide supplementary classroom materials. They are always looking for support from the district and their fellow teachers. This is important as teachers can work together for a common purpose while building trust and confidence with each other. This also created consistency in working to implement the CGI strategies. Such a strategy benefits students as they can engage better in learning. This facilitated a positive classroom community.

Conclusion

This study explored teachers' perceptions of using cognitively guided instruction in mathematics classrooms. The study's results depicted participants' responses as they described CGI strategies used in the classroom. Participants shared their experiences using CGI strategies in teaching mathematics to K-5 classes. Most participants described numerous challenging occurrences during the initial application of the program. Most teachers reported more challenging than rewarding experiences when implementing CGI. According to Becker (2021), CGI is quite intimidating and challenging without the proper training on how effectively it can be implemented in teaching mathematics in K-5 classes. However, after much support and provided resources, participants became comfortable and confident implementing the strategies

Results revealed that CGI strategies allowed teachers to present numerous learning possibilities to students. This is essential in establishing the wide reach of the program as it enables students to explore their intuitive understandings, which offers them a deeper grasp of mathematical principles. Participants used manipulatives and other resources to assist in implementing the strategies. Participants revealed that CGI exposed them to a different way of teaching mathematics.

Participants experienced high levels of self-efficacy in using the CGI program. They are very confident and committed to assisting children in using the strategies. As such, one aspect that can influence how prepared instructors are for organizational change is self-efficacy or confidence in one's ability to succeed in one's actions. The results indicated that using cognitively guided instruction to teach mathematics in K-5 classes increased participants' feelings of self-efficacy. In essence, the teachers were convinced that CGI was beneficial and offered a lot of direction and planning support. One participant indicated that her level of self-efficacy increased as she saw the regular progress that her students made in mathematics after implementing the CGI program in her class.

Examining teachers' confidence levels in the study was crucial since different feelings and perspectives, such as lack of confidence, reluctance to change, and self-doubt, can influence how teachers interact with new school reforms. The literature review indicated that teachers' ability to educate and react to reforms is affected by the teacher's personal beliefs and attitudes (Conowal, 2018). For all participants in this study, the confidence level was vital as it influenced how well the teachers could implement and teach mathematics using CGI. Although all discussed confidence issues while undertaking the program, most had differing comments about their confidence levels. Results revealed that some felt that the program increased, diminished, or had no impact on their confidence levels. However, participants were convinced that the cognitively guided instruction program increased their confidence levels, indicating that the program's efficiency had beneficial results in teaching mathematics. Results showed that the program had boosted confidence in teaching

Participants expressed their approval of the CGI program, and all had positive comments concerning the use of the program in teaching mathematics. The positive remarks were mainly due to the positive results most participants had experienced while using the program. Participants highlighted that one selling point of the program was that it instilled a love for learning into most of the students who experienced the program as opposed to the traditional math curriculum. The CGI program allowed students to actively engage in exciting and fun learning, which was vital as it ensured students developed a love for learning mathematics outside the classroom.

My utmost goal in conducting this research was to bring awareness to teachers' perceptions of using CGI strategies in the classroom. Students feel a sense of accomplishment when they have the autonomy to cultivate their learning. When teachers are provided with adequate resources and support, they are prepared to perform effectively. They are empowered with strategies to become change agents, empowering their students with 21st-century skills to contribute to social change.

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Appendix A: Superintendent Invitation to Participate

Dear (name)

I am a doctoral student at Walden University. As a part of my dissertation requirements, I am conducting an analysis whose purpose is to understand the lived experiences of elementary teachers who are using CGI methods in math instructions. The purpose of this study is to explore the perceptions of K-5 teachers about their confidence in using Cognitively Guided Instruction (CGI) strategies in the mathematics classroom and the resources or support that they feel are necessary to aid in the implementation of these strategies successfully.

I am including my proposal in this email for you to review.

This analysis will involve interviewing teachers from two school districts about their experience and perceptions of self-efficacy and confidence in using CGI strategies to teach mathematics and to identify the resources and support they need to implement CGI strategies successfully. Like most schools in California, they begin the new school year with virtual learning because of the pandemic. Therefore, I plan to do a virtual interview, but if school starts in-person classes before my interview occurs, I will do an in-person interview. I anticipate that I will be conducting my interviews in November and December of this year. The interview questions I plan to ask are listed in Table 2 of this chapter. I am humbly asking permission from you to approach teachers employed at 2 schools from each district to ask them if they would like to participate in this piece of research. I am considering recruiting 10-15 teachers to participate in this research, with a target of 3-4 teachers from each of the K-5 grade levels. Their participation would include consenting to one 30-45-minute virtual interview and one 30-45-minute follow-up interview (if needed), as well as taking time to confirm the accuracy of my interpretation of their interview data via email. The interviews will take place virtually through Zoom. Confidentiality of the school district, school site, and teachers will be maintained throughout the study. If multiple school districts agree to participate in my study, I anticipate only needing to interview 3-4 teachers from each individual school district.

If you consent to have me recruit participants from (insert name of school district) once I obtain IRB approval, please complete and return the attached Letter of Cooperation form via mail or email. Electronic signatures will be accepted.

Please contact me via email or via phone if you have any questions or need additional information. I am looking forward to starting my interviews and offering suggestions that have the potential to improve teacher efficacy and mathematics education.

Thank you in advance for your consideration.

Best regards,

Irin S.

Appendix B: Teacher Invitation to Participate

Dear (insert name),

I am a doctoral student at Walden University. As part of my dissertation requirement, I am conducting an analysis whose purpose is to understand the lived experiences of elementary teachers who are using CGI methods in math instructions and explore the perceptions of K-5 teachers about their confidence and self-efficacy in using Cognitively Guided Instruction (CGI) strategies in the mathematics classroom, and the resources or support that they feel are necessary to aid in the implementation of these strategies successfully. I have received approval from the (insert name of school district) administration to invite you to participate in my doctoral study entitled Teacher Perceptions of the Use of Cognitively Guided Instruction (CGI) Mathematics Classrooms. I hope that this study enabled me to suggest ways that teacher training programs and school districts can better support teachers of identified gifted students. I am excited to complete the last phase of my project, and share the results with all teachers who agree to partner with me.

Please view the attached Dissertation Research Consent Form to learn more about my project. If you agree to participate, I ask that you sign and return the Dissertation Research Consent Form to me via mail (Teacher address) or email (Teacher email). Electronic signatures are acceptable. Please contact me via email or via phone (Teacher phone number) if you have any questions or need additional information. I am looking forward to starting my interviews and obtaining information that has the potential to improve teacher efficacy and mathematics education.

Thank you in advance for your consideration.

Best regards,

Irin Sultana

Appendix C: Opening prompts:

1. How many years of teaching experience do you have?
2. What other grade levels have you taught?
3. How long have you used the CGI strategies?

Interview Questions

RQ 1: What are the teachers' perceptions and experiences towards CGI strategies used in teaching mathematics?

1. Can you describe your experience using the CGI strategies?

Follow up: How effective do you think the CGI strategies are on student success

2. Would you describe how your self-efficacy was different (if at all) from using the CGI strategies to not using the CGI strategies?
3. How confident do you feel when you implement CGI strategies in your math instructions?

   Follow up: what elements can help improve your confidence in CGI?
4. Can you describe some of the strategies in CGI that you have used to develop students' mathematical thinking abilities?
5. What do you observe as challenges, concerns, or obstacles that you face as you implement CGI in your classroom? Can you describe why?
6. How did you overcome potential challenges as you implemented CGI in your classroom?

RQ 2: What support or resources do teachers need to improve their self-efficacy in using CGI strategies more consistently in mathematics classrooms?

7. What kind of resources and support do you think might benefit you?
8. What resources and support did you use during CGI instruction?

   Follow up: Are there other resources and support that can help you improve CGI instructions?
9. What challenges are you facing because of a lack of resources?

   Follow up: Do you think having enough resources and support can enhance your self-efficacy in CGI implementation?
10. What kind of resources and support do you recommend for expanding CGI implementation?

    Follow up: Why did resources and support impact your practice?
11. Do you think having frequent professional development enhances your self-efficacy and confidence in using CGI methods?

    Follow up: how often do you think you should receive professional development?