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PERCEPTIONS OF THE IMPACT MATHEMATICS SUPPORT CLASSES HAVE ON STUDENT ACHIEVEMENT

by

CORDARYL CHARLES MIDDLETON

(Under the Direction of Teri Denlea Melton)

## ABSTRACT

Many students today struggle with mastering grade-level mathematics standards. School leaders have implemented mathematics support classes as a possible solution; however, not all students are showing significant improvement. The challenge is determining an effective mathematics support class that has the most positive impact on student achievement. As a result, the purpose of this research study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact mathematics support classes had on student achievement. This study employed a qualitative case study research design that consisted of one overarching research question and three sub-research questions that framed this research study that sought to uncover best practices within the mathematics support class, barriers within the mathematics support class, and ways in which the mathematics support class could be improved. Interview data were obtained from middle school personnel consisting of three triads of principals, mathematics teachers, and mathematics support teachers, with a total of nine participants, in a suburban public-school system in the state of Georgia during the Spring of 2020. The findings of this study provided insight of the perceptions of middle school educators on the impact mathematics support classes had on student achievement. Descriptive data analysis was conducted to determine commonalities and provide recommendations regarding

mathematics support classes in order to increase student achievement in mathematics. As a result, the analysis of data uncovered six overarching themes: best practices identified were implemented instructional strategies; barriers included lack of students' cognitive ability and skills, lack of educator's subject and pedagogical knowledge, and conditions of the class; and, improvements consisted of structure of the class and recommended instructional strategies. It can be concluded that the implementation of the mathematics support class was not as impactful as expected due to the myriad of barriers that exist. While there was not a mathematics support class that was deemed effective, the findings expressed a need to re-evaluate the current mathematics support class and make adjustments to meet the needs of the students to increase student achievement.

INDEX WORDS: Interventions, Mathematics, Mathematics achievement, Mathematics support class, Middle school, Perceptions, Prerequisite mathematics skills

# PERCEPTIONS OF THE IMPACT MATHEMATICS SUPPORT CLASSES HAVE ON STUDENT ACHIEVEMENT

DISSERTATION

by

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A Dissertation Submitted to the Graduate Faculty of Georgia Southern University

in Partial Fulfillment for the Requirements for the Degree

DOCTOR OF EDUCATION

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# PERCEPTIONS OF THE IMPACT MATHEMATICS SUPPORT CLASSES HAVE ON STUDENT ACHIEVEMENT

by

CORDARYL CHARLES MIDDLETON

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# DEDICATION

This dissertation is dedicated to my spiritual partner, my best friend, my wife: Tikki Middleton for encouraging me throughout this process and being my rock when I needed you the most. I am truly blessed to have you in my life and thank you so much for your love and support throughout this process. I love you immensely.

Also, this dissertation is dedicated to my three sons: Ezzard, Thomas, and Cortland. Through this journey, I know that my time was very limited, but you all understood the process in which this journey took. I am so thankful for you all and know that hard pays off and you can do anything you put your mind to. I love each of you.

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I thank the Richmond County School System Board of Education and Senior Leadership for giving me an opportunity to lead in such an amazing district where I can have impact on the lives of the students that I encounter on a daily basis. Your investment into me is unremarkable,

and I must say that I love what I do every day in helping individuals identify their purpose. #MoveOnPurposeWithAPurpose

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# CHAPTER 1

## INTRODUCTION

Mathematics has become one of the most essential subjects for students to comprehend and endure. Although students encounter mathematics in their everyday lives, in formalized mathematics classrooms, they are challenged with developing a clearer and more in-depth understanding of the various mathematics concepts. According to Boaler (2014), "a third of all schoolchildren end up in remedial mathematics courses, and the level of interest in the subject is at an all-time low" (p. 469). Students' low-interest level in mathematics can be attributed to students' experiences with mathematics and the consecutive years of struggle with understanding mathematics concepts that result in many students developing intense mathematics anxiety. Luttenberger, Wimmer, and Paechter (2018) stated in a national survey that "approximately 93% of adult US-Americans indicate that they experience some level of mathematics anxiety. Estimations are that approximately 17% of the US-American population suffers from high levels of mathematics anxiety" (p. 312). Consequently, both the mathematics struggle and mathematics anxiety become some of the underlying causes of students' inadequate performance in mathematics.

According to the International Association for the Evaluation of Educational Achievement's Third International Mathematics and Science Study (IEAs TIMSS 2015; as cited in Ryan 2013), students in the US are not performing as well as students in other countries, such as Singapore and Korea, in mathematics because other countries are focused on rigor and higher-order thinking skills. Students in other globalized countries are more self-motivated and highly involved in their learning processes because they are challenged at various levels (Ryan, 2013). In fact, many students in other countries initiate their own learning processes by teaching

themselves how to solve various mathematics problems or algorithms. Additionally, these students employ their higher-order thinking skills to derive solutions to mathematics problems. However, many students in the US lack the interest and motivation to be challenged at various levels of rigor due to the lack of familiarity with concepts (Ryan, 2013). Students tend to prefer mathematics concepts that are simple to do and understand. In addition, students in the US rely heavily on the teacher and the textbook to teach them how to derive solutions to mathematics problems. The lack of self-sufficiency is prohibiting students from tapping into their higher-order thinking skills; instead, leading students to employ surface-level thinking by mindlessly memorizing mathematics material (Inprasitha, Kongthip, Sangpom, & Suthisung, 2016). The employment of surface-level thinking "results in students' inability to concretely learn, fully comprehend and understand mathematical concepts and practices" (Inprasitha et al., 2016, p. 72). Consequently, students in the US experience a mathematics disadvantage because they are not accustomed to rigorous mathematics as students in other countries that have seamlessly embedded these strategies in their mathematics curriculum.

Changes to the mathematics standards from Georgia Performance Standards to Georgia Standards of Excellence now require students in Georgia to develop a deeper understanding of mathematics (GaDOE, 2015). In addition to the changes in the mathematics standards, students are now evaluated using a more rigorous assessment called the Georgia Milestones Assessment (GMAS). The GMAS requires students to complete selective responses and show their understanding by completing both constructed responses and extended constructed responses, which require students to justify their answers through writing. Although the Georgia Department of Education (GaDOE) is trying to make mathematics learning more in-depth via testing for students in the state of Georgia, it is evident that students are experiencing a

considerable amount of difficulty in achieving the new expected mathematics level of performance. Examining the overall mathematics performance for students in 6th through 8th grade on the Spring 2019 GMAS administration, 22% of the students scored in the achievement level of beginning learner, and 36% of the students scored in the achievement level of developing learning (GaDOE, 2019). Beginning learners are defined as "learners who do not yet demonstrate proficiency in the knowledge and skills necessary at their specific grade level/course of learning, as specified in Georgia's content standards" (GaDOE, 2015, p. 1). Developing learners are defined as "learners who demonstrate partial proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified by Georgia's content standards" (GaDOE, 2015, p. 1). Based on the Spring 2019 GMAS administration, it is evident that 58% of the students in 6th through 8th grade in the state of Georgia are struggling in mathematics. The GaDOE (2015) recommends that a student who is classified as a beginning learner "needs substantial academic support to be prepared for the next grade level or course and to be on track for college and career readiness" (p. 1). Additionally, the GaDOE (2015) recommends that a student who is classified as a developing learner "needs additional academic support to ensure success in the next grade level or course and to be on track for college and career readiness" (p. 1). Therefore, school leaders are challenged with providing low performing students, as defined by the GMAS, with the necessary academic support in moving students to either the expected achievement level of a *proficient* or a *distinguished* learner.

Proficient learners are defined as "learners who demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards" (GaDOE, 2015, p.1). Distinguished learners are defined as "learners who demonstrate advanced proficiency in the knowledge and skills necessary at this grade

level/course of learning, as specified in Georgia's content standards" (GaDOE, 2015, p. 1). The expected achievement levels demonstrate the student's proficiency based on the obtained knowledge and skills of the grade-level standards. In addition, performance at the expected achievement level ensures students are prepared for "the next grade level or course and are on track for college and career readiness" (GaDOE, 2015, p. 1).

As previously indicated, 58% of students in 6th through 8th grade in the state of Georgia are struggling in mathematics. Middle school leaders have implemented mathematics support classes as a possible solution for supplementing students' core mathematics classes to broaden students' understanding of mathematics and to close mathematics gaps directly related to prerequisite skills. A mathematics support class is defined as a class that provides students with additional support in meeting grade-level standards. This class is taught concurrently with the student's other grade-level mathematics class. Within the mathematics support class, students are provided with additional time and are exposed to multiple instructional strategies and interventions to aid in the development of adequate mathematics skills to be successful in the current mathematics class and future mathematics classes and to perform at a proficient or higher level on state assessments ("Georgia Standards," n.d.). Studies (e.g., Bragelman, Martinez, & Stoelinga, 2016; Durwood, Krone, & Mazzeio, 2010) have revealed that the implementation of the mathematics support class has resulted in students developing the necessary mathematics skills that are needed and an increase in academic gains for students who are enrolled.

Despite the implementation of mathematics support classes, students continue to perform poorly on state-mandated tests such as the GMAS, which has a negative impact on the school's overall College and Career Readiness Performance Index (CCRPI) score. With this setback, school leaders are still faced with the challenge of increasing students' performance in

mathematics and are strongly encouraged by both the local board of education, as well as the GaDOE, to revise the school's current action plan or develop other potential action plans to remedy this problem. Failure to do so could result in a decrease within the school's CCPRI score, which could cause a school to be classified as *low performing school* where additional monitored support is provided to the school from both the local and state level to aid in improving the school's overall performance (GaDOE, 2015).

## Background

The development of a society is heavily measured by the quality of education that is provided. Within each culture, educational systems have been established to collaborate in the development of educational systems that promote quality education, express the uniqueness of the socio-cultural identity, and identify educational challenges of the times (Adjabui, Asiedu-Owuba, & Churcher, 2014). One would agree that a continuing educational challenge of the time is in mathematics education. The importance of providing quality mathematics education instruction is at the forefront for many educational systems due to students' low performance on state assessments, which has a negative impact on the educational systems' measurement tool of effectiveness and achievement in mathematics. Due to a high percentage of students' low performance in mathematics, educational systems attempt to develop and implement other strategies, such as mathematics support classes for low performing students, with hopes for a potential solution. Despite these mathematics support classes; student achievement is not improving as anticipated. There are some mathematics support classes, but not all, that are producing positive results. Perhaps the different models or elements of the mathematics support classes are believed to produce better results. There is, in fact, a distinct need to study the implementation of the mathematics support classes to determine which model yields higher

academic success. The background will address students' struggle in mathematics and a potential solution to overcome the struggle in mathematics and increase students' achievement by discussing the current mathematics achievement, the mathematics support class itself, and the barriers that exist within the mathematics support class.

**Mathematics Achievement**

The struggle in mathematics among students in 6th through 8th grades in the state of Georgia is at the forefront with school leaders. School leaders must face reality and try to address the challenge that has been presented to them. Georgia students' low performance in mathematics has produced an adverse impact on students' achievements on mandated assessments and has further negatively affected schools' overall CCRPI score, leading students not to be on track for college and career readiness and schools potentially to be labeled as low performing (GaDOE, 2015).

Students' mathematics struggles begin at an early age, and most students continue to struggle in mathematics throughout their educational careers (Chang & Beilock, 2016). Students fall below the expected mathematics achievement level for multiple reasons. According to Shellard (2004), students are "unable to see the larger picture, make associations, or remember basic facts" (p. 41). Also, Sherman, Richardson, and Yard (2014) posited that the reason students fall below the expected mathematics achievement level is that students "never understood mathematics, or never liked it because it was too abstract, and it did not relate to them" (p. 1). These identified reasons make it difficult for students to be successful in mathematics and lead students to develop mathematics anxiety that remains active as students matriculate throughout their educational careers (Chang & Beilock, 2016).

**Mathematics Anxiety**. With mathematics challenges faced by the students continually, students begin to develop a strong dislike for mathematics, which further develops into anxiety. "Mathematics anxiety is the feeling of worry, frustration, agitation, and a fear of failure with regard to taking a mathematics class, completing mathematics problems, and/or taking a mathematics exam" (McMahon, 2015, p. 1). Ching (2017) further explained that "mathematics anxiety refers to the feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic situations" (p. 99). Mathematics anxiety is crucial and hinders students' ability to effectively perform well in the mathematics classroom due to the fear that has been developed. As McMahon (2015) stated:

> Unfortunately, when faced with a mathematics problem that he or she does not understand, the child suffering from mathematics anxiety becomes filled with negativism and focuses on that, distracting him- or herself from attempting to work through the problem. Furthermore, this distraction can start a negative cycle in which the same child rushes through the problem and makes a mistake because he or she is not focusing on the problem itself. (p. 1)

As a result of rushing through the problems, students are unsuccessful at correctly solving the problem and are furthered affected by the low grade received, which in turn leads to the development of more intense mathematics anxiety. With the development of mathematics anxiety, students cringe when faced with mathematics problems. Ching (2017) conducted a study that "examined the longitudinal associations between mathematics anxiety and mathematical performance in 246 Chinese children followed from second to third grade" (p. 99). Based on study findings, Ching (2017) concluded that mathematics anxiety is directly associated with poor

performance within the classroom as well on state-mandated assessments. In addition, the "severity of mathematics anxiety in children tended to increase over time" (p. 100). As a result, students' mathematics ability is directly impacted, and students either fail mathematics courses or perform at a minimal level, essentially doing just enough to pass mathematics courses without fully developing a clear understanding of the different mathematics concepts. The compound effects of consecutive years of mathematics challenges lead to poor performance and low scores in the classroom as well as on state assessments. As a result of the mathematics struggle and the development of mathematics anxiety, students must have "high-quality teaching, but well-planned instruction explicitly structured to develop a specific sequence of skills" (Shellard, 2004, p. 41). With this support, low performing students, students who are not performing on grade level, may be able to reach the expected mathematics achievement level.

**Prerequisite Mathematics Skills**. For students to meet the expected achievement level, they must perform satisfactorily in the prerequisite mathematics skills, because prerequisite mathematics skills are needed for students to be successful in other mathematics concepts. However, "students lack well-developed mental strategies for remembering how to complete algorithmic procedures and combinations of basic facts" (Sherman et al., 2014, p. 1). Students are not challenging themselves to remember the necessary procedures and facts to be successful in mathematics concepts, which hinders overall performance.

In addition to the lack of the students' memory ability, students have trouble understanding the language of mathematics. Within mathematics, there is an enormous amount of terminology that students must know to be successful. When mathematics terms are presented, students develop a sense of confusion, which negatively impacts their overall performance. Sherman et al. (2014) suggested terms such as "multiple," "power," "factor," and "area," if not

understood by students, could create a misconception among the students' understanding of the terms. Consequently, students' ability to select the appropriate operations for the algorithms and problem solve could be impacted.

**Mathematics Support Class**

Due to students' lack of performance on standardized testing, educational systems are mandated to intervene to support students' performance. One way in which support is provided is by filling in mathematics gaps by requiring underprepared students to take two mathematics classes: one class serving as the core mathematics class and the other class serving as a mathematics support class. In essence, not all students are exposed to double mathematics classes.

The impact of the effectiveness of double-dose mathematics classes has been evaluated to see if students' mindset changed and achievement increased. Bragelman, Martinez, and Stoelinga (2016) conducted a study to examine the effectiveness of a double-dose of mathematics classes. The quantitative study focused on the implementation of an Intensified Algebra I (IA) program that enabled students who were off-track to get back on track along with their peers. The IA program consisted of students taking a double period of algebra to provide students with additional support in algebra. The implementation of the IA program for underprepared students, students who have not mastered previously taught content, demonstrated that students who consistently had trouble in learning mathematics showed significant gains on grade-level material. Durwood, Krone, and Mazzeio (2010) researched the effectiveness of double-dose mathematics classes for low performing students, which are students that are performing below grade level. The quasi-experimental study discussed the implementation of two algebra classes for all ninth graders who were performing below average on state assessments in the Chicago

Public Schools. As a result of implementing the two algebra classes, the researchers found that the two algebra classes yielded a higher percentage of students improving their academic skills. The researchers concluded that students who were enrolled in the two algebra classes benefited from having additional teacher support and extra instructional time in mathematics.

## Barriers of Mathematics Support Classes

Within support classes, there are identified barriers that could hinder the success of the mathematics support classes and the impact the classes have on student achievement. One barrier includes but is not limited to the role of the teacher and the attitude and knowledge the teacher may possess. Another barrier includes but is not limited to the role of the leader and the ability of the leader to provide resources and appropriately schedule the mathematics support classes.

**Teacher-related barriers.** With the development of the mathematics support classes, teachers may already anticipate a challenge being that the students are already performing at a lower level in mathematics. In addition, teachers are now required to utilize their talents and skills to further develop students' understanding of prerequisite mathematics skills and assist the students in achieving grade-level content. The expectations that are placed on teachers to teach mathematics support classes could result in the teachers becoming extremely frustrated due to various limited mathematics skills that exist within the students or the teachers' ability to teach mathematics concepts effectively. These factors could harm students' overall performance in mathematics support classes.

Student achievement is often contingent upon teachers' attitudes. Biggs, Dill, Fonagy, Twemlow, and Vembery (2008) studied the impact teachers' attitudes had on student achievement and student behavior within the classroom. The study revealed that teachers who demonstrated dedication to educating students had a positive impact on student achievement and

development of students' behavior. On the other hand, teachers who demonstrated less commitment to educating the students had a negative impact on students' performance. They were more prone to have student behavior issues and classroom management challenges, which makes the classroom environment not conducive for learning.

The impact that teachers have on student achievement is crucial in the educational process. Teachers who support students, encourage students and share the love they have for educating students may ignite student achievement and desired behavior within the classroom. Unfortunately, many teachers fail to realize that their method of teaching, the way they interact with students, and the behavior that they display is more significant than what they are actually teaching (Yara, 2009). In a study conducted by Henderson and Rodrigues (2008), the researchers found that teachers' perceptions of mathematics, including anxiety level, comfort level, and dislike or like toward mathematics, have a direct relationship to teachers' attitudes toward mathematics. These perceptions have an impact student achievement levels. Students examine teachers' dispositions in order to develop an opinion about their own learning, which affects the students' learning outcomes. Guerriero (2014) stated that teaching is viewed as a

> Knowledge-rich profession with teachers as 'learning specialists.' As professionals in their field, teachers can be expected to process and evaluate new knowledge relevant for their core professional practice and to regularly update their knowledge to improve their practice and to meet new teaching demands. (p. 3)

However, because some teachers are accustomed to teaching higher levels of mathematics, teachers may not necessarily know instructional strategies to teach students' who do not possess all necessary prerequisite mathematics skills to master grade-level content. This complex issue poses a problem for teachers as well as for students within the classroom. Some

mathematics support teachers may not have received the pedagogical knowledge through training or professional learning needed to teach students within the mathematics support classes effectively. Due to a lack of content knowledge or pedagogical skills, teachers frequently develop a negative attitude toward the mathematics support class, which eventually affects students' overall performance. Guerriero (2014) concluded that teachers with better content knowledge and well-defined pedagogical skills yield higher student achievement.

**Leader-related barriers.** The role of the leader is a vital contribution to student achievement. It is the leader's responsibility to put things in place in order to promote student achievement within the learning environment. Within this learning environment, the leader should incorporate the mathematics support class into the school's master schedule. Additionally, he or she should provide viable resources to further promote the success of the students.

As leaders incorporate mathematics support classes into the master schedule, they must consider all factors. Considering all factors will require the educational leaders to be innovative to ensure that student's learning needs are addressed. The mathematics support class is generally offered during students' connections block in middle school. A connections block is a block of time where electives are taken in school. "Electives are taught by specific, specialized teachers to give students a more rounded education. They are an addition to regular classroom studies, including physical education, arts and technology" (GaDOE, 2019, p. 1). Bragelman et al. (2016) stated that the incorporation of mathematics support classes should provide little disruption within the school. However, students may become disgruntled having to take a mathematics support class as part of their core curriculum and as an elective and develop a negative attitude toward the subject matter. In a study conducted by Zan (2012), it was reported that individuals

who develop negative attitudes toward mathematics were profoundly affected by past encounters, such as recurring failures or problems with mathematics. It is essential that school leaders schedule support classes such that students are receptive to the support provided within the classes to diminish the negative attitude of students. As Mata, Monterio, and Peixoto (2012) stated, “the more positive the attitude, the higher the level of achievement for the student” (p. 8).

In addition, the availability of resources within the classroom is crucial. According to Chandrasegaran and Lay (2016):

> Resources are crucial for improving schooling, perhaps even more so in developing countries than in economically developed countries, where adequate school structures and material resources can be taken for granted. The extent and quality of school resources can have an important impact on the quality of classroom instruction. (p. 3077)

Similarly, Lee and Zuze (2011) stated that “resources are essential for schooling and can take many forms, but they all share one feature: they cost money” (p. 370). Therefore, having adequate resources are necessary for the classroom to yield higher student achievement. However, as stated by Lee and Zuze (2011), resources cost money. Not having adequate funding could result in limited resources being made available for the students. As a result of the limited resources, student achievement is negatively impacted. Resources can consist of but are not limited to textbooks, technology, and instructional materials such as manipulatives and interactive notebooks.

The impact resources have on student achievement can be supported by the study conducted by Chandrasegaran and Lay (2016); the researchers studied 8th graders in two countries: Singapore and Malaysia. Within each country, some schools had adequate resources, and some schools had limited resources. After the 2000 TIMSS test was administered, the results

illustrated that students who were in classrooms that provided adequate resources performed higher than students who had limited resources within the classroom. In another study conducted by Lee and Zuze (2011), the researchers studied 6th graders in four countries: Malawi, Namibia, Uganda, and Botswana. The availability of resources differed in each of the countries. Echoing other studies' results, the researchers were able to conclude that students who attended schools with more resources achieved higher than students who attended schools with limited resources. As evidenced in the above-cited results, it is best practices for leaders to ensure classrooms have enough resources that are made available for students in order to improve students' performance and increase students' mastery of the content taught.

In summary, based on the provided background, one can conclude that students' struggle in mathematics is present. With this struggle at the forefront, students' performance on state assessments is not improving. The struggle students may be experiencing could be attributed to the developed mathematics anxiety among students and disengagement among students within the mathematics classroom. In support of these concerns, mathematics support classes have been established as an intervention to address student's limited skills. Studies have been conducted (e.g., Bragelman, Martinez, & Stoelinga, 2016; Durwood, Krone, & Mazzeio, 2010) that communicated that the implementation of mathematics support classes has resulted in improved student achievement. However, there exist potential barriers that could negatively impact the success of the mathematics support class, such as the role of the teacher as it is related to the teacher attitude, teacher anxiety, and lack of teacher content and pedagogical knowledge. In addition, barriers could consist of the role of the leader regarding the scheduling of the class and the availability of resources. It is expected based on the review of literature that this study will

assist in bridging the gap in the literature by contributing valuable information to an already large puzzle with efforts toward increasing student achievement in mathematics.

## Statement of the Problem

Mathematics is an essential subject for students to comprehend and understand. Many students today struggle with mastering grade-level mathematics standards resulting in the development of mathematics anxiety and disengagement in the mathematics classroom. Due to this development, students' performance on state assessments is negatively impacted, which has an adverse effect on schools' overall student achievement within mathematics. School leaders are identifying a higher percentage of students who are one or more grade levels behind in mathematics. This factor is alarming to school leaders.

To overcome the challenge, school leaders have implemented multiple mathematics interventions to provide a solution to students' limited mathematics skills and shortcomings. One intervention that has been implemented within school districts is a mathematics support class to supplement students' core mathematics class. Despite the utilization of mathematics support classes, not all students are showing sufficient improvement in achievement. Therefore, school leaders are faced with the challenge of determining an effective mathematics support class that has the most positive impact on student achievement. There exist limited studies in the state of Georgia to date that support school leaders in determining an effective mathematics support class, which further hinders student achievement in mathematics at the middle school level.

## Purpose Statement

The purpose of this study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact that mathematics support classes had on student achievement at the middle school level. Based on the examination of the perceptions

of the impact that mathematics support classes had on student achievement, commonalities were discovered, and a recommended mathematics support class will be communicated to school leaders in schools that had implemented or were planning on implementing mathematics support classes to increase student achievement in mathematics at the middle school level.

## Research Questions

The following overarching research question guided this study: How impactful is the mathematics support class on student achievement? In addition, the following sub-questions served to add clarity to the investigation:

1. According to principals and teachers, what are best practices within the mathematics support class that positively impact student achievement?
2. According to principals and teachers, what are barriers within the mathematics support class that negatively impact student achievement?
3. According to principals and teachers, in what ways could the mathematics support class be improved to obtain greater academic gains in mathematics?

## Significance of the Study

With the lack of mathematics skills that exist among the student population at all levels, school leaders and teachers are challenged with the responsibility to solve the problem of mathematics deficiencies among students. This research allowed the researcher to communicate the impact that various components of the mathematics support class had on student achievement. Additionally, the study examined the perceptions of principals, mathematics teachers, and mathematics support teachers at the middle school level on the implementation the mathematics support classes as related to student achievement. The examination of the perceptions of the implementation of the mathematics support class is limited in the current

research involving the impact mathematics support classes have on student achievement. In addition, limited research exists on the impact mathematics support classes have on student achievement at the middle school level. The majority of the research illustrates the impact the mathematics support classes have on the high school level. As a result, this research was intended to provide school leaders with pertinent information that was needed in order to improve student achievement and provide an effective mathematics support class that increased student achievement at the middle school level, which could result in the closing of the current mathematics gaps.

## Procedures

In an effort to evaluate the perceptions of principals and teachers as they relate to the impact mathematics support classes had on student achievement, the researcher employed a qualitative approach in this study. According to Creswell and Creswell (2018), "qualitative approaches focus on exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (p. 4). The justification for utilizing this approach within the current study was that the qualitative data was vital in the discovery of themes obtained from the responses to the conducted interviews as related to the impact the mathematics support classes had on student achievement. With the qualitative approach being the overall research approach of this research study, the researcher utilized a case study design to further evaluate the perceptions of principals and teachers in reference to the implementation of the mathematics support class. Merriam and Tisdell (2016) stated: "a case study [involves] an empirical inquiry that investigates a contemporary phenomenon (the 'case') within its real-life context" (p. 37). Taking this approach provided valuable information to the researcher by identifying common perceptions of the impact the mathematics support classes had on student achievement.

To fully evaluate the perceptions of principals and teachers related to the impact mathematics support classes had on student achievement, the researcher utilized one southeastern rural school district due to the easy accessibility of the school personnel to answer the given research questions. The researcher solicited three middle schools to participate in this case study, the participants of which consisted of one principal, one mathematics teacher, and one mathematics support teacher from each school for the purpose of this study. In order for the middle schools to participate in this study, their 2019 CCRPI score had to be 59 or below due to a higher percentage of students within these schools performing below grade level in mathematics resulting in mathematics support classes being more prevalent; whereas, schools with a 2019 CCRPI score with 60 and above had a higher percentage of students who were performing at or above grade level resulting in mathematics support classes not being evident in these schools.

The mode of data collected was virtual interviews. Once data were collected, the researcher conducted a thematic analysis based on the data collected from the virtual interviews. Taking this approach required the researcher to take the following steps: "organize the data in preparation for analysis, read through all data, code the data, generate a description and themes, and interpret the meaning of themes/descriptions" (Creswell & Creswell, 2018, p. 194). Through the conduction of this data analysis, the researcher was able to report out common perceptions of the mathematics support class as related to the impact the class had on student achievement. As a result, the researcher was able to share with leaders in the school district an identified mathematics support class that positively impacted student achievement yielding higher growth in students' performance in mathematics and on state assessments, which would have a greater impact on the school's overall CCRPI score.

## Definition of Key Terms

The following terms below are intended to provide clarity and an understanding of the meaning of specific terms utilized within the context of this research study:

*College and Career Readiness Performance Index (CCRPI):* CCRPI is a performance measurement platform that is utilized by educational stakeholders that focus on school improvement and accountability (GaDOE, 2015).

*Georgia Milestones Assessment (GMAS):* GMAS is a comprehensive assessment administered to students in grades 3rd to high school. The intent of the assessment is to evaluate students' understanding and knowledge of specific content taught (GaDOE, 2015).

*Interventions:* Interventions are instructional strategies implemented within classrooms with the intent to support the learning process of the students (What Works Clearinghouse, 2017).

*Low Performance:* Low performance is a classification of students who are performing more than two or more grade levels below the student's current grade level (Purpura, Day, Napoli, & Hart, 2017).

*Mathematics Anxiety:* Mathematics anxiety is the feeling of nervousness, apprehension, frustration, agitation, and a fear of failure with regard to taking a mathematics class, completing mathematics problems, and/or taking a mathematics exam (McMahon, 2015, p. 1).

*Mathematics prerequisite skills*: Mathematics prerequisite skills are defined as skills that are necessary as a prior condition for something else to happen or exist. Therefore, mathematics prerequisite skills describe the skills or background knowledge a student needs (prior condition) before working on a specified concept (National Center and State Collaborative, n.d.)

*Mathematics Support Class:* Mathematics support class is a class that provides students with additional support in meeting grade-level standards. This class is taught concurrently with the student's other grade level mathematics class. Within the mathematics support class, students are provided with additional time and exposed to multiple instructional strategies to aid the students in the development of adequate mathematics skills to be successful in their current mathematics class and future mathematics classes and perform at a proficient level on state assessments ("Georgia Standards," n.d.).

## Chapter Summary

Low mathematics performance has been moved to the forefront of many educational systems improvement plans today. Educational leaders need to identify solutions in order to address the given issue of the lack of mathematics skills and insufficient math test scores among students. A solution that has been implemented thus far was the implementation of the mathematics support class for students who were consistently performing low in mathematics. With the implementation of this solution, the researcher investigated the effectiveness of the mathematics support class based on the perceptions of the principals, mathematics teachers, and mathematics support teachers on the impact the mathematics support classes had on student achievement at the middle school level. Most research studies on mathematics support classes discussed the impact mathematics support class had on student achievement at the high school level. However, this study took a different approach in reference to investigating the mathematics support class and looked deeper into the mathematics support class by examining the perceptions of the impact the mathematics support classes had on student achievement at the middle school level. The purpose of the qualitative approach complemented with a case study design supported in the evaluation of the perceptions of principals and teachers as related to the

mathematics support class and the impact the class had on student achievement at the middle school level. As a result of this study, an identified mathematics support class based on perceptions was determined and recommended to be implemented to improve students' achievement at the middle school level and yield an increase in the school's CCRPI score.

# CHAPTER 2

# REVIEW OF LITERATURE

The vast majority of students in the United States struggle with mathematics; in fact, 63.5% of the students in the United States scored below the proficiency level and above on the 2017 administration of the National Assessment of Educational Progress (NAEP). This assessment is utilized to "measure the progress of our nation's fourth- and eighth-graders in mathematics, reading, and various subjects" (National Assessment of Educational Progress, 2017, para. 1). Unfortunately, mathematics literacy is an integral part of everyday life, regardless of a person's chosen profession. While there is a myriad of reasons found in the literature for why students struggle in mathematics, mathematics support classes have been identified as a possible solution to this problem. Unfortunately, research has shown that some mathematics support classes are successful, and others are not. What makes one successful and the other not has yet to be determined. Therefore, the purpose of this study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact the mathematics support classes had on student achievement at the middle school level. Based on the examination of the perceptions of the impact the mathematics support classes had on student achievement, commonalities were discovered, and a recommended mathematics support class was communicated to school leaders in schools that had implemented or were planning on implementing mathematics support classes in order to increase student achievement at the middle school level.

## Organization of Literature Review

For the purpose of this study and the review of literature, the literature is organized in a manner that showcased students' struggle in mathematics and a potential solution to overcome

the struggle in mathematics and increase student achievement. Within this chapter, current literature is presented that highlights students' struggle in mathematics and the impact of mathematics support classes. Based on the review of the literature, results in this chapter are divided into multiple sections: mathematics achievement, mathematics support class, and barriers of the mathematics support class. Within each section, there are subsections that support the students' struggle in mathematics and a potential solution to overcome the mathematics struggle.

In an effort to obtain quality scholarly articles, the researcher utilized Georgia Southern library resources. Based on the resources provided, the following databases were identified that deemed more useful in identifying relevant literature for this study: Galileo, ERIC, EBSCOhost, ProQuest, JSTOR, and Wiley Online Library. With these identified databases, the following search terms were utilized to identify literature that was aligned to this study: mathematics, mathematics support classes, double-dosing classes, interventions, mathematics anxiety, mathematics performance, mathematics achievement, prerequisite mathematics skills, mathematics basic skills, disengagement, manipulatives, teacher attitude, teacher anxiety, teacher knowledge, master schedule, and availability of resources.

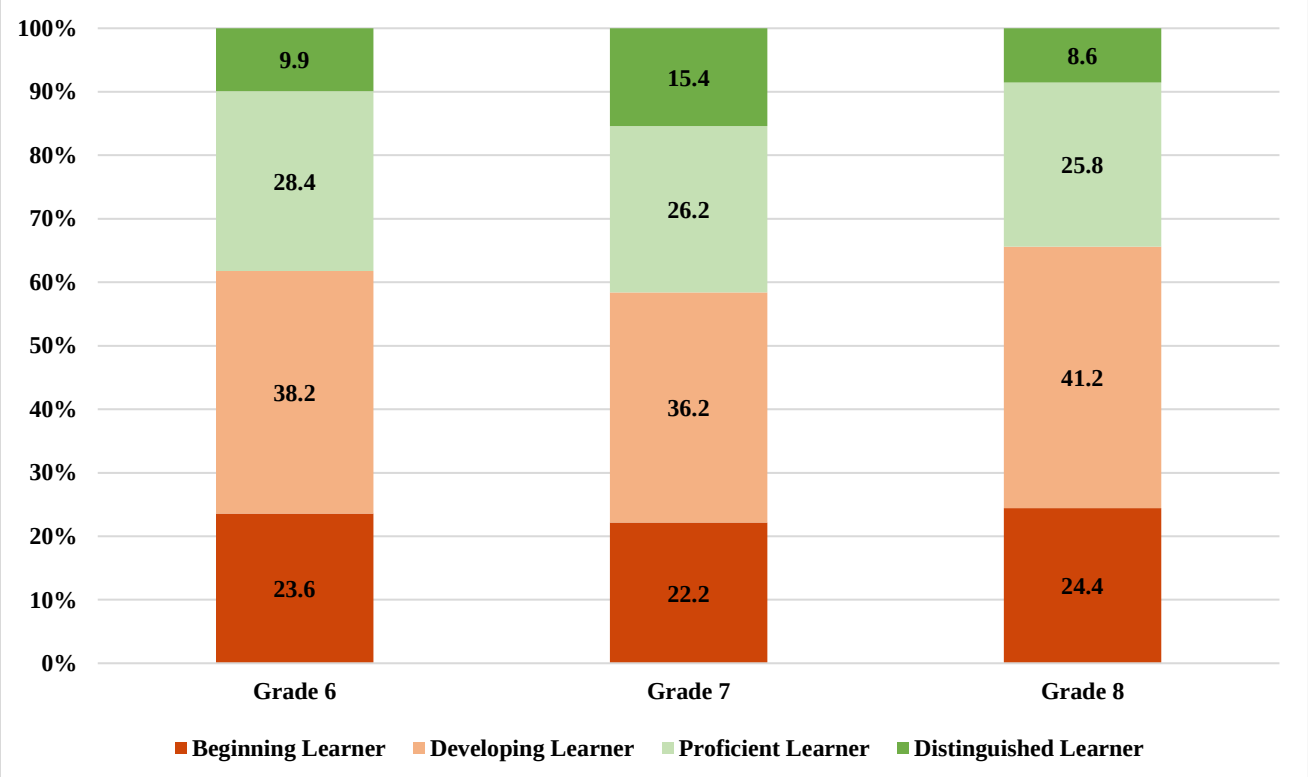
## Mathematics Achievement

In the state of Georgia, students in 6$^{th}$ through 8$^{th}$ grade are required to demonstrate their understanding in mathematics on a summative assessment called the GMAS. The GMAS in mathematics consists of the following items: selective responses, open-ended responses, and norm-referenced responses. Students in 8$^{th}$ grade are required to receive a passing score on the assessment in order to be considered for promotion to the next grade level. It is evident that this assessment system has established high expectations for students in the state of Georgia, and the intended purpose is to hold schools accountable for students' performance (GaDOE, 2015).

Students' performance on the GMAS impacts schools' CCRPI scores, which affects schools' performance designation as either a priority school, focus school, or alert school. The designation of the school determines the level of financial support that will be received from the district and state levels. Schools designated as a priority school receive intensive support from the GaDOE by assigning each school a school improvement specialist (SIS); however, schools designated as focus or alert schools have to implement similar requirements as priority schools but do not receive an SIS for each school (The Governor's Office of Student Achievement, n.d.).

Tables 1, 2, and 3 represent middle school students in the state of Georgia mathematics performance on the GMAS in 6th through 8th grade for the past three years.

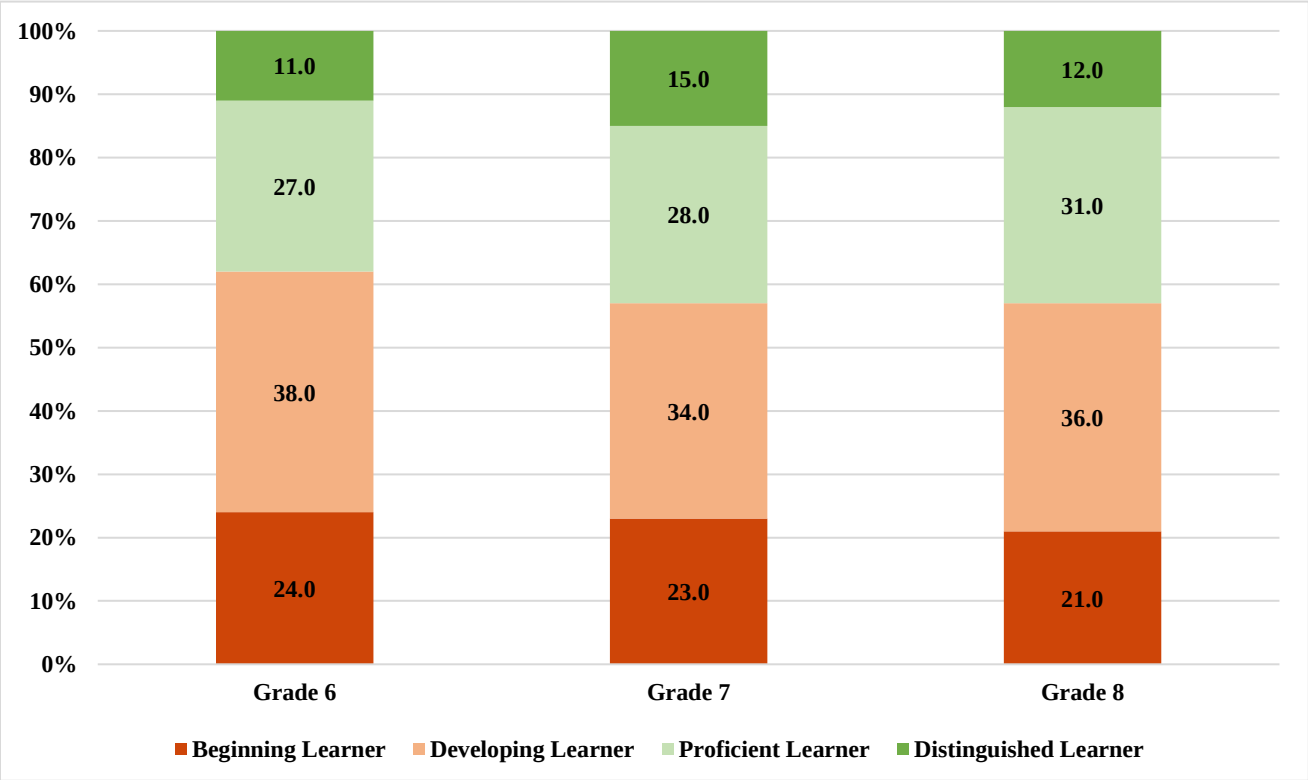
*Table 1: Students' Mathematics Performance on GMAS 2016-2017*




*Note*. Adapted from "Georgia Milestones 2016-2017 Statewide Scores," by The Georgia Department of Education, 2017.

Based on the data presented in Table 1, it is evident that during the administration of the 2016-2017 GMAS in mathematics, 61.93% of the middle school students in the state of Georgia scored either as a beginning learner or a developing learner; only 38.07% scored in the area of proficient or distinguished learner. As indicated in Table 1, in the academic year 2016-2017, the range of students reaching a minimum score of proficient on the GMAS was 25.8 - 28.4%.

*Table 2: Students' Mathematics Performance on GMAS 2017-2018*

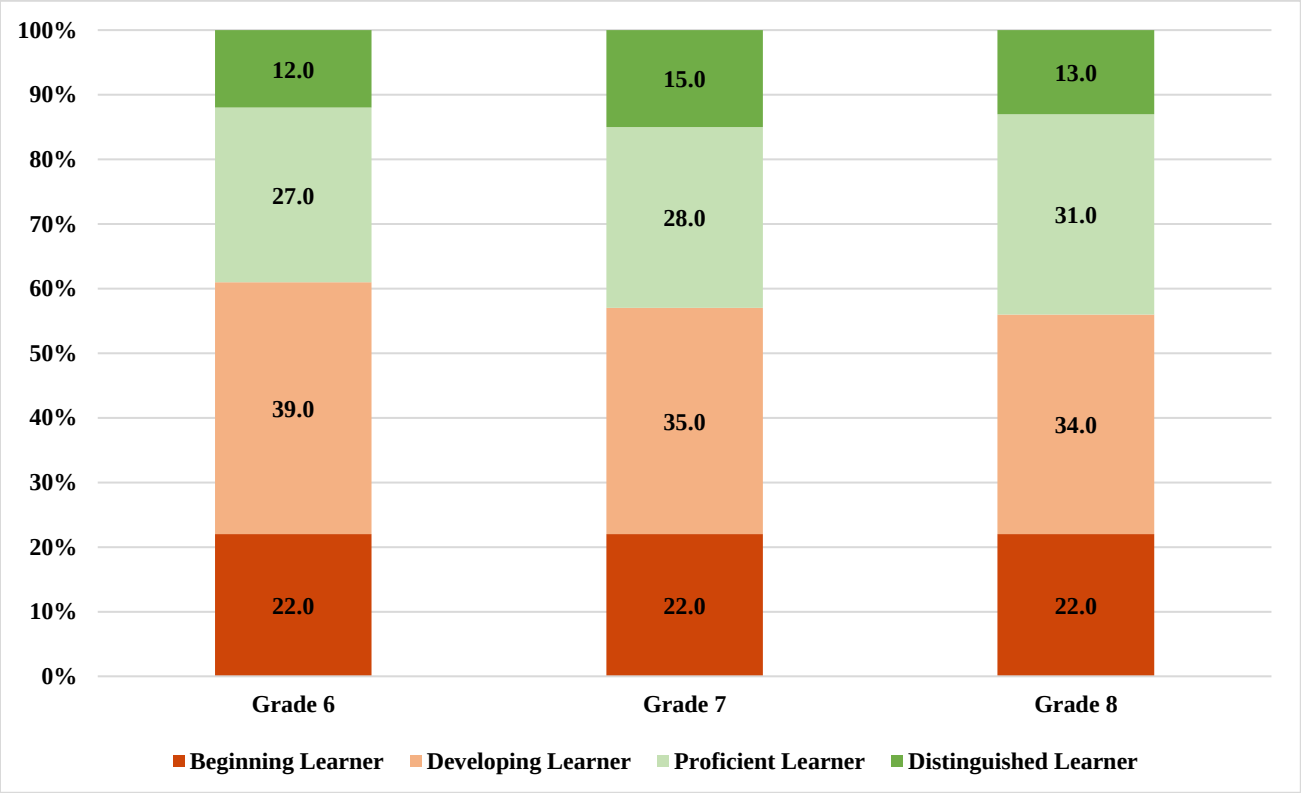



*Note*. Adapted from "Georgia Milestones 2017-2018 Statewide Scores," by The Georgia Department of Education, 2018.

Based on the data presented in Table 2, it is evident that during the administration of the 2017-2018 GMAS in mathematics, 58.7% of the middle school students in the state of Georgia scored either as a beginning learner or a developing learner; only 41.3% scored in the area of

proficient or distinguished learner. As indicated in Table 2, in the academic year 2017-2018, the range of students reaching a minimum score of proficient on the GMAS was 27.0 - 31.0%.

*Table 3: Students' Mathematics Performance on GMAS 2018-2019*




*Note*. Adapted from "Georgia Milestones 2018-2019 Statewide Scores," by The Georgia Department of Education, 2019.

Lastly, based on the data presented in Table 3, it is evident that during the administration of the 2018-2019 GMAS in mathematics, 58.0% of middle school students in the state of Georgia scored either as a beginning learner or a developing learner; only 42.0% scored in the area of proficient or distinguished learner. As indicated in Table 3, in the academic year 2018-2019, the range of students reaching a minimum score of proficient on the GMAS was 27.0 - 31.0%.

According to the GaDOE (2015), the following definitions are used to interpret each level in the table:

> Beginning learners do not yet demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards… developing learners demonstrate partial proficiency in the knowledge and skills necessary at this grade level/course of learning, as specified in Georgia's content standards… proficient learners demonstrate proficiency in the knowledge and skills necessary at this grade level/course of learning… distinguished learners demonstrate advanced proficiency in the knowledge and skills necessary at this grade level/course of learning. (p. 1)

It is evident that the number of beginning learners and developing learners are decreasing after each year as represented in the tables above; however, that decrease is almost negligible as in percentage from year to year, as evident in the tables above, which is a concern. This struggle challenges teachers and educational leaders. They must consider the implementation of instructional practices that could address this struggle to ensure that educational institutions are aligned to the mission of the GaDOE which is "preparing all students for college or a career in a safe and drug-free environment where we ensure that no child is left behind" (GaDOE, 2015, p. 1). According to Heim (2016):

> Students in the United States have not gained any ground [in mathematics] and continue to trail students in a slew of developed countries around the globe… In the latest Program for International Student Assessment (PISA) measuring mathematics literacy in 2015, U.S. students ranked 40th in the world. (p. 1)

Therefore, grade-level standards mastery, as measured by the GMAS testing poses a concern for educational leaders within the United States as students' low performance in mathematics has had a negative impact on the overall performance ratings of schools. As teachers attempt to teach grade-level content, students experience difficulty in mastering the content due to the students already being behind in mathematics, which has an adverse impact on the students' present performance in their current mathematics class. Heim (2016) stated that students being behind makes it difficult for the teacher to teach the current content, which is known as losing ground in mathematics. According to current research (e.g., Chang & Beilock, 2016; Harris, 2018; Martin, Anderson, Bobis, Way, & Vellar, 2012; Ruff & Boes, 2014), students' low performance in mathematics could be attributed to the following: the development of mathematics anxiety, the possession of limited mathematics skills, or the lack of student engagement within the mathematics classroom. Each of these topics will be discussed, focusing on the impact it has on student achievement in mathematics.

**Mathematics Anxiety**

McMahon (2015) defined mathematics anxiety as feelings of nervousness, apprehension, frustration, agitation, and a fear of failure with regard to taking a mathematics class, completing mathematics problems, or taking a mathematics exam. Blazer (2011) defined mathematics anxiety as "negative emotions that interfere with the solving of mathematical problems" (p. 1). Sparks (2011) characterized mathematics anxiety as a form of a disease, or negative emotion developed when one is required to either conduct mathematics computation or institute mathematics problem techniques. Sparks continued by stating that the development of mathematics anxiety results in a discomfort level in mathematics, which has an adverse effect on students' willingness to seek career opportunities in mathematics.

Leppavirta (2011) defined mathematics anxiety "as a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in both everyday life and academic situations" (p. 425). Leppavirta's study focused on the relationship mathematics anxiety has with students' performance in electromagnetics. In relationship to mathematics, engineering students must be proficient in mathematics in order to be successful in electromagnetics. In an effort to examine mathematics anxiety and the impact it has on students' performance in electromagnetics, the study involved 118 undergraduate students enrolled in a Static Field Theory course at the Helsinki University of Technology in Finland. Leppavirta (2011) evaluated students' mathematics anxiety by using an Electromagnetics Mathematics Anxiety Rating Scale (EMARS), which consisted of five qualitatively different components: usefulness, mathematics confidence, interpretation anxiety, fear of asking for help, and persistency. After the administration of the EMARS, students' data were collected and analyzed using descriptive statistics, correlation, and analysis of variance (ANOVA). Leppavirta concluded that mathematics anxiety did have a significant impact on students' performance in electromagnetics.

Chang and Beilock (2016) explained possible factors that cause mathematics anxiety: individual possesses a lower competency level than his/her counterparts in mathematics, previous poor performance in mathematics, and experience difficulties with mathematics prerequisite skills that are the building blocks to other advanced mathematics concepts. Ruff and Boes (2014) further explained that:

> …contributing factors of mathematics anxiety in students involves various social, cognitive, and academic elements. Social factors include continued race and gender stigmas and lack of parental support in low socioeconomic (SES) households. Cognitive

> factors comprise dyscalculia and deficits in working memory. Academic factors encompass the traditional mathematics curriculum used in classrooms, ineffective teaching styles, and the influence of mathematics anxious teachers. (p. 2)

Ruff and Boes (2014) stated that with these contributing factors, students experience extreme difficulty within the mathematics classroom that negatively impacts their performance. As students' performance is impacted, limited growth is established in mathematics.

Beilock and Maloney (2015) stated that "mathematics anxiety is a multifaceted phenomenon that arises due to a combination of cognitive predispositions, as well as exposure to negative attitudes about mathematics" (p. 6). The research conducted by Beilock and Maloney (2015) focused on the characteristics of mathematics anxiety and the impact it has on mathematics achievement. Within their research, the researchers highlighted other research findings (e.g., Ferguson, Maloney, Fugelsang, & Risko, 2015; Maloney, Risko, Ansari, & Fugelsang, 2010; Ramirez, Gunderson, Levine, & Beilock, 2013) in psychology, education, and neuroscience on mathematics anxiety. Based on the analysis of the research findings on mathematics anxiety, Beilock and Maloney (2015) concluded that mathematics anxiety should not be ignored but should be addressed in order to promote mathematics achievement.

"Mathematics anxiety appears to increase across development until it peaks at about ninth or tenth grade and then plateaus thereafter" (Beilock & Maloney, 2015, p. 6). However, in order to prevent the increase in mathematics anxiety as individuals develop, it is essential to implement interventions that could aid in reducing mathematics anxiety within an individual. Park, Ramirez, and Beilock (2014) recommended utilizing an expressive writing technique that aids in the reduction of mathematics anxiety. The expressive writing technique allows students to freely write about their feelings and thoughts related to a significant stressor that they may be facing.

The study conducted by Park et al. (2014) consisted of the identification of students with various levels of mathematics anxiety by utilizing a pre-screener known as a Short Mathematics Anxiety Rating Scale that consisted of a 25-item self-report measure. Based on the pre-screener, 44 participants were identified as having high mathematics anxiety, and 39 participants were identified as having low mathematics anxiety. Participants were randomly assigned to either the control group or the experimental group; the experimental group was the expressive writing group. The instrument used in this study consisted of an exam that consisted of 60 mathematics problems and 60-word problems (half high-demand, half low-demand). "The exam was divided into a series of consecutive mathematics and word problem blocks, each containing 12 problems (half high-demand, half low demand)." (Park et al., 2014, p. 105). As a result of the implementation of the expressive writing technique, students' anxiety level decreased, resulting in a positive impact on students' performance in mathematics. The implementation of the expressive writing technique may be an effective strategy utilized to allow students with mathematics anxiety to reassess a potentially negative situation, such as a mathematics task or mathematics test. This strategy could also change students' mindset, which could aid in their success in their current situation.

In order to prevent mathematics anxiety from robbing individual working memory, Beilock and Willingham (2014) stated that teachers need to reinforce fundamental skills, institute professional learning for students, provide flexibility within assessments, and incorporate a writing exercise. In addition, Ruff and Boes (2014) stated that incorporating professional counseling sessions with students with mathematics anxiety could reduce nervousness in mathematics. Ruff and Boes (2014) utilized a mixed-methods approach to determine the effectiveness of incorporating counseling as an intervention to reduce mathematics anxiety. The

study sample consisted of 14 fifth graders who did not meet the target on a winter benchmark; as a result, these students were placed in a small intervention group that received counseling. As a result of the implementation of the intervention, students within the small group experienced a reduction in their mathematics anxiety and an increase in mathematics achievement on district assessments. The researchers concluded that allowing students to communicate with an expert and receive strategies to overcome mathematics anxiety is essential for the success of the student. Based on the solutions recommended by the above researchers, it is evident that mathematics anxiety can be reduced; however, it requires the necessary efforts of the professionals to support students in this manner with intentions on increasing students' achievement. However, with limited support, students will remain stagnant in their current mathematics intellectual abilities, which will further contribute to their mathematics anxiety.

**Prerequisite Mathematics Skills**

Low mathematics performance could be attributed to students lacking the prior knowledge that is needed for them to be successful in a mathematics classroom. Prior knowledge begins with a clear understanding of the prerequisite mathematics skills that have been taught prior to the current mathematics class. These skills are the key components to any mathematics algorithm.

> Prerequisite skills are essential in stimulating mathematical development because this is when the informal competences (acquired outside of the school setting) can become formal knowledge and skills that facilitate acquisition of subsequent mathematical competences, especially taking into account that such competences evolve hierarchically and integratively. (Gonzalez-Castrol, Cueli, Cabeza, Alvarez-Garcia, & Rodriguez, 2014, p. 378)

Therefore, students must have the prerequisite skills that are needed due to these skills being building blocks to other mathematics concepts. Harris (2018) further stated that "it is essential to have the necessary basic prerequisite knowledge before beginning to study a new mathematics topic" (p. 1).

Often, students who fail to acquire the prerequisite skills are not identified early on, which can result in mathematics struggles throughout the students' education. In a study conducted by Hudson, Kadan, Lavin, and Vasquez-Berger (2010), students in fourth, fifth, sixth, and ninth grade mathematics classrooms were targeted as the sample. Based on their assessment of the students' mathematics skills, the researchers were able to conclude that the majority of students in the targeted grade-level "exhibited difficulties with number sense that interfered with understanding and recall of basic mathematics facts" (Hudson et al., 2010, p. 1).

In another study conducted by Kerr and Krull (2017), they too identified accounting students on the college-level struggling with the prerequisite mathematics skills, which caused increased frustration for the faculty and students. As a result of the delayed detection of students' lacking the prerequisite skills, educators are faced with challenges in addressing the learning needs of the students. Therefore, it is essential to identify mathematics challenges early on to reduce frustration later. Lago and DiPern (2010) stated that early identification of challenges within mathematics is essential. "First, children are most receptive to intervention during early developmental periods… Second, researchers have demonstrated that it is better to intervene early before learning problems become chronic and secondary problems arise" (Lago & DiPern, 2010, p. 165).

Incorporating an ongoing screening process that is conducted several times throughout the early years of a students' education to identify students' challenges could be a solution to

improving students' prerequisite mathematics skills. Another action that could be taken to improve students' prerequisite mathematics skills could consist of addressing the challenges that the students may be experiencing early on. Assisting students to increase their prerequisite mathematics skills can provide students with an opportunity to perform better at advanced mathematics concepts as they grow educationally. As a result, this could be vital in the reduction of mathematics anxiety within students due to students' needs are being addressed early, resulting in success instead of frustration as they progress through the content (Lago & DiPern, 2010).

**Working memory.** Not only do students lack prerequisite mathematics skills, some students are challenged with working memory, also known as short-term memory, in mathematics. Instructors present a particular concept, and the concept is retained by the students but only for a brief period of time. As a result, students are unable to apply the previously taught concept to a newly taught concept causing the students to be unsuccessful at mastering the given concept. Sherman, Richardson, and Yard (2014) discussed students' struggles in mathematics was due to the fact that students lack well-developed mental strategies for remembering how to complete algorithmic procedures and combinations of basic facts. Several studies explored memory and concluded that individuals are less likely to be able to recall statements and concepts that are taught due to the short-term memory, as well as the fact that teachers are not doing enough to encourage application and retention of concepts (e.g., Rotella & Richeson, 2013). The reality is that individuals struggle with the recollection of knowledge in order to be applied to concepts, which hinders the success of the individual. Stress and anxiety could be contributing factors that cause an individual to forget concepts. Therefore, "the ability to retain educationally relevant content in a readily accessible state in memory is critical for students at all

stages in schooling" (Ramirez, McDonough, & Jin, 2017, p. 1). Having prior knowledge can further support students in the learning, which makes learning easier for the students as well as the instructors as students matriculate throughout their educational journey.

**Student engagement.** The student engagement level in mathematics is considered a factor in the declining trend of students' performance in mathematics (Martin, Anderson, Bobis, Way, & Vellar, 2012). Due to the decline in students' performance in mathematics, the enrollment in higher-level mathematics courses in high schools has dropped, and students' interest to pursue a degree in mathematics education and mathematics-related programs/degrees at universities is on a steady decline (Vandenberg, 2012). As a result, the National Council of Teachers of Mathematics (2000) has expressed a strong need to build students' engagement levels in mathematics. NCTM recommends that instructional practices are implemented within mathematics classrooms that aim at increasing students' level of engagement in mathematics, which would result in active participation among students within the learning environment. Increasing students' engagement could allow students to make connections between the mathematics concepts they are learning and the real world.

Multiple factors cause students to become disengaged from the mathematics classroom. Martin et al. (2012) identified several factors that may result in disengagement within the classroom: sociodemographic, mathematics ability, anxiety, self-efficacy and valuing, enjoyment, parental interest and support, home-based logistic support, perceived classroom climate, and teacher-to-student ratio. Some students do not enjoy the classroom due to the classroom being less student-centered, with more emphasis on a teacher-centered learning environment. Within the classroom, there is mainly traditional, lecture-style teaching (teacher-centered). The traditional method of teaching is not feasible for students anymore because it is

not geared toward how students learn, resulting in the majority of the students becoming disengaged from the classroom, further resulting in potential difficulty or failure of the mathematics course. “Today it is often believed that student-centered approaches to teaching are generally more effective in comparison to teacher-centered approaches” (Dervić, Glamočić, Gazibegović-Busuladžić, & Mešić, 2018, p. 289). To evaluate the effectiveness of teacher-centered approaches and student-center approaches, Dervić et al. (2018) conducted a study involving a control group and experiment group. The researchers were able to conclude that “the results of this research support the idea that a progression from teacher-centered to student-centered approach may be optimal for learning novel concepts” (Dervić et al., 2018, p. 297). With this conclusion, it could be stated that student-centered approaches could aid in the positive impact of student achievement within the mathematics classroom.

A student-centered approach that could be utilized within the mathematics classroom in order to increase student engagement is the utilization of manipulatives to teach and practice mathematics concepts. It is believed that the use of manipulatives will help improve students’ understanding of integer operations and increase student engagement in the classroom. Stix (2012) stated that when using manipulatives, “results in a better understanding and retention of mathematics, a decrease in mathematics anxiety, and a heightened confidence level among students who have really made a lesson their own” (p. 1). Another benefit of using manipulatives in the classroom is to bring a “deeper level of comprehension” which “will then allow the low academic achievers and high-level achievers to feel motivated to learn” (Stix, 2012, p. 1). The use of manipulatives is a way to get students involved and engaged in their learning process.

Another factor that affects student engagement level is teacher-student ratio. Due to the increased measures of accountability and cuts in educational funding, determining the idealistic

teacher to student ratio is vital in ensuring students' academic success as well as the success of the schools. Within classrooms today, class sizes are becoming larger without reducing the number of students assigned to a given teacher. Consequently, "the class size affects classroom management, classroom instruction, and the academic achievement of the students" (Vandenberg, 2012, p. 12). As a result, students become disengaged and experience a negative impact on their performance in the classroom. Within the classroom, there are limited efforts to address the individual needs of the students, which negatively impacts the students' overall performance. The instructor may experience difficulty in differentiating the curriculum, providing individual attention to students, conducting small groups for learning opportunities, and developing a more efficient process to assist students with their academic development (Martin et al., 2012). In the study conducted by Martin et al. (2012), the researchers determined that teacher-student ratio has a statistically significant relationship to students' achievement. Therefore, a reduction in a teacher-student ratio could have an impact on students' engagement level resulting in a positive impact on student achievement.

## Mathematics Support Class

Due to the lack of significant increase in student achievement in mathematics, leaders are determining whether providing students with additional instructional time in remedial mathematics courses for low performing students could increase students' performance in mathematics. In theory, the more time students spend on concepts in which they are not proficient could result in students becoming proficient and mastering the given concepts. The additional instructional time provided for low performing students could be incorporated in mathematics support classes that could be offered as an elective for high schoolers or a connection class for middle schoolers. Mathematics support class is an intervention strategy that

provides students with additional support in meeting grade-level standards. This class is taught concurrently with the student's other grade-level mathematics class. Within the mathematics support class, students are provided with additional time and exposed to multiple instructional strategies to aid the students in the development of adequate mathematics skills to be successful in the current mathematics class and future mathematics classes and perform at a proficient level on state assessments (Georgia Standards, n.d.).

The implementation of mathematics support classes could result in an increase in student achievement, remain stagnant at the current student achievement level, or result in a decrease in student achievement. Nomi and Allensworth (2012) stated that since there seems to be some effectiveness in the mathematics support classes regarding students' achievement, the implementation of mathematics support classes has become more prevalent in many school districts in order to support low performing students based on the expectations that have been established within the Response to Intervention (RTI) process. Students who are not meeting grade-level standards or perform poorly on state-mandated assessments are identified as potential candidates to be enrolled in the mathematics support classes in order to receive the necessary interventions to support the students' learning needs.

Several studies (e.g., Cortes, Goodman, & Nomi, 2013; Lavy, 2015; Durwood et al., 2010) found increasing the amount of instructional time spent on mathematics instruction within the classroom has a positive relationship with students' achievement in mathematics. Based on findings in The Nations' Report Card: Mathematics 2000, NAEP (2017) illustrated that students in 4th and 8th grade demonstrated an increase in their average assessment scores due to the time being spent with improved instructional activity. Utilizing the additional instructional time wisely includes time spent on student-centered instruction and direct instruction in lieu of

assigning seatwork or kill and drill assignments or tasks. In a study conducted by Lavy (2015), it was concluded that maximizing instructional time is positively correlated with students' performance. Therefore, maximizing instructional time is essential and could be a positive aspect in increasing student achievement.

The implementation of mathematics support classes affords teachers an opportunity to identify the needs of the students and address the needs in innovative ways. Not only does this setting provide opportunities for students to work on prerequisite mathematics skills, current concepts, and vocabulary, but students could be provided with additional time to work outside their current mathematics book, which could seem foreign to some of the students (Lavy, 2015). Sending students home with homework becomes problematic due to students not completing the homework or students completing the homework with incorrect responses, causing a more profound challenge for teachers by determining a method to undo what has been done. Therefore, the additional time spent in the mathematics support classroom could be beneficial to the students by assisting them with assignments that are intended to be completed at home (Lavy, 2015).

The implementation of the mathematics support classes has yielded academic achievement for students who are enrolled in the mathematics support classes in some school districts. In the studies cited below, in lieu of utilizing mathematics support classes, studies utilized double-dose algebra or double-dose mathematics. Chicago Public Schools were one of the first school districts to implement the double-dose algebra class in 2003. Before implementing the double-dose algebra class district-wide, the Chicago Public Schools decided to pilot this implementation with a specific grade level. As a result, rising ninth graders who had low assessment scores were required to take two periods of algebra. To solidify the decision of

the implementation of the double-dose algebra initiative in Chicago as well as other school districts nationwide, researchers at the University of Chicago studied the implementation policy of the double-dose algebra conducted by the Chicago Public Schools for approximately two and half years. The researchers discovered that the implementation of the double-dose algebra class could improve the mathematics skills of students enrolled. With the implementation of the initiative, the Chicago Public Schools experienced an increase in their mathematics assessment scores; however, they also experienced a negative impact due to students who were only enrolled in a single period regular algebra class grades began to decline resulting in an increase in their failure rate. The residual effect of the implementation of this initiative posed concerns due to students' grades resulting in a negative impact on high school graduation. Because the implementation of the double-dose algebra classes rendered success for students enrolled and not for students who were not enrolled, it was necessary to institute complementary efforts to support students in the improvement of their efforts and grades while enrolled in a regular single algebra class (Durwood et al., 2010).

An extensive study conducted by Cortes, Goodman, and Nomi (2013) was designed to examine the long-term effects of the implementation of the double-dose algebra course on low performing ninth graders. Within the course, the ninth graders received double instructional time, and the focal point of the course included the rebuilding of mathematics skills that the students lacked. With the implementation of this support class, students were provided with 90 minutes of mathematics instruction every day for a full academic year. As a result of the implementation of the double-dose algebra course, the majority of the students enrolled in the course demonstrated gains. Gains consisted of an increase in students' GPAs (average .14 increase) and an increase in students' scores on the ACT compared to students who were a part of the control group (.15

standard deviation improvement compared to the control group). The researchers concluded long-term benefits of students taking a double-dose of mathematics courses included but were not limited to an increase in the high school graduation rate, an increase in college entrance exam scores, and an increase in college enrollment rates. Likewise, Nomi and Allensworth (2012) found that students who are assigned to the double-dose algebra courses gained skills and knowledge to be able to write sentences to explain how they solved a mathematics problem, explain how they solved a problem to the class, write mathematics problems for other students to solve, discuss viable solutions with other students, and apply mathematics to situations in life outside of school. The researchers concluded that with these acquired skills, students would be able to gain academic success within their current mathematics course through the demonstration of their understanding of the concept.

Though most studies show mathematics support classes being implemented at the high school level as students mainly transition into algebra, the North Carolina Public Schools felt it necessary to implement this initiative at all levels: elementary, middle, and high within the school districts. The North Carolina Public Schools' implementation consisted of 26% of high school students, 5% of middle school students, and 1% of elementary school students receiving a double-dose of mathematics (Henry, Barrett, & Marder, 2016). The double-dose of mathematics opportunity was made available for all students at varying academic levels. Within the double-dose mathematics classes at all grade levels, students received mathematics remediation, mathematics maintenance, or mathematics enrichment. Henry et al. (2016) defined:

> Double-dosing for remediation: Double-dosing in which at least one course contains content below the student's grade level. Double-dosing for maintenance: Double-dosing in which all courses contain content at the student's grade level. Double-dosing for

enrichment: Double-dosing in which at least one course contains content above the student's grade level. (p.1)

Students' performance on the previous year on the North Carolina end-of-grade mathematics test determined which type of double-dose of mathematics the students would receive. As a result of the implementation of the double-dose mathematics classes, it was discovered that students who received a double-dose of mathematics for enrichment purposes were the only group whose performance on the state assessment was higher than the students who only received one dose of mathematics daily. The double-dosing of mathematics can be utilized for multiple purposes as stated within the above study; however, "each strategy requires diverse types and levels of resources—extra teachers, classrooms, computers, and so on. In addition, each strategy may have distinct levels of effectiveness, possibly differing across groups of students" (Henry et al., 2016, p. 13).

The studies above show the implementation of mathematics support classes rendering an increase in students' achievement; however, some results illustrate that the implementation of mathematics support classes has a negative impact on students' achievement. In a study inspired by the 2010 Chicago study, Taylor (2014) studied how beneficial it would be with doubling up mathematics opportunities for students who were performing below their grade level expectations. With the implementation of the additional mathematics course, the middle school students made gains; however, over time, the gains began to diminish as the students matriculated through school. In the study, it was found that the identified sixth graders who took part in the study grew tremendously while in the sixth grade; however, as the students enrolled in another mathematics class the following year the students' gain was cut in half, during eighth grade the students' gain was only one-third. As the students reached high school, the same

students demonstrated little to no gain in mathematics. Taylor's (2014) study illustrated that the mathematics support class provided a temporary fix for students; however, there was an aftermath effect on student achievement as they matriculated through subsequent grades. It can be concluded that some mathematics support classes yield sustainable students' achievement; however, some mathematics support classes only yield students' achievement temporarily or no students' achievement at all.

## Barriers of Mathematics Support Classes

The purpose of the implementation of the mathematics support classes is to increase students' achievement in mathematics. However, with this implementation, there exist barriers that could hinder the success of students. Potential barriers from a teacher's perspective include but are not limited to teacher attitude, teacher anxiety, and teacher knowledge, which could negatively impact students' achievement. From a leader perspective, the barriers include but are not limited to scheduling of mathematics support classes and availability of resources to support the mathematics support classes.

### Teacher-Involved Barriers

The role and behaviors of a teacher are essential components in the success of students. As Sirait (2016) stated, teacher quality is central to student achievement. Teachers help drive the vehicle of achievement for students. However, students' achievement can be impacted if the teacher's attitude is not conducive toward the learning environment, if the teacher has developed anxiety as a result of having to teach a particular subject or group of students, or if the teacher has limited knowledge and pedagogical strategies to teach the content effectively.

**Teacher attitude.** With the stigmas that have already been placed on students who are required to take an additional mathematics support class to assist them in mathematics skills they

lack, encountering a teacher who possesses a bad attitude about teaching the course or toward the students could impact student's achievement. In a study conducted by Uluga, Ozdenb, and Eryilmazc (2011), the intended purposes of the researchers were to discover how teachers' attitudes affect the personalities and performance of their students. The study consisted of a select group of college students at Istanbul Kultur University and Maltepe University. The students were provided a questionnaire where they had to provide examples of their teachers' attitudes and behavior at the primary, middle, high, and college level, and how it affected the students' performance and personality development. Based on the questionnaire results, the researchers were able to conclude that regardless of the subject-matter teachers who possess a positive attitude have a positive effect on students' performance; however, teachers who possess a negative attitude have a negative effect on students' performance. Similarly, Biggs, Dill, Fonagy, Twemlow, and Vembery (2008) concluded in their study that students who had teachers who demonstrated their dedication to educating students had a positive impact on students' achievement and development of students' behavior. Conversely, teachers who demonstrated less dedication to educating the students had a negative impact on student achievement and were more prone to have student behavior issues and classroom management challenges, which made the learning environment not conducive for learning.

Teachers should invest in their students and always have their students in their best interests.

> A teacher who realizes that the nature of knowledge and abilities directly affects his/her students and surroundings takes responsibility for his/her own knowledge and abilities, creates positive relationships with his/her students and can relay these to students in the most efficient manner. Furthermore, being able to interact with the student and display

> positive behavior such as asking questions, understanding their thoughts, showing interest and appreciation increases the students' motivation and success. (Uluga et al., 2011, p. 739)

A teacher building that relationship with the students can go a long way and have a lasting impact on the students. Based on the students, teachers having a positive attitude and possessing a desire to help can impact the achievement of the students. Furthermore, students enrolled in a mathematics support class with a teacher who has an attitude conducive for learning could result in increased academic achievement of the students.

**Teacher anxiety.** Though some students develop mathematics anxiety, some teachers have developed anxiety for having to teach mathematics or having to teach lower-performing students. "[Teacher] Mathematics anxiety has been recognized as an impediment to [student] mathematics achievement" (Beilock, Gunderson, Ramirez, & Levine, 2010, p. 1860). Therefore, with the development of the anxiety by the teacher, students' performance is negatively affected. This finding was substantiated in a study conducted by Beilock and colleagues (2010). The study consisted of 17 female mathematics teachers. In the study, the researchers assessed the teachers' anxiety at the beginning of the school year to determine whether it had an impact on student achievement. Based on the assessment, it was found that there is no significant relationship between teachers' mathematics anxiety and students' mathematics achievement. Two months before the school year concluded, the teachers' anxiety and mathematics knowledge were assessed. A Mathematics Anxiety Rating Scale was utilized to assess teachers' anxiety, and the Elementary Number Concepts and Operations subtest of the Content Knowledge for Teaching Mathematics was utilized to assess teachers' mathematics knowledge. Based on the results obtained from the assessments, the researchers concluded that the higher the teacher's anxiety,

the lower the student achievement. Teachers developed anxiety due to them worrying and feeling a sense of uneasiness because they had to teach mathematics. With this development, students were exposed to the teachers' level of anxiety; as a result, the students' performance was negatively impacted when comparing students' assessment scores at the beginning of the year to the end of the year.

Usually, students who are labeled as being low performing are taught by the least-qualified teachers (Boyd, Lankford, Loeb, & Wychkoff, 2005). Boyd et al. (2005) describe least-qualified teachers as teachers who are novices or not fully certified to teach. Having least-qualified teachers teaching low performing students could cause resentment, challenges, and anxiety within the teacher. These circumstances will impact students. In a study conducted by Boyd and colleagues (2005), it was found that highly qualified teachers, teachers with experience and fully certified, who were required to teach low performing students either transferred to another school or quit. As a result of the teachers' neglect, students in the class were not provided with a quality education. Therefore, the students were provided with either a least qualified teacher or substitute teacher, both of which had a negative impact on student performance.

**Teacher knowledge.** The knowledge-level of the teacher is essential in increasing student achievement. Teachers should be equipped with the pedagogical skills that are needed to execute an effective lesson that drives student achievement. However, teachers with limited content and pedagogical knowledge could negatively affect the performance of their students. Metzler and Woessmann (2012) stated that "teacher subject knowledge exerts a statistically and quantitatively significant impact on student achievement" (p. 487). Likewise, Lekwa, Reddy, Dudek, and Hua (2019) stated that "research highlights that the ways in which teachers provide

instruction and manage student behavior are among the most important influences for student achievement" (p. 271). Lekwa and colleagues (2019) conducted a study to determine whether teaching practices predicted gains in student achievement. The study consisted of 130 teachers and 2771 students in kindergarten through eighth grade in 13 urban schools. The students were given a MAP test which assessed students' reading and mathematics skills. The teachers were assessed using a CSAS Observation Form that assessed the teachers' use of evidence-based instructional and classroom management strategies. The conclusion of the implemented study reported that "students in classrooms with higher quality use of evidence-based teaching strategies exhibited greater gains, whereas students in classrooms with lower quality use of effective strategies exhibited lesser gains" (Lekwa et al., 2019, p. 271). Therefore, it could be concluded that the subject knowledge and knowledge of evidence-based teaching strategies can aid in the improvement of students' achievement. Teachers with limited content or pedagogical knowledge could receive targeted professional development to support the limited skills and provide strategies and advice that could increase teachers' knowledge level. With these acquired skills, teachers would be able to maximize the instructional time within the learning environment and meet the needs of the students within the classroom resulting in student achievement. However, the acquired skills can only be effective through the support of the building leader by leading and guiding the teacher in improving his or her knowledge level in order to obtain greater gains in student achievement.

**Leader-Involved Barriers**

The role of the leader is to ensure that the school is running in an effective manner that warrants high student achievement. Day, Gu, and Sammons (2016) stated that "effective leadership has a positive impact on [the] school organization, culture and conditions, and,

through these, on the quality of teaching and learning and student achievement" (p. 223). Furthermore, "leadership is second only to classroom teaching as an influence on pupil learning and that such influence is achieved through its effects on school organization and culture as well as on teacher behavior and classroom practices" (Day et al., 2016, p. 223). School-related factors that have an influence include but are not limited to the school's master schedule and the availability of resources, which are vital factors in contributing to the students' learning resulting in student achievement.

**Master scheduling.** Working mathematics support classes into the master schedule can become troublesome for educational leaders. Due to limited funding resulting in teacher shortages, leaders must be innovative in incorporating the mathematics support class into their master schedules. Generally, at the middle school level, mathematics support classes are offered during the students' connection block. A connection block is an opportunity for students to participate in extracurricular activities such as physical education, art, music, dance, and other courses. The implementation of the mathematics support class into the master schedule causes a reduction in the number of connection classes offered. Even though other interventions could be offered, such as after-school tutoring or a computer-based program, implementing the mathematics support class is one of the easier solutions to address student needs and causes the least amount of disruption within the school (Beveridge, 2010). Replacing a connection class with a mathematics support class seems like a logical solution from an administrative perspective. However, an art student who enjoys art and has to be withdrawn from art and placed in a mathematics support class could lose the one outlet at school of expressing his or her creativity, which could have a negative impact on the student's interest in school resulting in a possibility of the student dropping out (Abril, 2019).

Additionally, having to move students to a mathematics support class during the middle of the semester while enrolled in another connection class due to students' data could also have an impact on students' interest. When incorporating the mathematics support class into the master schedule, it is essential that the administrator markets the class in a manner that students do not view the class as a "slow class" or a "dumb class" as students sometimes call it. Taking this approach, students will be more receptive to the class and work toward exiting the class by making the necessary academic gains.

**Availability of resources.** With the research sharing the impact of the mathematics support classes, some school district leaders are receptive to and implementing the mathematics support classes within their schools. However, with this implementation, some schools are experiencing difficulties with providing the classes with adequate resources. This struggle is primarily due to limited funding of the school. Therefore, teachers are forced to use the available resources on the school level in order to create an effective class resulting in increases in student achievement. Some studies show that limited resources affect students' performance. In a comparative study conducted by Chandrasegaran and Lay (2016), the study focused on the relationship between the availability of school resources and student achievement. Within the study, the researchers studied eighth graders in two countries: Singapore and Malaysia. The study included 11,660 students. Within each country, some schools had adequate resources, and some schools had limited resources. The researchers utilized the TIMSS test in order to measure students' achievement. Findings indicated that students who were in a classroom that provided adequate resources performed higher than students who had limited resources within the classroom. The researchers concluded that resources are crucial for improving schooling, perhaps even more so in developing countries than in economically developed countries, where

adequate school structures and material resources can be taken for granted. In another study conducted by Lee and Zuze (2011), the researchers studied 6th graders in four countries: Malawi, Namibia, Uganda, and Botswana. The study included 12,609 students and a total of 707 schools taking part in this study. Teachers, as well as school principals at the perspective schools, participated in this study as well. Data were obtained from students' performance on the SACMEQ-II test which tested students' skills level in reading and mathematics. Also, data were obtained from an administered survey that was given to teachers and school principals on the availability of resources at the school. Based on the results from the survey, it was reported that the availability of resources differed in the various countries as well as different schools. The researchers concluded that the accessibility of resources has an impact on student achievement.

Based on the research that the availability of resources plays a significant role in students' achievement. Therefore, principals can identify innovative ways of obtaining resources to be implemented within the mathematics support classes. With the availability of resources, students in mathematics support classes will have the opportunities to make academic gains resulting in students' achievement. In conclusion, the extent and quality of school resources have a significant impact on the quality of classroom instruction.

## Chapter Summary

Based on the literature, it is evident that students in middle schools are struggling in the area of mathematics, specifically in the state of Georgia. With this struggle, students' performance on state assessment is not improving. The struggle in mathematics could be attributed to the development of mathematics anxiety, lack of prerequisite mathematics skills, and disengagement of the students. As a result of this challenge, principals are making decisions to implement mathematics support classes within the schools in an effort to support the skills that

the students lack. Some studies illustrate the impact that mathematics support classes have on students' achievement. However, with the implementation of the mathematics support classes, there exist potential barriers that could hinder the success of the mathematics support classes such as teacher attitude, teacher anxiety, lack of teacher knowledge, scheduling of the class, and the availability of resources. With the support of the administrator, it is possible that barriers to the mathematics support class could be eliminated, and the effectiveness of the mathematics support class could be executed, resulting in an increase in student achievement.

The intent of this study was to identify an effective mathematics support class, best practices that aid in increasing student achievement and that can be communicated to school districts that had or were planning on implementing mathematics support classes in order to increase student achievement. Middle school students' continually declining performance in mathematics warrants a need for a study to evaluate current practices and identify key components within the current practices that will further aid in students' achievement in mathematics due to limited research on the impact math support classes have on student achievement at the middle school level.

# CHAPTER 3

# METHODOLOGY

Contributing to the existence of current research on the implementation of interventions within mathematics, specifically focusing on the implementation of mathematics support classes to bridge the gap in the lack of mathematics skills among students, the purpose of this study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact that mathematics support classes had on student achievement. It was the intent of the researcher that commonalities would be discovered, and a recommended mathematics support class be communicated to school leaders who had implemented or were planning on implementing a mathematics support class in order to increase student achievement in mathematics.

For the purpose of this study, the methodology section was organized in a manner that provided vital, procedural details pertaining to this study. The details within this chapter were divided into multiple sections: research questions, research design, reporting the data, and chapter summary. Within the research design section, there were subsections that provided essential details to the development of this study, such as site information, populations, sample, sampling, instrumentation, ethical consideration, the role of researcher, data collection, and data analysis of this study. This division of this chapter provided insight into this study, making the study easier to follow and understand.

## Research Questions

The researcher developed the following overarching research question for exploration purposes of this study: How impactful is the mathematics support class on student achievement? In addition, the following sub-questions served to add clarity to the investigation:

1. According to principals and teachers, what are best practices within the mathematics support class that positively impact student achievement?
2. According to principals and teachers, what are barriers within the mathematics support class that negatively impact student achievement?
3. According to principals and teachers, in what ways could the mathematics support class be improved to obtain greater academic gains in mathematics?

## Research Design

To evaluate the perceptions of the principals, mathematics teachers, and mathematics support teachers as related to the impact the mathematics support classes had on student achievement, the researcher employed a qualitative basic interview approach in this study. According to Creswell and Creswell (2018), "qualitative research is an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem" (p. 4). Evaluating the perceptions of the principals, mathematics teachers, and mathematics support teachers provided the researcher with an understanding of the impact the mathematics support classes had on student achievement. The obtainment of this understanding allowed the researcher to explore the effectiveness of the mathematics support class, which served as the centralized focus of this research study.

In evaluating the effectiveness of the mathematics support class in terms of how the class impacted student achievement based on perceptions, the researcher framed this study by utilizing responses to virtual interviews as a form of data, which further supported the approach of utilizing the qualitative research design. The use of structured interview questions aided in the researcher understanding the perceptions of principals, mathematics teachers, and mathematics support teachers as related to the impact the mathematics support classes had on student

achievement. Merriam and Tisdell (2016) defined "a research interview as a process in which a researcher and participant engage in a conversation focused on questions related to a research study" (p. 108). Therefore, examining the impact the mathematics support classes had on student achievement based on perceptions warranted the qualitative approach. Whereas a quantitative approach can measure the impact the interventions within the mathematics support classes had on student achievement, a qualitative approach was vital to elucidate information pertaining to the perceptions of the impact the mathematics support classes had on student achievement.

With the qualitative approach being the overall design of this research study, the researcher specifically utilized the case study approach to further compliment this study in evaluating the perceptions. Merriam and Tisdell (2016) defined a case study as "an in-depth description and analysis of a bounded system" (p. 37). The mathematics support classes within the school district the researcher utilized served as the bounded system for the purpose of this study serving as the unit of analysis. Taking this approach supported the efforts of the research as well as assisted with answering the research questions that guided this study.

**Site Information**

The researcher utilized one school district due to the easy accessibility of school personnel in order to solve problems of educational practice in one's own area. Perry (2012) affirmed this approach by stating that researchers should be "change agents and affect practices at all levels. Additionally, researchers should create positive changes that have the potential to make a difference in the lives of children and communities affected by social and cultural inequity" (p. 42). In serving as the change agent, the researcher selected a school system that is located in the state of Georgia which is tasked with educating over 32,000 students in 56 different schools. It is a public-school servicing grades Pre-kindergarten through 12. For the

purpose of this research study, the researcher utilized middle schools within the school district that had a 2019 CCRPI score of 59 and below as these schools had a higher percentage of students who were performing below grade level in mathematics as well as mathematics support classes. There exists a total of 15 middle schools within the school district. Of those 15 middle schools, seven schools had an overall CCRPI score of 60 and above for 2019, and eight schools achieved a CCRPI score of 59 and below for 2019. Pseudonyms were assigned for the school district as well as the schools and personnel that participated in this study. The pseudonym that was utilized for the school district was CM School District. The pseudonyms for the schools are discussed later in this section.

**Population, Sample, and Sampling**

The researcher targeted middle schools within CM School District. In middle schools, core subjects are departmentalized, and mathematics support classes are offered. Whereas in most elementary schools' core subjects are not departmentalized, all core subjects are taught in a self-contained environment, and mathematics support classes are non-existent at this level. Additionally speaking, in middle school, unlike elementary school, all students are faced with requirements to participate in content-specific high-stakes assessments, which are often linked to promotion requirements. With the selection of the middle schools, the researcher focused on middle schools with a CCRPI score of 59 and below for 2019 with the population, including principals, mathematics teachers, and mathematics support teachers. Middle schools with a 2019 CCRPI score with a 59 and below had a higher percentage of students performing below grade level in mathematics resulting in mathematics support classes being more prevalent than those with a 2019 CCRPI score of 60 and above. These schools had a higher percentage of students

who were performing at or above grade level resulting in mathematics support classes not being evident in these schools.

Generally, within every middle school, there exists a principal, at least three mathematics teachers, and at least one mathematics support teacher. The majority of the middle schools within this school district either offer the mathematics support class as a connection class during students' connection time, or the class is embedded within the regular rotation of the core subjects where five rotations are required. The principal of the school determines the type of mathematics support class. Typically, a mathematics support teacher teaches a minimum of three classes. Generally speaking, these mathematics support classes are typically made up based on student data on state assessments, local assessments, and classroom observations. Students who obtain a score of a beginning learner on the state mathematics assessment or who failed their previous mathematics class are identified as potential candidates for the mathematics support class. However, if there is an increased number of students who meet the qualifications to get into the mathematics support class, then the administrator of the school will make the final decision as to whom to put into the mathematics support class.

For the purpose of this study, the researcher's goal was to involve a maximum of three middle schools that had a 2019 CCRPI overall score of 59 or below. Each middle school had a pseudonym as an identifier: CM Middle 1, CM Middle 2, and CM Middle 3. With the identification of the three middle schools, the researcher used a triad from each school which consisted of a principal, a mathematics teacher, and a mathematics support teacher to participate in this study. The maximum number of triads for this study was three. According to Creswell and Creswell (2018), "case studies include about three to five cases" (p. 186). There must be a triad

from each school in order to participate; however, if there was not a triad from each school, then the participants were not allowed to participate in this study.

With the individuals having the choice to participate in this research study, the sampling technique the researcher utilized was purposive sampling. Etikan, Musa, and Alkassim (2016) stated: “purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses” (p. 2). Selecting these individuals was a part of the strategic design in evaluating the perceptions as related to the mathematics support class and the impact the class has on student achievement. The principal’s role is to serve as the instructional leader of the building by evaluating and monitoring instruction. The mathematics teacher’s role is to serve as a content specialist, whereas, the mathematics support teacher’s role is to serve as the mathematics interventionist. The expectation of the district is for mathematics support teachers to incorporate a variety of interventions they deem necessary in supporting students in increasing their mathematics performance, which is expected to have a positive impact on state mathematics assessment and will yield an increase in achievement as it is related to the CCRPI.

Other middle schools within the school district could have been selected to be a part of the study; however, these middle schools did not meet the criteria due to their 2019 CCRPI score being 60 and above. Their participation in this research study could have skewed the results in which is being collected due to resources provided at the schools as well as a higher percentage of students not needing to enroll in a mathematics support class due to students being on grade level. Therefore, only involving the middle schools with a 2019 CCRPI score 59 and below were essential for reporting the perceptions of the impact the mathematics support classes had on student achievement for students who were performing below grade level in mathematics.

## Ethical Considerations

Given the qualitative nature of this study and the closeness of the participants, each participant was given an opportunity to choose to participate in this study by signing an Informed Consent Form. Participants also had an opportunity to withdraw at any time from the study by sending an email to the researcher. Giving participants this opportunity reassured participants that their participation in this study was voluntary, and they were free to withdraw at any point and for any reason during this study.

The participants were fully informed about the objectives of this research study. Additionally, they were reassured that the answers obtained were treated confidentially and were used for educational purposes only and only for the purpose of this research study. Surmiak (2018) supported this notion by stating that "one way to protect participants is maintaining confidentiality" (p. 1). According to Lancaster (2017), "the concept of confidentiality is associated with anonymity, insofar as anonymity is one way to operationalize (or apply) confidentiality by ensuring that individuals cannot be identified" (p. 98). Therefore, the participants in this study identity were not to be disclosed. Each participant was provided with a unique ID for the purpose of this study. During the conduction of this research study, participants were not harmed or abused both physically and psychologically. The intent of the researcher was to create and maintain a climate of comfort for the participants.

## Role of the Researcher

In a qualitative study, the role of the researcher is to "access the thoughts and feelings of research participants, which can enable development of an understanding of the meaning that people ascribe to their experiences" (Austin & Sutton, 2015, p. 231). Similarly, Merriam and Grenier (2019) stated the role of the researcher is "interested in knowing how people understand

and experience their world at a particular point in time and in a particular context" (p. 4). For the purpose of this study, the researcher accessed the thoughts and feelings of the participants by conducting virtual interviews that were implemented within this research study. In addition, the researcher interpreted the results of the interviews within this research study.

According to Merriam and Grenier (2019), "exploring how individuals experience and interact with their social world, and the meaning it has for them, is based on an interpretive (or constructivist) perspective embedded in qualitative approach" (p. 4). Therefore, the researcher explored the knowledge obtained pertaining to the qualitative data collected in order to interpret the data and develop an understanding of the thoughts and feelings of the participants. However, the interpretation of the data was subjective based on the researchers' knowledge. The researcher believed that the data obtained provided insight into the mathematics support classes resulting in the identification of an effective mathematics support class and communicated a viable solution to improve student achievement.

**Instrumentation**

A virtual interview served as the means by which data were collected for this study. The type of interviews that the researcher conducted were structured interviews (see Appendix B). Puyvelde (2018) defined a structured interview as:

> An interview which rely on a standardized set of questions that frames interactions with interviewees. The context and process of structured interviews is repeated in the exact same manner with all the interviewees to ensure that results can be aggregated reliably. Questions are clear and specific enough for the sources to respond to them effectively. Structured interviews standardize the data collection process and make it easier to compare answers from one interviewee to another. (p. 382)

The utilization of structured interviews aided the researcher in obtaining quality information as it pertained to the perceptions of the mathematics support classes. In addition, taking this interview approach shed light on any misunderstandings and allowed participants to elaborate on their thoughts to evaluate better the perceptions of the participants as related to the impact the mathematics support classes had on student achievement.

Being that there are limited research interview questions pertaining to the desired questions the researcher wants to ask, the researcher developed questions that were aligned to Teacher Keys Effectiveness System (TKES), which is an evaluation system utilized in the state of Georgia that is designed to build effective teachers and create consistency and comparability, as well as the Leader Keys Effectiveness System (LKES), which is an evaluation system utilized in the state of Georgia that is designed to develop effective school leaders (GaDOE, 2019). A list of the TKES and LKES associated with the questionnaire are listed in Appendix C.

**Data Collection**

Once the IRB gave the official approval of the proposed study (see Appendix A), the researcher communicated with all middle school principals whose school's overall CCRPI score was 59 and below for 2019 about the principal being a part of this study. Within the email, the principals were asked to provide a list of mathematics teachers and mathematics support teachers with their contact information that could be considered as participants in this study. After the receipt of the consent forms and the requested list from the principals, the researcher sent an email to the identified mathematics teachers and mathematics support teachers providing them with a summary of the research study and the possible benefits as a result of being a part of this study. Due to multiple mathematics teachers and mathematics support teachers being invited to participate in this research study, the researcher selected the first mathematics teacher and

mathematics support teacher that submitted his or her consent form back from each school to participate in this study. Once the researcher had a triad from each of the three schools, the researcher notified the selected participants through email the next steps for participation in moving forward with this study, such as scheduling a virtual interview. After three triads had been identified, the researcher notified others who desired to participate in this study that they were not to be part of this study.

Each interview lasted no more than 60 minutes. Interviews were conducted virtually via Google Hangouts, which allowed the researcher to record each interview. Once an interview was completed, the researcher downloaded the recording into NVivo-12 for transcription. For verification purposes, the researcher checked to ensure that the transcription matched the audio version of the interview. Taking this approach allowed the researcher to obtain a deeper understanding of the participants' perceptions through their experiences. Once that was complete, the researcher anonymously selected one principal and one teacher to verify the accuracy of his or her transcript via email, which constituted member checking. The researcher made appropriate changes requested by the member-checker. Once this process was complete, audio-files were destroyed and data analysis began.

**Data Analysis**

The researcher conducted a data analysis by following the data analysis process discussed by Creswell and Creswell (2018) "Step 1: Organize and prepare the data for analysis. Step 2: Read or look at all the data. Step 3: Start coding all of the data. Step 4: Generate a description and themes. Step 5: Representing the description and themes" (p. 193). Utilizing these steps guided the data analysis process of this study to assist the researcher in obtaining an understanding of the data collected.

The transcription of the interviews was inputted into NVivo-12 software to assist with the data analysis of the collected data. According to QSR International Pty Ltd. Version 12 (2018):

> NVivo-12 is a qualitative data analysis application that allows you to collect, organize, analyze, and visualize unstructured or semi structured date. With NVivo-12, on can import data in a range of file formats, organize demographic data, code sources, captures ideas, run queries, and visualize project items. (p. 1)

The data obtained from the interviews were organized chronologically and categorically, reviewed repeatedly, and coded continually (Creswell & Creswell, 2018). Utilizing this computer program assisted the researcher in further analyzing the data collected and identifying the major themes that existed within the data. Additionally, this program assisted with eliminating any errors within the data, which was beneficial to the researcher as he reported the findings and drew a conclusion to this research study. After taking the actions discussed above, the researcher conducted a case analysis and cross-case analysis. In essence, analyzed data from the principals, the mathematics teachers, and the mathematics support teachers involved in this research study were reviewed to determine if there exist any commonalities within each of the groups. Then the researcher analyzed the data for each "set" consisting of the principal, the mathematics teacher, and the mathematics support teacher and determine if there existed any commonalities within each "set." Following the conduction of the case analysis and cross-case analysis, the researcher examined the data analyzed and reported commonalities that were discovered as well as additional findings that exist within the data.

## Reporting the Data

The findings of this study are presented as they addressed each research question. Within that, emergent themes are presented with well-chosen direct quotes to support each finding, as

recommended by Creswell and Creswell (2018) and Merriam and Tisdell (2016). Findings from this research study were obtained from data analyzed by the researcher as well as data that were inputted into HyperQual. Based on the analysis of data, the data were displayed by utilizing a narrative text. Creswell and Creswell (2018) suggested that "narrative text has been the most frequent form of display for qualitative data" (p. 209). In addition to displaying the data utilizing a narrative text, the researcher ensured that the reporting of the data was in a descriptive form. The incorporation of a descriptive form assisted in communicating a holistic picture of this research study.

## Establishing Trustworthiness

Lincoln and Guba (1985) recommended strategies for the researcher to employ in order to increase the trustworthiness of the qualitative research study findings. In a qualitative study, trustworthiness is determined through credibility, confirmability, transferability, and dependability. In an effort to decrease the threats to the credibility of the findings of the research, the researcher incorporated member checking by anonymously selecting one principal and one teacher to verify the accuracy of his or her own transcript via email. To increase the confirmability of results, the researcher provided an audit trail consisting of a detailed description of how the data were collected, how themes were derived, and how decisions were made throughout the analysis (Amankwaa, 2016). The researcher has utilized a rich, thick description in order to enable other researchers to evaluate the research conducted and make decisions in reference to the transferability of this research study. "It is the responsibility of the consumer of research to determine or decide if and how research results might be applied to other settings" (Amankwaa, 2016, p. 122). To increase the dependability, the researcher consistently compared the data, searched the literature to identify examples of the phenomenon

as well as searched for negative instances of the phenomenon, and checked and rechecked the data (Lincoln & Guba, 1985).

## Limitations, Delimitations, and Assumptions

Within this study, there were several limitations. One of the limitations consisted of only studying the mathematics support classes within the researcher's school district; therefore, findings within this study may only be limited to mathematics support classes within the researcher's school district and no other school districts. However, the researcher provided enough information regarding the district so the reader can determine the transferability of findings for him/herself. Another limitation of this study consisted of limited access to the availability of resources offered by the school district at the different schools involved in this study. In addition, this study was limited to various mathematics pedagogical knowledge of the principals as well as the teachers. Additionally, the study was limited to the various teaching styles within the mathematics support class, which may affect student-teacher relationships; however, teaching style was not part of this study. These limitations posed a threat to the results of this research study. Only limiting the research study to focus on middle schools with a 2019 CCRPI overall score of 59 and below did not allow the researcher to examine all the mathematics support classes within the school district. This delimitation was put in place to narrow the researcher's focus due to the numerous mathematics support classes within the school district.

In this current research study, it can be assumed that the mathematics support classes were the same at every school within the school district. In addition, it can be further assumed that the mathematics support classes should automatically impact student achievement in a

positive way yielding an increase in the school's achievement points, which is a critical component of the school's CCRPI score.

## Chapter Summary

In summary, this study utilized a qualitative approach in the case study tradition. The participants in this study included a principal, a mathematics teacher, and a mathematics support teacher from each of the three identified schools. Therefore, this study included a total of three principals, three mathematics teachers, and three mathematics support teachers, for a total of nine (9) participants. Data collected consisted of the participants' responses to structured interviews; data obtained were organized in a manageable manner and coded for potential themes that existed within the data. NVivo Version 12 software was utilized to assist with transcription and data analysis. Commonalities were identified for all the participants as well as for each set of participants. Lastly, findings were reported in narrative and descriptive form, which further assisted with discussing the findings in greater detail and aided in drawing a conclusion to this research study. Details provided in this methodology provided an audit trail so the study may be replicated.

# CHAPTER 4

## REPORT OF THE DATA AND DATA ANALYSIS

The purpose of this research study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers regarding the impact the mathematics support classes had on student achievement. It was the intent of the researcher that commonalities would be discovered, and a recommended mathematics support class be communicated to school leaders who had implemented or were planning on implementing a mathematics support class in order to increase student achievement in mathematics. The following overarching research question for exploration purposes informed this study: How impactful is the mathematics support class on student achievement? In addition, the following sub-questions served to add clarity to the investigation:

1. According to principals and teachers, what are best practices within the mathematics support class that positively impact student achievement?
2. According to principals and teachers, what are barriers within the mathematics support class that negatively impact student achievement?
3. According to principals and teachers, in what ways could the mathematics support class be improved to obtain greater academic gains in mathematics?

In this chapter, the research findings are presented as explicated from the analysis of the data obtained from the virtual interviews that were conducted. During the in-depth interviews, research participants described their perceptions of the mathematics support class. The analysis of nine interview transcripts aided in the researcher obtaining the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact that the mathematics support class had on student achievement.

## Description of Participants

There were a total of three dyads from three middle schools from a suburban public-school system in the state of Georgia that services grades Pre-kindergarten through 12 involved in this research study. Each school had a 2019 CCPRI of 59 and below. The enrollment of the middle schools ranged from 450 students to 750 students. The student demographics of the school population of the middle schools were predominantly African Americans. Within each middle school, there existed at least one math support class. At each middle school, there was a triad: the principal, the mathematics teacher, and mathematics support teacher who participated in this research study for a total of nine participants.

The gender of the participants consisted of six females and three males. The educational experience of participants in this research study ranged from 3 years to 22 years. All participants were fully certified in their current discipline. There were eight participants who had additional certifications in addition to their current discipline such as social studies, history, special education, and/or language arts to name a few. However, the three principals did not have a mathematics certification on their certificate but had additional certification background that was not directly related to leadership.

Table 4 below displays the list of participants. Each participant has a unique code in order to conceal his/her identity and also to ensure confidentiality. The table displays the description in terms of their position, school's pseudonym, and educational experience in years.

*Table 4: Participants' Description by Position, School's Pseudonym, and Years of Educational Experience*

| Participants' ID Code | Position | School's Pseudonym | Educational Experience in Years |
|---|---|---|---|
| P1 | Principal | CM Middle 1 | 14 |
| M1 | Mathematics Teacher | CM Middle 1 | 6 |
| MS1 | Mathematics Support Teacher | CM Middle 1 | 6 |
| P2 | Principal | CM Middle 2 | 20 |
| M2 | Mathematics Teacher | CM Middle 2 | 22 |
| MS2 | Mathematics Support Teacher | CM Middle 2 | 16 |
| P3 | Principal | CM Middle 3 | 16 |
| M3 | Mathematics Teacher | CM Middle 3 | 17 |
| MS3 | Mathematics Support Teacher | CM Middle 3 | 3 |

*Note*. Each of the participants has been given a unique code for confidentiality.

## Findings

At the time of this research study, the school district mandated that the schools embed the mathematics support class into the regular mathematics class in eighth grade only. This was the second year in which the school district mandated the schools to embed the mathematics support class into the regular eighth grade mathematics class. Schools had the autonomy to embed the mathematics support class into sixth and seventh grade and/or make the mathematics support class a separate class either a part of the core curriculum or during the school's connections block.

The data collection was over a two-week time period. The researcher conducted virtual interviews, and the interviews were transcribed accordingly. In addition, the researcher compared

the transcription of the interviews to the audio recording for accuracy. The participants contributed differing amounts of information to the six themes that comprised the narrative. During the interview, there were some participants who talked at length on four or five themes, whereas some participants made nearly equal contributions across all six themes. Therefore, all participants' voices and perceptions are represented in this research study.

The six broad emergent themes that stemmed from the analysis of the data consisted of the following:

Theme One: Implemented Instructional Strategies

Theme Two: Lack of Students' Cognitive Ability and Skills

Theme Three: Lack of Educator's Subject and Pedagogical Knowledge

Theme Four: Conditions of the Class

Theme Five: Structure of the Class

Theme Six: Recommended Instructional Strategies

The first theme *Implemented Instructional Strategies* represents the various types of instructional strategies that were utilized within the mathematics support classes that positively impacted student achievement. The second theme *Lack of Student's Cognitive Ability and Skills* embodies student-related barriers that negatively impacted student achievement of the mathematics support classes. The third theme *Lack of Educator's Subject and Pedagogical Knowledge* characterizes different teacher-related and leader-related barriers that have a negative effect on the mathematics support classes. The fourth theme *Conditions of the Class* exemplifies the various attributes of the mathematics support classes that hinder the success of students within the mathematics support classes. The fifth theme *Structure of Class* represents recommendations of improvement to the mathematics support classes to improve student

achievement. Finally, the sixth theme discusses *Recommended Instructional Strategies* that could be incorporated into the mathematics support classes to improve student achievement.

Emergent themes are organized in a perspective that fits the narrative of the findings of this study and are aligned to the research questions that guided this research study. In addition, there are some themes that overlap one another as participants' responses to the interview questions addressed more than one of the represented themes. As a result, the interview data are described where they appear to fit most logically. The following presents the research questions along with the themes that are aligned to each research question with a brief summary of findings.

**Best Practices That Positively Impact Student Achievement**

The first research sub-question sought to uncover principals' and teachers' perceptions regarding best practices that positively impact student achievement. One emergent theme was aligned to this question: *Implemented Instructional Strategies*.

Implemented instructional strategies were highlighted that positively impacted student achievement. The participants agreed on the following implemented instructional strategies: hands on, manipulatives, and grouping. In addition, other participants added the following implemented instructional strategies: the incorporation of differentiation, technology, project-based learning, and real-world applications that had a positive impact on student achievement due to an increase in students' engagement level within the mathematics support classes.

**Implemented Instructional Strategies.** The first theme, *Implemented Instructional Strategies*, focused on the different instructional strategies that were implemented within the mathematics support classes that had a positive impact on student achievement. The participants of this study discussed a variety of instructional strategies that positively impacted student

achievement. Majority of the participants discussed similar strategies, whereas some discussed distinctly different strategies.

The incorporation of hands-on activities (i.e. manipulatives) were heavily identified by the participants. P3 explained that the incorporation of this strategy,

> allows students to understand abstract math. When have an opportunity to apply their tactile skills make the math more realistic for them which allows them to be more receptive to understanding the concepts which aid in the mastery of the concepts. (L 93-96)

MS3 further stated that "the use of manipulatives allows students to experience hands on which further engage students in active learning" (L 98-99). It was evident within the participants that as a result of the implementation of hands on strategies, student engagement is ignited which yields student achievement.

In addition to utilizing hands-on activities, majority of the participants expressed that the incorporation of groups that were structured engaged students in active learning. P1 explained that "working in groups has helped. And it really helps to keep them engaged because they are held accountable for their portion of work within the class" (L 109-110). Through the incorporation of groups, P3 explained "students experienced stations through differentiation which addressed students' learning needs" (L 97-98). MS3 stated that "differentiation allowed me to assist the students in mastering the skills needed in order to be successful" (L 99-100).

Differentiation was another instructional strategy that was commonly deliberated by the school personnel of CM Middle 3. The other middle schools involved in this research study expressed other effective instructional strategies such as incorporating technology, project-based learning, and real-world applications. With the different strategies cited at the different schools

could be attributed to the participants' comfort level of utilizing the strategies as well as the resources that are made available at the current school.

**Barriers That Negatively Impact Student Achievement**

The second sub-question asked: According to principals and teachers, what are barriers within the mathematics support class that negatively impact student achievement? The following three themes were aligned to this question: *Lack of Students' Cognitive Ability and Skills*; *Lack of Educator's Subject and Pedagogical Knowledge*; and, *Conditions of the Class*.

The findings revealed student-related barriers. Students' math anxiety and lack of prerequisite skills had an impact on the students' performance within the mathematics support classes as expressed by the majority of the participants. As a result of these conferred factors, participants indicated that students became fearful of being a part of the mathematics class, developed stress, and assumed a defeated attitude which further hindered the students in being successful within the mathematics support classes. In addition, a participant expressed that parents were not supportive due to them not being able to assist students with the current content which further hindered the students in being successful in the mathematics support class making it difficult to close mathematics gaps, for students to think critically, and for students to be able to apply previous knowledge.

In addition to student-related barriers, the findings revealed teacher-related and leader-related barriers. A barrier that was expressed for both the teachers as well as the leaders by the participants was having the background knowledge of the mathematics support classes. It was evident in the discussion that without the background knowledge it was difficult for the leader to understand what to look for when observing the mathematics support classes. In addition, it was evident from the perspective of the teachers that teachers lack the pedagogical skills such as

differentiation in order to meet the needs of the students which also could be attributed to the lack of training for the teachers. Additionally, the findings reported that teachers have anxiety which caused teachers to fear teaching struggling students and being overwhelmed due to the number of standards that are required to be taught. The participants concluded that these factors had a negative impact on student achievement in the mathematics support classes.

Lastly, the findings revealed the conditions of the class that hindered the success of the students within the mathematics support classes. Participants described different structures of the mathematics support classes such as a blended class, a co-taught class, and a separate class during the connections block. The majority of participants expressed that the blended class as well as the separate class were ineffective. This conclusion was drawn based on limited time within the class to address the different needs of the students as well as having too many students in the class. These two conferred factors were heavily expressed by the participants. It was further explained that this caused discipline concerns which made it difficult to teach. Therefore, some teachers incorporated ineffective strategies such as skill and drill, worksheets, and/or lectures. This further disengaged students from the learning environment and limited interaction within the classroom. Lastly, participants expressed that adequate resources were not available within the classroom which negatively impacted student achievement.

**Lack of Students' Cognitive Ability and Skills.** The second theme, *Lack of Students' Cognitive Ability and Skills*, revealed student-related barriers as being a major issue for participants as well as a hindrance in student achievement in the mathematics support classes. This theme emerged due to the multiple challenges the participants discussed as related to the students being enrolled into the mathematics support classes. First speaking on mathematics anxiety, the majority of the participants discussed this as being prevalent in students which

hindered the students' ability to feel comfortable in the class as well as instilled fear in the students. P3 explained that "students are fearful when asking questions in class or obtaining support in the classroom. In addition, students may fear of being made fun of due to the students not knowing the content that is being taught" (L 66-68). M1 further stated that students "have anxiety because they do not know the basic math. It has not been drilled into them like when we went to school" (L 50-51). Though not all participants identified this as being a barrier, the majority of the participants did state that this barrier had an impact on students' learning. This could be due to some participants not being sure of how to identify the anxiety and/or how to support those students in lessening their anxiety.

Second, the majority of the participants expressed the limited mathematics skills as another concern. Participants utilized various types of lingo instead of limited mathematics skills such as limited core basic skills, prerequisite skills, basic skills, math skills fundamentals, or critical math skills. Participants discussed that students enrolled in the mathematics support classes were academically behind due to them not being able to master skills such as addition, subtraction, multiplication, and division as well as previously taught content. MS2 stated that "without those skills students have a lot self-esteem issues and don't have the confidence to do the math resulting in a defeated attitude" (L 73-74). M1 stated that "without having those strong core basic skills trying to apply those skills into different content and doing different things. I think it kind of makes it a little more stressful to them when trying to master new content" (L 52-54). Participants were consistent in stating that these skills are needed in order for students to be able to master grade level content. Additionally, not having these skills could intensify the mathematics anxiety when students are challenged to evaluate problems that incorporate the various skills.

Another concern that was revealed was the ability of the parent to assist students in mastering content. This concern was not common among the rest of the participants but was heavily emphasized. MS2 stated when she asked "parents for assistance, parents say I can't do it. I can't help my kid with that. And so, a lot of that is being fed from the parent down to the student" (L 89-90). With a defeated attitude already being instilled into the students, it impacted the students' mindset to be successful in conquering different mathematics skills which further "impacted students' ability to critically think due to their current mindset" (Participant M3, L 91). As a result, it was evident that students' cognitive ability was impacted which ultimately impacted student achievement. Lastly, it was evident among participants that the lack of students' cognitive ability and skills hindered the ability to effectively close the mathematics gaps of the students.

**Lack of Educator's Subject and Pedagogical Knowledge.** The third theme, *Lack of Educator's Subject and Pedagogical Knowledge***,** represented the teacher-related barriers and leader-related barriers which were expressed as major issues among some participants in reference to the negative impact the barriers had on student achievement. The principals agreed that teacher's background knowledge as being a barrier. P1 stated that "math support teachers do not have a background in mathematics" (L 91). P3 further stated that "teachers are not equipped to teach students who lack the basic skills that are needed even though teachers have certification in the content but lack the knowledge that is needed to teach the skills that the students need" (L 125-128). Similarly, the principals as well as the mathematics support teachers expressed that the leader too does not have the background knowledge which had a hindrance to the success of the mathematics support classes. MS2 described it as the "administrator does not provide the support and throws it off on the instructional coach" (L 213). With the principals not having the

background knowledge in mathematics, they are uncertain as to what to look for in the mathematics support classes to improve student achievement. P1 stated that "identifying the time to observe and what to look for become difficult due to limited knowledge" (L 172). As a result, it is evident that the principals could only measure their observations based on their current background knowledge. With limited knowledge of the mathematics support classes, it was evident that the principals did not provide adequate training for teachers. P2 explained that "providing adequate professional learning was difficult especially for new teachers to the profession" (L 93-94).

With the lack of training for the teachers, it was evident within the findings that the teachers had difficulty in providing effective pedagogical strategies to improve student achievement. P2 stated that "teachers have not successfully differentiated the instruction or did the response to intervention" (L 29-30). P2 further stated that "teachers have a hard time with the support strategies" (L 51). It was evident that the mathematics support teachers not having the skills needed further impacted the success of the class. The success of the mathematics support classes was based on other contributing factors. Some participants stated that teachers have anxiety within themselves which made it difficult for those teachers to be able to execute an effective lesson. MS2 discussed that teacher anxiety could be attributed to the "plethora of standards that you got [*sic*] to teach within a timeframe" (L 65). In addition, P3 explained that "teachers may show a fear of teaching students who struggle with math" (L 72). As a result, P2 explained that "math teachers are tense and agitated as a result of students' performance" (L 60-61). With these factors, MS2 reported that "teachers lose the motivation which further impacted [*sic*] the student success within the mathematics support classes" (L 192).

Lastly, the incorporation of the mathematics support classes into the master schedule becomes difficult for the leader. P1 explained it is "difficult to find the time in the master schedule for the mathematics support teacher to collaborate with other mathematics teachers on skills that students need and/or lacking" (L 168-169). Several principals argued that there is not enough time in the day that affords the opportunity for the mathematics support teacher and mathematics teachers to collaborate which has a hindrance on the success of the students. Participants in the study did not limit their responses to these specific barriers but expressed other barriers, such as the leader being overwhelmed, teacher mindset, and hiring concerns that had an impact on student achievement within the mathematics support classes but was not commonly discussed by participants within this study.

**Conditions of the Class.** The fourth theme, *Conditions of the Class*, encompassed the different aspects of the mathematics support class that affected the impact the class had on student achievement. This theme emerged due to various responses of the participants in reference to different perceived class-related factors that had a negative impact. First, it was evident based on the participants' responses that the mathematics support classes were not of one unified structure; instead, structure varied from school-to-school with blended classes within the regular mathematics class, co-taught classes with two teachers, and/or separate classes offered during the students' connections block. CM Middle 1 implemented the co-taught class structure. CM Middle 2 implemented the blended class structure. CM Middle 3 implemented the blended class for students in grade 8 as well as a separate class during the students' connections block for students in grade 6 through grade 8. CM Middle 1 stated that the implemented structure did help but limited discussion was provided to substantiate the level of the help the structure had on student achievement. CM Middle 2 and CM Middle 3 reported that the implemented structures

were ineffective. As a result, participants discussed class-related concerns that impacted the mathematics support classes. A primary concerned that was expressed by participants was having too many students within the mathematics support classes. The teachers reported having too many students in the classroom made it difficult for the teacher to be able to teach the students with various needs and resulted in an increase in behavior problems within the classroom. M1 explained that "it is hard to deliver anything within one managed classroom of unruly" (L 164). P1 stated that "it's hard for a teacher to move around to thirty-two kids or twenty-eight kids in the classroom to try to assist each kid with each problem" (L 129-130). M1 further stated that "the teacher can't address every student's need and that the ratio of students to the teacher is too high" (L 75-76). MS1 stated that "having twenty-six to thirty kids in there and they're all different levels and they struggle in math concepts make it difficult for the teacher to teach" (L 120-121). MS3 expressed that "larger classes may also make behavioral challenges more difficult" (L 78). It was evident that the classroom size was a huge concern to the participants.

With larger classes being evident, it became even difficult to teach the students due to the limited time within the classes. MS3 explained that "time becomes difficult in order to review or scaffold a particular topic, resulting in students losing out on much of the benefit of having a course just to support another course" (L 90-91). MS2 further stated that "we can't hit them all and we can't make the impact that we really want to make" (L 112-113). As a result, other strategies were implemented within the classes such as lecturing, skill and drill, unstructured groups, and/or worksheets with hopes of supporting student learning as expressed by the participants. However, the participants stated that these strategies were ineffective strategies. P2 explained that classes consisted of, "sit and get and lecturing limited student interaction with one

another" (L 87). MS3 further explained that "lecture is often the least effective way to transfer knowledge from the educator to the student, granted sometimes it is also the only method available" (L 28-29). MS1 stated that "worksheets are boring" (L 220). P1 expressed that "the incorporation of worksheets, kids are less engaged in the work session" (L 132-133).

Lastly, limited resources within the mathematics support classes were another factor that hindered the success of the students. M1 stated that "leaders are unable to financially provide adequate resources resulting in limited resources being provided" (L 146-147). M3 stated that "the resources sometimes are limited" (L 140). P3 furthered explained "due to funding, I may not be able to purchase the necessary resources that are needed in order to supplement the support class, whereas some schools may have the funding to purchase the resources that are needed" (L 143-144). It was evident that half of the participants expressed that adequate resources were lacking due to funding resulting in the mathematics support classes not making the necessary gains.

**Mathematics Support Class Improvements for Academic Gains**

The final sub-question that guided this study addressed was the following: According to principals and teachers, in what ways could the mathematics support class be improved to obtain greater academic gains in mathematics? Two themes emerged that addressed this topic: *Structure of the Class*; and, *Recommended Instructional Strategies*.

The findings revealed ways the mathematics support classes could be improved to obtain greater academic gains in mathematics. The findings presented the following: a reduction in the class size as well as a model class for teachers and leaders to go and observe in order to obtain ways in which to improve the mathematics support classes. In addition, participants expressed the need to improve the culture of the mathematics support class as well as increase more time in

the class to work on the lack of prerequisite skills that the students possess. The findings continued to reveal slowing the pace of the classes, selecting an experienced teacher, separating the class from the regular mathematics class, and adding two adults in the class to support the needs of the students.

In addition to improvement of the mathematics support class, findings reported the incorporation of different recommended instructional strategies to obtain greater academic gains in mathematics. The following were instructional strategies that were recommended by the participants: incorporating differentiation into the mathematics support classes, use the RTI process to intervene on the limited skills of the students, utilize a scripted program to further assist in meeting the students' needs, and incorporate technology to individualized instruction. The participants did not all agree to the same instructional strategies that were discussed; however, they expressed a need to improve the mathematics support classes to obtain greater academic gains.

**Structure of the Class.** The fifth theme, *Structure of the Class*, revealed recommendations that were given by the participants to improve the mathematics support class to obtain greater academic gains in mathematics. This theme emerged based on experiences and knowledge of the participants that were changes that could be effective and would improve the mathematics support classes. Findings reported that there were a few similar recommendations for improvement from participant to participant and from school to school. One recommendation that was commonly articulated by some of the participants was improving the culture of the class by possibly changing the name of the class to more of a positive name. Having support attached to the name creates a negative connotation that impact students' self-esteem as well as confidence level. M2 recommended changing the name of the class to "the word math *innovation*

or make it something like *math rocks* or something that brings about a positive image" (L 56-57). As a result, M2 stated that this would allow "students to be more confident and motivated to do their work" (L 73). M1 concluded that "the culture of your classroom [has] to be one that is inviting" (L 55). Another recommendation that was voiced by the majority of the mathematics support teachers was to increase the time in the class in order to build students' limited skills to a proficient level. MS3 expressed "more time to be spent in the areas of need to build a foundation so that they are capable of learning grade level content in their primary math class" (L 33-34). MS1 recommended "including more instructional time in the class for teachers to work on the [limited] skills" (L 269). With the increase of time, student's learning needs could be met resulting in growth within the student as well as resulting in content mastery.

The findings reported below were not consistent in the recommended improvement to the structure of the mathematics support classes from the participants individually or the different schools. There was a recommendation in providing a model mathematics support class in order for principals and teachers to come and observe to obtain knowledge on how to properly implement the mathematics support class. P3 explained that "a clear structure is needed in order to effectively provide support for students in order to meet the needs of the students. Having a clear structure promotes a solidified structure for implementation" (L 44-45). Another recommendation that was expressed was the reduction in class size. In reducing the class size, the teacher expressed that he/she will be able to provide adequate support in meeting the students' unique learning needs. M3 recommended "a smaller group setting like one on one or maybe three or four students at a time is definitely what is needed" (L 76). A large class size with students with various learning needs creates classroom management issues resulting in learning not taking place, as alluded to earlier by participants. Lastly, there were other

recommended structure-related improvements by the participants but were not commonly discussed among each other such as implementing a slower pace for the class, obtaining an experienced teacher to teach the mathematics support class, including two adults within the class for added support, and separating the mathematics support class from the regular mathematics class.

**Recommended Instructional Strategies.** The sixth theme, *Recommended Instructional Strategies*, encompassed instructional strategies recommended by participants to obtain greater academic gains in mathematics. There was no identified consistency in the recommended instructional strategies for the mathematics support classes from the participants individually or across the different schools. It was recommended that differentiated instruction should be an element of the mathematics support classes. MS2 stated that "the need to incorporate differentiation. You gonna [*sic*] have to have the differentiation in there because you got [*sic*] different levels" (L 237-238). P2 explained that the mathematics support class was not successful because "we have not successfully differentiated the instruction or did the response to intervention" (L 30). Through the incorporation of differentiation, P1 explained that this would "afford [us] the opportunity of breaking the content down more for our students" (L 180-181). It was evident that the participants recommended strategies that they believed will meet the unique needs of the students within the mathematics support classes.

In an effort to further meet students' learning needs, two participants expressed the need for a scripted program that would consist of highly structured lessons that are aligned to specific skills. MS1 recommended "having a scripted program will help" (L 278). P3 added that "a scripted program can be utilized to assist in meeting the students' need" (L 149-150). Other participants did not discuss a scripted program but did recommend incorporating technology for

students to utilize to assist with tailoring instruction to meet students' needs. P2 recommended "incorporating individual technology devices into the classroom" (L 125). MS3 recommended "integrating technology into daily lessons which can help students to feel like the material is new and fresh. Technology offers a valuable way for students to interact with the material" (L 171-172). The incorporation of technology allows for students to experience project-based learning. P2 recommended "increasing student engagement and students practice by incorporating project-based learning" (L 103-104). MS3 explained that "project-based learning allows students to see mathematics in a tactile way" (L 66-67). Though there were different instructional strategies recommended by the participants, it was evident that they feel there are ways in which the mathematics support classes can be improved in order to obtain greater academic gains in mathematics.

**The Impact of Mathematics Support Class on Student Achievement**

The overarching question this study sought to answer was how impactful was the mathematics support class on student achievement. Based on the findings of this research study, it was evident that there were only two participants: P1 and MS1 who expressed the mathematics support class as being impactful. P1 explained that "the support class helps students who are behind" (L 46-47). MS1 further stated that "the support class gave students confidence in math class when dealing with difficult concepts" (L 67-68). However, the remaining participants explained that the mathematics support classes were not effective or failed to comment on the effectiveness of the mathematics support class. There were best practices discussed such as different improved instructional strategies; however, the findings revealed limited improved instructional strategies discussed by the participants. In addition, the findings revealed barriers to the mathematics support classes that were discussed by the participants in great detail. With the

discovered barriers, the findings revealed ways in which the mathematics support class could be improved to obtain greater academic gains. While the data provided limited knowledge on the impact the mathematics support class has on student achievement and heavily discussed the ineffectiveness of the mathematics support class, it can be concluded that the findings reported that the mathematics support class was not impactful as it was intended to be. However, data also provided recommendations for improvements that could be made in order to develop a mathematics support class that promotes student achievement.

Overall, the principals involved in this research study deemed the incorporation of grouping as well as the utilization of hands-on activities (e.g. manipulatives) as effective implemented instructional strategies. With the identification of best practices within the mathematics support class, the principals discussed many common barriers within the mathematics support class such as the following: students having mathematics anxiety which resulted in students exhibiting fear and timid behavior; students lacking the prerequisite mathematics skills; the lack of the teacher's background knowledge; teacher anxiety; the leaders' lack of knowledge to be able to assist and provide support; the incorporation of the mathematics support class into the master schedule; too many kids in the mathematics support class; the incorporation of ineffective strategies; and, limited resources within the mathematics support class. Though there exists a variety of barriers, the principals commonly discussed one way in which the mathematics support class could be improved was by observing a model mathematics support class.

Overall, the mathematics teachers involved in this research study identified the incorporation of grouping as well as the utilization of hands-on activities (e.g. manipulatives) as effective implemented instructional strategies. Though best practices were identified, the

mathematics teachers identified a few common barriers within the mathematics support class, such as students lacking the prerequisite mathematics skills needed for mastering grade level content; too many students within the mathematics support class; and, limited resources within the mathematics support class. Though barriers exist, the mathematics teachers discussed a few common ways in which the mathematics support class could be improved by improving the overall culture of the mathematics support class and reducing the class size of the mathematics support class in order to meet the needs of the students.

Overall, the mathematics support teachers involved in this research study expressed the incorporation of grouping as well as the utilization of hands-on activities (e.g. manipulatives) as effective implemented instructional strategies. The identification of best practices did not hinder the mathematics support teachers from identifying common barriers within the mathematics support class, such as the following: students lacking the necessary skills to be successful; students having mathematics anxiety, which further impacts students' ability to perform proficiently in the mathematics support class; teacher anxiety; limited knowledge of the leader, which affects the level of support that the teachers need; limited time in the mathematics support class to address the different needs of the students; too many students within the mathematics support class, which makes it difficult for teachers to be able to effectively teach and support students; and, the implementation of ineffective strategies. With the existence of barriers, the mathematics support teachers expressed in common discussed the way in which the mathematics support class could be improved would be by increasing the time within the mathematics support class which will allow the teachers to be able address the diverse needs of the students.

Based on the perceptions of participants, it was apparent that all participants identified the same implemented instructional strategies such as the incorporation of grouping as well as

the utilization of hand-on activities as best practices within the mathematics support class that positively impacted student achievement. However, there were limited best practices discussed among the participants. With the discussion of the best practices, the participants expressed multiple barriers within the mathematics support class that negatively impacted student achievement. Common barriers identified by the participants were students' lack of prerequisite mathematics skills and too many students in the mathematics support class. The principals and the mathematics teachers expressed another barrier as limited resources within the mathematics support class. Additional barriers that were commonly identified by the principals and the mathematics support teachers were students' mathematics anxiety; leaders' knowledge and the ability to support; teacher anxiety; and, the incorporation of ineffective instructional strategies. As a result of the barriers, the participants expressed ways in which the mathematics support class could be improved to obtain mathematics gains. Though recommendations were provided, there were not any common recommendations shared among principals and teachers.

## Chapter Summary

The case study conducted within CM School District with a focus on improving the mathematics support class included nine participants: three middle school principals, three middle school mathematics teachers, and three middle school mathematics support teachers. Descriptive findings resulted in six broad emergent themes being unpacked that included the following: *Implemented Instructional Strategies*, *Lack of Students' Cognitive Ability and Skills*, *Lack of Educator's Subject and Pedagogical Knowledge*, *Conditions of the Class*, *Structure of the Class*, and *Recommended Instructional Strategies.*

The structure of the mathematics support classes did vary from school-to-school which made it difficult for the researcher to identify an effective mathematics support class to increase

student achievement based on the understanding of the various perceptions of the participants in this study. To that end, Chapter Five presents a detailed analysis of these findings by discussing the emerged themes from this research study, drawing a conclusion from the emerged themes, and providing recommendations for further research and practice.

# CHAPTER 5

## SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The purpose of this research study was to examine the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact mathematics support classes had on student achievement. This study employed a qualitative case study research design that consisted of one overarching research question and three sub-research questions that framed this research study. The overarching research question was: How impactful is the mathematics support class on student achievement? In addition, the following sub-questions served to add clarity to the investigation:

1. According to principals and teachers, what are best practices within the mathematics support class that positively impact student achievement?
2. According to principals and teachers, what are barriers within the mathematics support class that negatively impact student achievement?
3. According to principals and teachers, in what ways could the mathematics support class be improved to obtain greater academic gains in mathematics?

Interview data were obtained from middle school personnel consisting of three triads of principals, mathematics teachers, and mathematics support teachers in a suburban public-school system in the state of Georgia that services grades Pre-kindergarten through 12 during the Spring of 2020. The findings of this study provided insight to the perceptions of the middle school personnel on the impact the mathematics support classes had on student achievement. Descriptive data analysis was conducted to determine commonalities and provide recommendations regarding mathematics support class to school leaders who had implemented

or were planning on implementing a mathematics support class in order to increase student achievement in mathematics.

## Summary of Findings

The findings of this research study can be categorized into six broad emergent themes. The represented themes provide insight into the perceptions of participants who contributed to this research study. The six broad emergent themes that developed from the analysis of the data consisted of the following:

Theme One: Implemented Instructional Strategies

Theme Two: Lack of Students' Cognitive Ability and Skills

Theme Three: Lack of Educator's Subject and Pedagogical Knowledge

Theme Four: Conditions of the Class

Theme Five: Structure of the Class

Theme Six: Recommended Instructional Strategies

The findings revealed that each school implemented different structures of the mathematics support class. CM Middle 1 implemented the co-taught structure. CM Middle 2 implemented the blended structure. CM Middle 3 implemented the blended structured as well as a separate class during the connections block. Findings uncovered that CM Middle 1 implemented the co-taught structure that did help students, but limited discussion was provided to substantiate the level of the help the structure had on student achievement. CM Middle 2 and CM Middle 3 reported that the implemented structures were ineffective. Though the findings revealed that the majority of the participants expressed the structures being ineffective, there were some positive aspects of the mathematics support classes revealed. The findings revealed a variety of implemented instructional strategies within the mathematics support classes such as

hands on, manipulatives, grouping, differentiation, technology, and project-based learning that resulted in a positive impact on student achievement.

With the stated positive factors of the mathematics support classes, the findings did reveal barriers to the mathematics support classes that negatively impacted student achievement. Findings illustrated that students lacked the basic skills, which caused students to experience difficulty in applying knowledge and being able to critically think. Additionally, the findings revealed that students possess math anxiety resulting in students being fearful and having a defeated attitude, which, in some cases, could be attributed to the lack of the parent's ability to support their children in mastering the content. Other negative barriers that were reported in the findings highlighted that teachers and leaders did not have the background knowledge needed to support students within the mathematics support classes. With this challenge, leaders were uncertain as to what to look for as evidence of good teaching in mathematics support classes resulting in the leaders not being able to provide adequate training for the teachers. As a result, teachers were unable to successfully implement effective pedagogical practices, such as differentiation to meet the needs of the students. This could be further attributed to teachers having anxiety due to the fear of teaching struggling students and/or having to teach too many standards. Additional barriers were identified within the findings which were directed toward the conditions of the class. The findings revealed that there were too many students within the mathematics support classes resulting in discipline concerns. In addition, the time in the class was limited which caused for ineffective strategies to be incorporated into the mathematics support classes, such as lecturing, worksheets, and/or skill and drill causing limited interaction among the students. Lastly, the findings demonstrated that there existed limited technology as

well as other resources within the class that further impacted the students' ability to be successful within the mathematics support class.

Though barriers exist, the findings reported of ways in which the mathematics support classes can be improved to obtain greater academic gains in mathematics. Findings provided the recommendations of reducing the class size, improving the culture of the class, observing a model mathematics support class to take critical elements to improve the current mathematics support class, allowing an experienced teacher to teach the mathematics support class, separating the class from the general mathematics support class, and allowing two adults to teach the class to support in meeting the needs of the students. The findings also recommended instructional strategies to be implemented within the mathematics support classes to improve student achievement in mathematics, such as the incorporation of differentiation, employing the RTI process to intervene and meet the students' needs, utilizing a scripted program to support student learning, and embedding technology into the class to meet the needs of the students by individualizing instruction.

## Discussion of Findings

The findings revealed six broad emergent themes that serve to answer each research question that framed this case study. The following discussion will relate the findings of this study to the existent literature presented in the review of literature.

### Best Practices That Positively Impact Student Achievement

Reviewing current literature on the impact mathematics support class has on student achievement, there exists limited evidence that discusses different effective instructional strategies that were implemented in order to increase student achievement. The participants of this study discussed a variety number of effective implemented instructional strategies that

engaged students in active learning. One strategy that stood out the most among the participants was hands-on activities (e.g. manipulatives). Participants expressed that the incorporation of hands-on activities such as manipulatives were a best practice that positively impacted student achievement. Similarly, Stix (2012) concluded the use of manipulatives "results in a better understanding and retention of mathematics, a decrease in mathematics anxiety, and a heightened confidence level among students" (p. 1).

In addition to the incorporation of manipulatives, the findings revealed the incorporation of groups as another best practice that positively impacted student achievement and maintained the engagement level of the students. Likewise, Cortes, Goodman, and Nomi (2013) explained that to further engage students, support teachers should implement small groups. Additionally, the findings revealed the incorporation of technology into the class as another best practice. Henry, Barrett, and Marder (2016) supported this finding by explaining that mathematics support classes need diverse resources such as technology.

Another strategy identified within the findings of this study was the incorporation of differentiation. With the different needs of the students within the mathematics support class, participants expressed a need to incorporate differentiation into the class. One way to incorporate differentiation into the class is through the RTI process. Nomi and Allensworth (2012) found evidence that the RTI process was helpful in meeting the needs of low-performing students. It was evident among participants in the current study that instructional strategies should engage students in authentic learning.

The participants did include additional implemented instructional strategies. It should be noted that although participants recommended additional implemented instructional strategies, there was very little discussion regarding the growth of the students as a result of implementing

the instructional strategies. The cited implemented instructional strategies could be based upon the participants' current level of knowledge as it is related to the different instructional strategies.

**Barriers That Negatively Impact Student Achievement**

According to current research, students' low performance in mathematics could be attributed to the following: the development of mathematics anxiety as cited by Ruff and Boes (2014) and/or the possession of limited prerequisite mathematics skills as identified by Chang and Beilock (2016). The majority of the participants in this study concurred with these attributed factors. In a study conducted by Leppavirta (2011), it was concluded that mathematics anxiety did have a significant impact on students' performance. Similarly, the findings of this study revealed that students' mathematics anxiety played a major role in the students' success level in the mathematics support class. As a result, students became stressed, which had a negative impact on students' growth and may have added to the inability to close mathematics gaps. In addition to mathematics anxiety, the findings identified the possession of limited prerequisite mathematics skills as another barrier that negatively impacted student achievement. Hudson et al.'s (2010) study revealed that students "exhibited difficulties with number sense that interfered with understanding and recall of basic mathematics facts" (p. 1). Likewise, the findings of this study expressed that students have limited skills such as prerequisite mathematics skills which make it difficult for the students to be able to apply the needed knowledge to be successful within the mathematics support class. Lastly, it was evident that the participants expressed a major concern with students' cognitive ability and skills.

Findings revealed that participants believed that both the leaders and the teachers lacked the background knowledge of mathematics support classes resulting in students' academic achievement being negatively impacted. First, it was revealed that leaders cannot properly

support the teachers due to their lack of knowledge regarding mathematics support classes, which hindered the leaders' ability to provide effective feedback to teachers and to know what to look for when observing the class. Day et al. (2016) stated that "effective leadership has a positive impact on [the] school organization, culture and conditions, and, through these, on the quality of teaching and learning and student achievement" (p. 223). Sirait (2016) explained that teacher quality is central to student achievement. Therefore, the involvement of school principals was crucial in this study because their leadership had an impact on teachers as well as students.

Second, it was revealed that participants believed that teachers' lack of knowledge resulted in students' academic achievement being negatively impacted. Metzler and Woessmann (2012) stated that "teacher subject knowledge exerts a statistically and quantitatively significant impact on student achievement" (p. 487). Lekwa et al.'s (2019) study concluded that students in classrooms with higher quality use of evidence-based teaching strategies exhibited greater gains, whereas students in classrooms with lower quality use of effective strategies exhibited lesser gains. Similar to the findings of the aforementioned studies, the lack of teachers' knowledge is a barrier that negatively impact student achievement.

Teacher anxiety was identified as yet another barrier that negatively impact student achievement. As Beilock et al. (2010) stated, "[Teacher] Mathematics anxiety has been recognized as an impediment to [student] mathematics achievement" (p. 1860). It was evident that participants within this study agreed that teacher anxiety does have a negative impact on the student achievement. Participants further expressed that anxiety could be attributed to the teacher fear of working with struggling students, difficulty incorporating different pedagogical strategies, and/or the expectations to teach multiple standards within the curriculum.

Lastly, the findings of this study demonstrated that the current conditions within the mathematics support class had a hindrance on the students' ability to be successful, as discussed by Martin et al. (2012). The participants highlighted major issues that altered the success of the students, such as the following: too many students within the classroom, a problem cited by Vandenberg (2012); limited resources within the mathematics support class, a problem cited by Chandrasegaran and Lay (2016); and, not having enough time within the class, as discussed by Vandenberg (2012) and Martin et al. (2012). Participants discussed that the increased number of students within the classroom resulted in classroom management problems, which indeed negatively impacted the learning of the students within the mathematics support class. Martin et al. (2012) stated that teacher-student ratio has a statistically significant relationship to students' achievement.

Findings also revealed that not having enough time within the mathematics support class was a barrier, which could possibly be attributed to the large number of students within the classroom. As Vandenberg (2012) stated, class size affects classroom management, classroom instruction, and the academic achievement of the students" (p. 12). In addition to too many students and limited time, the findings revealed that having limited resources within the mathematics support class was another barrier that negatively impacted student achievement. Participants reported that the limited resources within the mathematics support class resulted in limited growth. Similar to findings in this study, Chandrasegaran and Lay's (2016) study concluded that students who were in a classroom that provided adequate resources performed higher than students who had limited resources within the classroom.

The participants did discuss other barriers within the mathematics support class that negatively impacted student achievement such as the incorporation of the lecture method,

worksheet driven, and/or skill and drill. It should be noted that although participants' identified the aforementioned barriers, there was very little discussion regarding the negative impact those barriers had on student achievement. While these barriers are not present in the literature, it is expected that they will make a contribution to current literature.

**Mathematics Support Class Improvements for Academic Gains**

The ways in which the mathematics support class could improve were heavily expressed by participants in this study, such as reducing the class size, improving the culture of the class, and providing experienced teachers to teach the class. According to Martin et al. (2012), teacher-student ratio has a statistically significant relationship to students' achievement. Therefore, the reduction in the class size could improve student achievement. Another recommendation to improve the mathematics support class was to improve the culture of the class. Martin et al. (2012) found that the culture of the class impacted the engagement level of the students. In order to engage students within the mathematics support class, the culture should be inviting and conducive to the needs of the students which also could improve student achievement. Another recommendation to improve the mathematics support class was to provide an experienced teacher to teach the class. However, this recommendation conflicts with findings of Boyd (2005). Boyd (2005) found that teachers with experience who were required to teach low performing students either transferred to another school or quit. Another recommendation to improve the mathematics support class was to observe a model mathematics support class in order to obtain ideas on ways in which the current implemented class could be improved. This structure-related recommendation was not present in the literature; however, it is expected to be a contribution to current literature.

Findings also revealed different recommended instructional strategies that could be implemented within the mathematics support class to improve student achievement. The first recommended instructional strategy was the incorporation of differentiation. One way to differentiate is to incorporate the RTI process. Nomi and Allensworth (2012) found evidence that the RTI process was helpful in meeting the needs of low-performing students. The second recommended instructional strategy was embedding technology into the class. Henry, Barrett, and Marder (2016) explained that the mathematics support class need diverse resources such as technology. The third recommended instructional strategy was breaking down content of the class. According to Cortes, Goodman, and Nomi (2013), the focal point of the mathematics support class must include rebuilding of mathematics skills that student lack; the rebuilding of the skills calls for the content to be broken down to further meet the needs of the students.

The fourth recommended instructional strategy was the utilization of a scripted program that would consist of highly structured lessons that are aligned to specific skills. This recommended instructional strategy was not present in the literature; however, it is expected to be a contribution to current literature. Lastly, it was evident that the strategies that were recommended by the participants were strategies that engage students; therefore, the incorporation of the engaging strategies are vital in the implementation of the mathematics support class.

## Conclusions

As a middle school principal and former mathematics teacher, it is somewhat eye-opening to experience the different perceptions of middle school educators on the impact the mathematics support class has on student achievement. In examining current research, studies have shown that students have demonstrated growth as a result of the implementation of the

mathematics support class. However, the findings of this case study do not align with that research. Findings revealed that some participants agreed that the mathematics support classes implemented were impactful, whereas the majority of the participants expressed that the current implementation of the mathematics support class as being ineffective.

Data analysis uncovered best practices within the mathematics support class that positively impacted student achievement were *Implemented Instructional Strategies*. However, the findings also indicated that barriers existed within the mathematics support class that negatively impacted student achievement such as the *Lack of Students' Cognitive Ability and Skills*, the *Lack of Educator's Subject and Pedagogical Knowledge*, and the *Conditions of the Class*. Though different factors were cited pertaining to the impact that the current implementation of the mathematics support class had on student achievement, findings did report ways in which the mathematics support class could be improved such as improvement to the *Structure of the Class* and incorporating effective *Recommended Instructional Strategies* to further increase student achievement in mathematics. Therefore, it can be concluded based on the findings of this research study that the implementation of the mathematics support class was not as impactful as expected due to the myriad of barriers that exist within the mathematics support classes.

The results of this research study were not only valuable to the researcher but will also be valuable to other school leaders within the school system in which this research study was conducted. This qualitative case study provides evidence that the mathematics support classes in their current state are not positively impacting student achievement. This finding results in the need to re-evaluate the current mathematics support class and make adjustments to meet the needs of the students in order to increase student achievement. While there was not a

mathematics support class that was deemed effective, participants provided recommendations that can be used to develop a mathematics support class that has the potential to allow students to become engrossed in learning through the incorporation of hands-on activities, the connection of real world applications, the incorporation of differentiated learning strategies to meet the needs of the students, the increasing of time within the class to build prerequisite skills, and the other effective strategies and implications for the mathematics support class that were elucidated in this report.

## Implications

Reflecting on the findings from this research study, it was evident that these findings presented several implications. First, findings provided unique insight on the impact the mathematics support class had on student achievement by focusing on the perceptions of middle school personnel. The results obtained in this research study are valuable when compared to other research studies that mainly focused on the achievement level of the students increasing as a result of the implementation of the mathematics support class and not focusing on the mathematics support class and the strategies within the class that yield student achievement. As a result, this will allow school leaders to review the results and assess current mathematics support classes and make adjustments as needed.

A second implication of this research study was the methodology of this study, which was a qualitative case study utilized to evaluate the perceptions of middle school principals, middle school mathematics teachers, and middle school mathematics support teachers, selected as three dyads. The methodology of this research study was detail-oriented which affords others the opportunity to possibly replicate this study.

A third implication of this research study is for school leaders who have or are planning on implementing mathematics support classes are able to observe the classes that were reported and understand the reasoning why the implemented classes were ineffective. This too will allow school leaders to assist with making decisions in identifying an appropriate mathematics support class that may yield increased student achievement.

A fourth implication of this research study is that these recommendations provide vital knowledge that is needed to improve current mathematics support classes and/or to be taken into consideration when incorporating a mathematics support class. Current research does not include ways in which the mathematics support class could be improved, which makes the results of this study valuable to school leaders and teachers alike, specifically those serving a suburban student population.

## Impact Statement

In education, school leaders are often searching for ways in which to improve student achievement particularly in the area of mathematics due to students' low performance in this content area. Leaders resort to recommendations that are provided by researchers to try to solve the problem at hand. Unfortunately, there seems to be some misguidance on the implementation of the mathematics support classes. As a result, leaders are faced with continuous low student performance as measured by various assessments.

This qualitative case study not only provided an examination of middle school personnel as related to the impact the mathematics support class has on student achievement, but also provided ways in which the mathematics support class can be improved in order to develop a solid mathematics support class. The findings may be helpful for school leaders who are attempting to re-evaluate their mathematics support classes or for school leaders who are

planning to implement the mathematics support classes. Finally, as a result of the students' mathematics performance being impacted, the findings of this research study may contribute to current literature of the mathematics support class that can be utilized by educational practitioners to help in improving student achievement in mathematics.

## Recommendations

This study presented valuable information related to the impact mathematics support class had on student achievement. As a result, the researcher provided recommendations for practices as well as recommendations for future research.

### Recommendations for Practice

As an educational leader as well as a former mathematics teacher, the following recommendations are for leaders as well as teachers to take into consideration. A recommendation for the leaders consist of first obtaining clarity of a good operational definition for identifying *success* in the mathematics support class. When evaluating the mathematics support class, it is vital to understand what success looks like in the classroom. Another recommendation for leaders is to participate in professional development to obtain understanding of the mathematics support class, the role in which the leaders should play in support of the implementation of the mathematics support class, and effective pedagogical strategies that could be utilized within the mathematics support class. This could provide insight to the leaders in ways to properly support the teachers and students within the mathematics support class. Another recommendation for leaders is to develop a criterion for identifying students to be a part of the mathematics support class as well as ways to progress monitor the students to ensure their needs are being met and that students are exiting the mathematics support class at the appropriate time.

This is a critical component because the right students need to be identified in order for them to benefit from taking the mathematics support class.

A recommendation for teachers is to develop meaningful relationships with students that will establish trust and promote a safe learning environment. As students are entering the class with pre-existing conditions, it vital for the students to understand that it is alright to make mistakes and the intent of the class is to support. Another recommendation for teachers is take part in professional development in order to garner a better understanding of the whole child, students' mathematics anxiety, growth mindset, expectations of the mathematics support class and the role in which the teachers play in the mathematics support class, and effective pedagogical strategies that could be utilized within the mathematics support class. This would prepare the teachers to facilitate a class that is well-rounded and able to meet the different needs of students. Another recommendation is for teachers to obtain clarity of what does the improvement in student achievement consist of and look like in the mathematics support class. When determining the effectiveness of the class, teachers should be equipped to self-assess to determine whether or not the practices implemented are effective and adjust accordingly based on the level of student achievement within the class.

**Recommendations for Future Research**

Future studies with similar intent could examine student data from state assessments to better measure student achievement of the implemented mathematics support class. This study only obtained perceptions of participants, which is subjective and could be skewed due to participants utilizing different forms of assessments to measure student achievement.

This study included regular mathematics teachers. The regular mathematics teachers did contribute valuable data to this research study; however, they were not as knowledgeable to the

current implementation of the mathematics support class as were the principals and the mathematics support teachers. As a result of this reasoning, the mathematics teachers were only able to answer the questions posed in reference to the impact the mathematics support class has on student achievement as it related to students' performance in their class. Future studies with similar intent should primarily focus on principals as well as mathematics support teachers due to them being more knowledgeable of the mathematics support class.

This study focused on middle schools within a particular school district. As a result, this study was able to report out findings from the middle schools. However for future studies, it is recommended to include elementary schools and high schools as well in order to gather additional findings of the impact the mathematics support class has on student achievement. This will allow future researchers to report out findings that are geared toward both levels to improve student achievement in mathematics.

This study included mathematics support teachers as participants. However, this study did not examine the years of experience of the teacher to determine whether or not the years of experience impacted participant responses. Therefore, future studies examining mathematics support class should correlate the years of experience of the teacher to student achievement to determine if the years of experience of the teacher also have an impact on student achievement.

Lastly, this study took a qualitative approach in determining the perceptions of principals, mathematics teachers, and mathematics support teachers on the impact the mathematics support classes had on student achievement. However, this study did not directly compare the perceptions to quantitative data in reference to student achievement. Therefore for future studies, it is recommended to compare the perceptions to quantitative data in reference to student

achievement by taking a quantitative or mixed methods approach to further determine the impact the mathematics support class has on student achievement.

## Dissemination

### Internal Dissemination

The findings of this research study are intended to have an impact in the CM School District in order to increase student achievement in mathematics. Therefore, these findings will be presented to the CM School District's Mathematics Coordinator as well as the Director of Teaching and Learning to review as decisions are being made for the upcoming school year. In addition, these findings will be presented to middle school principals within the CM School District that have a mathematics support class within their buildings or who are planning on implementing a mathematics support class to determine an appropriate mathematics support class to meet the needs of their students as well as to better support the mathematics support teacher.

### External Dissemination

School leaders as well as other school districts may be interested in the findings of this research study in order to improve and/or implement a mathematics support class that positively impacts student achievement. The findings of this study can serve as a resource when school leaders are making decisions related to the mathematics support classes. The results of this study will be made accessible to school leaders once this dissertation has been approved.

## Concluding Thoughts

The implementation of this research study has brought about valuable knowledge to the researcher in identifying ways to improve the mathematics support classes to further increase student achievement. With challenges that currently exist with students' performance in

mathematics, there are always opportunities to improve. Therefore, as an educational leader it is imperative to be reflective and knowledgeable of the implementation of the mathematics support classes within the school building in order to be able to build and support the teachers as well as the students. With the support of the school district, school administration, and math support teachers, it is necessary to collaborate with one another to develop a mathematics support class that works best for addressing students' needs. This study revealed ways in which mathematics support classes can be improved; therefore, taking the necessary recommendations can aid in the improvement of the mathematics support class in order to better engage students in authentic learning and support students in their learning, ultimately closing the mathematics gaps resulting in students performing proficiently on grade level content and increasing student achievement.

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# APPENDIX A

## IRB APPROVAL LETTER

Georgia Southern University
Office of Research Services & Sponsored Programs

**Institutional Review Board (IRB)**

Phone: 912-478-5465
Fax: 912-478-0719
IRB@GeorgiaSouthern.edu
Veazey Hall 3000
PO Box 8005
Statesboro, GA 30460

**To:** Middleton, Cordaryl

**From:** Office of Research Services and Sponsored Programs
Administrative Support Office for Research Oversight Committees
(IACUC/IBC/IRB)

**Approval Date:** April 6, 2020

**Subject:** Institutional Review Board Exemption Determination - Limited Review

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Your proposed research project numbered **H20407,** and titled **"The Perceptions of The Impact Math Support Classes Have on Student Achievement."** involves activities that do not require full approval by the Institutional Review Board (IRB) according to federal guidelines. <**In this research project research data will be collected anonymously**>.

According to the Code of Federal Regulations Title 45 Part 46, your research protocol is determined to be exempt from full review under the following exemption category(s):

Exemption 2 Research involving only the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, if: Information obtained is recorded in such a manner that human participants cannot be identified, directly or through identifiers linked to them. Please visit our FAQ's for more information on anonymous survey platforms; Any disclosure of the human participant's responses outside the research could not reasonably place the participant at risk of criminal or civil liability or be damaging to the participant's financial standing, employ-ability or reputation; Survey or interview research does not involve children; The research project does not include any form of intervention.

Any alteration in the terms or conditions of your involvement may alter this approval. *Therefore, as authorized in the Federal Policy for the Protection of Human Subjects, I am pleased to notify you that your research, as submitted, is exempt from IRB Review. No further action or IRB oversight is required, as long as the project remains the same. If you alter the project, it is your responsibility to notify the IRB and acquire a new determination of exemption. Because this project was determined to be exempt from further IRB oversight, this project does not require an expiration date.*

Sincerely,

Eleanor Haynes
Compliance Officer

# APPENDIX B

## INTERVIEW QUESTIONNAIRE

### Perceptions of the Mathematics Support Class Interview

**Demographics**

1. Current position: _____
2. Total educational experience (including the current year): _____ years
3. In what discipline is your certification? _____

**Mathematics Support Class**

Knowledge

4. *Principal Only*: Describe the current structure of the mathematics support class that is implemented within your school. (LKES Standard 1 & 3)

5. *Principal & Teacher*: According to your professional knowledge, how is the implementation of the mathematics support class meeting the needs of students? (TKES Standard 1 and LKES Standard 1)

Student Achievement

6. *Principal & Teacher*: As a result of students enrolled in the mathematics support class, how impactful has the class been on student achievement? (TKES Standard 6 and LKES Standard 3)

    a. *Principal & Teacher*: Follow Up: What evidence do you have of this? (TKES Standard 6 and LKES Standard 3)

Mathematics Anxiety

7. *Principal & Teacher*: Mathematics anxiety is defined as a feeling of nervousness, apprehension, frustration, agitation, and a fear of failure with regard to taking a mathematics class, completing mathematics problems, and/or taking a mathematics exam. What evidence have you noted related to the existence of mathematics anxiety? (TKES Standard 3 and LKES Standard 3)

    a. *Teacher Only*: Follow Up: How does mathematics support class help students to overcome pre-noted mathematics anxiety? (TKES Standard 3)

    b. *Teacher Only*: Follow Up: In what ways does mathematics support class not support students in overcoming pre-noted mathematics anxiety? (TKES Standard 3)

Prerequisite Mathematics Skills

8. *Principal & Teacher*: Prerequisite mathematics skills are defined as background mathematics knowledge and skills a student needs (prior condition) before working on a specified concept. What evidence have you noted related to the existence of students' prerequisite mathematics skills? (TKES Standard 3 and LKES Standard 3)

    a. *Teacher Only*: Follow Up: How has the implementation of the mathematics support class rebuilt or aimed to rebuild prerequisite mathematics skills of the students enrolled? (TKES Standard 3)

Student Engagement

9. *Principal & Teacher*: Please discuss the instructional strategies that have been implemented within the mathematics support class that engage students in active learning and explain why each instructional strategy has been effective. (TKES Standard 3 and LKES Standard 1)

    a. *Principal & Teacher*: Follow Up: Please discuss the instructional strategies implemented within the mathematics support class that do not promote active learning and explain why are the instructional strategies are ineffective. (TKES Standard 3 and LKES Standard 1)

Barriers

10. *Principal & Teacher*: What are teacher-related barriers or potential barriers within the implementation of mathematics support classes? (TKES Standard 3 & 7 and LKES Standard 1)

11. *Principal & Teacher*: What are leader-related barriers or potential barriers with the implementation of mathematics support classes? (TKES Standard 3 & 7 and LKES Standard 1)

General

12. *Principal & Teacher*: In what ways could the mathematics support class be improved to enhance student achievement (TKES Standard 5 and LKES Standard 1 & 3) in terms of:
    a. Instructional content
    b. Delivery method
    c. Other

13. *Principal & Teacher*: Is there anything about mathematics support classes that we have not discussed that you would like to add?

# APPENDIX C

## TKES AND LKES STANDARDS

Below are a list of Teacher Keys Effectiveness System (TKES) Standards and Leader Keys Effectiveness System (LKES) Standards that were aligned to specific interview questions within the interview questionnaire utilized for this study. TKES is an evaluation system utilized in the state of Georgia that is designed to build effective teachers and create consistency and comparability. (GaDOE, 2019) Additionally, LKES is an evaluation system utilized in the state of Georgia that is designed to develop effective school leaders. (GaDOE, 2019)

### Teacher Keys Effectiveness System (TKES)

TKES Standard 1: PROFESSIONAL KNOWLEDGE
The teacher demonstrates an understanding of the curriculum, subject content, pedagogical knowledge, and the needs of students by providing relevant learning experiences.

TKES Standard 3: INSTRUCTIONAL STRATEGIES
The teacher promotes student learning by using research-based instructional strategies relevant to the content to engage students in active learning and to facilitate the students' acquisition of key knowledge and skills.

TKES Standard 5: ASSESSMENT STRATEGIES
The teacher systematically chooses a variety of diagnostic, formative, and summative assessment strategies and instruments that are valid and appropriate for the content and student population.

TKES Standard 6: ASSESSMENT USES
The teacher systematically gathers, analyzes, and uses relevant data to measure student progress, to inform instructional content and delivery methods, and to provide timely and constructive feedback to both students and parents.

TKES Standard 7: POSITIVE LEARNING ENVIRONMENT
The teacher provides a well-managed, safe, and orderly environment that is conducive to learning and encourages respect for all.

### Leader Keys Effectiveness System (LKES)

LKES Standard 1: INSTRUCTIONAL LEADERSHIP
The leader fosters the success of all students by facilitating the development, communication, implementation, and evaluation of a shared vision of learning that leads to school improvement.

LKES Standard 3: PLANNING AND ASSESSMENT
The leader effectively gathers, analyzes, and uses a variety of data to inform planning and decision making consistent with established guidelines, policies, and procedures.