

THE EFFECTS OF A SEVENTH GRADE MATHEMATICS REMEDIATION COURSE ON
STUDENT ACHIEVEMENT

by

Jason Marshall Nix

Liberty University

A Dissertation Proposal Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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ABSTRACT

THE EFFECTS OF A SEVENTH GRADE MATHEMATICS REMEDIATION COURSE ON STUDENT ACHIEVEMENT

Since the installment of the *No Child Left Behind Act*, schools have sought strategies to help students meet these academic requirements. Many middle schools have turned to math remediation classes as a way to improve students' achievement scores. The purpose of this quantitative causal-comparative study was to explore the relationship of the mathematics remediation class as an intervention strategy to help low performing seventh grade students' achievement on the Georgia Criterion-Referenced Competency Test. The sample consisted of N= 775 (391 male, 384 female) seventh grade students enrolled in one rural middle school. The result of the statistical test, ANCOVA, revealed a significant difference between the non-remediation students and remediation students on post-test mathematics achievement while adjusting for the pre-test scores, therefore the hypothesis was rejected. In addition, this study examined the gender and socio-economical differences within the math remediation students. Gender was found not to be statically significant, while socio-economical differences were found to be statically significant.

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ACKNOWLEDGEMENTS

I would like to acknowledge first my Lord, thank you Lord for all the blessings that you have bestowed upon me. Without You nothing is possible.

Secondly, I would like to thank the entire Liberty Faculty. Every professor that I came in contact with is a devoted and caring person, who led me toward this goal. I must thank Dr. Kuhne for being my chair; your patience, words of wisdom, and guidance throughout this process has been invaluable. Thank you. To Dr. Stanley and Dr. Smith, words cannot express my gratitude for all of your hard work on my behalf. You have both spent a lot of time and energy pondering over this document and your feedback, corrections, and guidance have been wonderful, thank you. I would also like to thank Dr. Watson for all of his patience and for helping me persevere through this process, and for asking me the right questions to lead me forward.

Lastly, a big thank you goes to my family for believing in me. Many times I was ready to give up on this dream and you kept encouraging me to finish. To my good friends who have shared in this journey, I will be forever grateful for your help and encouragement. You guys are the best and I will always cherish this journey together.

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List of Abbreviations

A One Way Analysis of Covariance (ANCOVA)

Adequate Yearly Progress (*AYP*)

ANOVA (analysis of variance)

Criterion-Referenced Competency Tests (*CRCT*)

Data-Driven Decision Making (DDDM)

Elementary and Secondary Education Act (ESEA)

Georgia Performance Standards (*GPS*)

Governor's Office of Student Achievement (GOSA)

Governor's Office of Student Achievement (GOSA)

Institutional Review Board (IRB)

National Assessment of Education Progress (*NAEP*)

No Child Left Behind (NCLB)

Project STAR (Student-Teacher Achievement Ratio)

Science, Technology, Engineering, and Mathematics (STEM)

Socioeconomic Status (SES)

Standard Error of Measurement (SEM)

Statewide Longitudinal Data System (*SLDS*)

The American Recovery and Reinvestment Act of 2009 (ARRA)

The Remedial Education Program (REP)

CHAPTER ONE: INTRODUCTION

In 1961, President John F. Kennedy made an urgent call for America to be the first to the moon. In the aftermath of this famous speech, a "wave of activity that followed included an intensive focus on identifying and providing the necessary science and math focused educational supports for elementary, middle, and high school students" (Jackson, 2007, p. 21). To this day, the American educational system continues to struggle to find the educational supports needed to bridge the gaps among the different subgroups of the student population in United States' schools. This study examined remediation classes and student achievement. Also, this study focused on the socio-economic status and gender as it related to the remediation class and student achievement. Chapter One discusses the significance of this study, presents an overview of the research design, and defines terms important for the study. Additionally, background information is presented explaining the laws that are affecting public school systems.

Background

As public schools across the nation plan to meet the requirements of *No Child Left Behind (NCLB)*, schools must find ways to implement strategies and programs to ensure that their schools meet these mandated requirements and show growth on standardized test scores. Since mathematics is one of the targeted content areas of focus, administrators and teachers have searched for and put into practice many different programs trying to raise their students' scores to meet the rigorous standards set forth by the *NCLB* to meet Adequate Yearly Progress (*AYP*). Some of these schools have put into place a remediation program designed to help struggling or at risk students master these required standards. Many schools use a student's elective course time as the time when the remediation is scheduled. An extra math course, in addition to a student's regularly scheduled math course, created within the time frame a student would

normally go to an elective course is one way this remediation occurs (Georgia Department of Education, 2011 c).

In Georgia, students must pass the reading, language arts, and mathematics portion of the Criterion-Referenced Competency Tests (*CRCT*). This standardized test is designed to measure student mastery of the Georgia Performance Standards (*GPS*). Students are classified by this performance into three categories: Does Not Meet Expectations, Meets Expectations, and Exceeds Expectations (Georgia Department of Education, 2010). The state uses this data to help determine if schools are making AYP. In order for schools to make AYP, schools need to implement evidence based interventions that can help students score above the "Does Not Meet Expectations." Remediation program classes are designed to meet at least 50 minutes per day and assist students in meeting academic expectations in the Georgia Performance Standards (Governor's Office of Student Achievement, 2007). While there exists some research on math remediation programs, more research is needed (Adams, 2011).

According to the *Governor's Office of Student Achievement (GOSA)*, the unemployment rate has risen in Georgia to 10.5% in 2010. This unemployment rate also means a greater number of economically disadvantage students. With the economic struggles in our nation over the past few years, schools are also required to meet the needs of these new economically disadvantaged students by the *NCLB* to "close the achievement gap between disadvantage children and their more advantaged peers" (U.S. Department of Education, 2008, para. 4). Therefore, it is important to examine the impact of remediation classes on both the economically disadvantaged students and the non-economically disadvantaged students.

In addition to studying economically disadvantaged students and the impact that an additional mathematics class had on this sub-group, the sub-group of gender was also under

examination throughout this study. According to Liu & Wilson (2009) recent research has shown that males and females have significant differences in mathematics on standardized test scores, with males historically outperforming females. This current study adds to the research in the field as to whether or not a remediation mathematics course in addition to the student's regularly scheduled mathematics course renders similar outcomes.

Problem Statement

Georgia school administrators are desperately trying to maintain AYP in order to receive federal funds. Each year the percentage of students who must meet the standards rises.

According to the state-wide data, the three year average of the seventh grade students not meeting the basic standards on the math Criterion-Referenced Competency Test between the years of 2009 and 2011 was: males, 16.3%, female 11.7%, economically disadvantaged, 19.3%, and non-economically disadvantaged, 6.3% (Georgia Department of Education, 2011 a). These groups of students not meeting the state standards could prevent the school from making AYP. Along with the general population, sub groups are also measured for AYP purposes.

The economic struggles over the past few years have created more economically disadvantaged students, and schools are required to meet the needs of these new economically disadvantaged students by closing the achievement gap between these groups of students and their peers (U.S. Department of Education, 2008). Students with socio-economic disabilities, as measured by students who receive free or reduced lunch, are also increasing in number as more students are living in poverty. The poverty rate has increased from 14.3% in 2009 to 15.1% in 2010. Along with this increase of economically disadvantaged students comes an increase in the achievement gap (Redd, Karver, Murphey, Moore, & Knewstub, 2011).

Also, the role of gender in mathematics has been a predominate theme in educational research. In 2006, it was reported that males have demonstrated stronger ability and interest in

math and science, while females lean toward language arts and writing (Meece, Glienke, & Burg). Interestingly, Duckworth and Seligman (2006) state that, "Throughout elementary, middle and high school, girls earn higher grades than boys in all major subjects, including math and science" (p. 198). Schools are implementing extra remediation in math to help students who are at risk for not passing the math section of the CRCT. This extra remediation many times comes in the form of replacing a student's elective course with an extra mathematics course. Studies need to be conducted to find out if remediation programs are closing the gap and allowing students to make Adequate Yearly Progress.

Purpose Statement

The purpose of this casual-comparative study was to determine whether an additional remedial mathematics course, substituted for an elective course, for low performing students significantly increased standardized test scores by comparing at risk students' seventh grade Criterion-Referenced Competency Test scores, while adjusting for variation in capability using their sixth grade Criterion-Referenced Competency Test scores as a pretest measure. The dependent variable was the students' test score on the Criterion-Referenced Competency Test. The independent variable was whether or not a student received a remediation class defined as an additional mathematics class offered during the school day that replaced a connections class, such as physical education, art, music, band, and other exploratory classes. Typically in middle school, an elective class is called a connection class. The student's sixth grade Criterion-Referenced Competency Test was statistically controlled for in this study. Additionally, this study examined the mathematical achievement of economically disadvantaged students and non-economically disadvantaged students enrolled in the remediation mathematics course. Finally, this study examined the mathematical achievement of seventh grade at risk remediation mathematics students based on gender.

Significance of the study

In Georgia, at grades three, five, and eight students must pass the reading, language arts, and mathematics portions of the CRCT test to be promoted to the next grade. Students that are not passing these portions of the standardized test are considered at risk students and must receive some type of intervention that is researched based (Georgia Department of Education, 2010). Therefore, the findings of this study can be used by schools looking for an intervention program to install to help their at risk populations. Also, with the budget cuts those schools have to make, schools that are currently using an alternative intervention program may want to look at cost efficiency to see if changes are needed.

Research Questions

Research Question 1. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores.

Research Question 2. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores?

H_0 : There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores.

Research Question 3. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores?

H_0 : There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores.

Research Design

A causal-comparative research design was used to determine if remedial mathematics courses influenced seventh grade students' standardized test scores on the Criterion Referenced Competency Test (CRCT) in mathematics. This study also examined if economically disadvantaged students who are in remediation classes have statistical significant differences than their counterparts who do not qualify for free/reduced lunch. Eligibility for free/reduced lunch will serve the determination of the economically disadvantaged students. Finally, this study analyzed if there were any statistical significant differences between male and female students enrolled in the mathematics remediation courses during the seventh grade school year. The CRCT test scores from students' sixth grade year served as the pretest variable. The CRCT test scores from the students' seventh grade year served as the posttest variable. In order to

utilize a longitudinal data collection process, this study examined CRCT scores from the school years between 2008 and 2011 using student-level data matched from the sixth grade CRCT scores to the seventh grade CRCT scores. All seventh grade students enrolled in a small, rural middle school between the years of 2008-2011 in Northeast Georgia were the participants in this study. The two comparison groups were those seventh grade students who were placed into a mathematics remediation class in comparison to those students who were not in a mathematics remediation class. Those students fell in one of two groups, those students who received the remediation program and those students who did not receive the remediation program. Random assignment could not be used as the administrators of the school placed the students into the remediation program based on CRCT results from the previous sixth grade year.

Definitions

At Risk Students- At risk students are students who score 810 or below on their sixth grade CRCT.

Criterion-Referenced Competency Test (CRCT) - State mandated end of the year tests in Georgia to assess how well students have mastered the content and skills described in the Georgia Performance Standards (Georgia Department of Education, 2010).

Economically Disadvantaged Students- An economically disadvantaged student is "a student who is eligible for free or reduced priced meal program" (Governor's Office of Student Achievement, 2007).

Georgia Performance Standards (GPS) - Standards that detail what content a student should master at each grade level. These are designed to provide teachers a guide for instruction and a definition of what is considered mastery at the grade level (Georgia Department of Education, 2010).

No Child Left Behind Act (NCLB) - "An act to close the achievement gap with accountability, flexibility, and choice, so that no child is left behind" (U.S. Department of Education, 2008).

Non-economically Disadvantaged Student- A non-economically disadvantaged student is "a student who is not eligible for free or reduced priced meal program" (Governor's Office of Student Achievement, 2007).

Remediation Math Course- An additional math class offered during the school day that replaces a connections class such as physical education, art, music, band, and other exploratory classes.

Self-efficacy - "Self-efficacy is concerned with people's beliefs in their capability to produce a given level of attainments" (Pastorelli, Caprara, Barbaranelli, Rola, Rozsa, & Bandura, 2001).

CHAPTER TWO: LITERATURE REVIEW

Literature related to remediation programs, legislation, self-efficacy, economically disadvantaged students, and gender was reviewed to understand information and previous research studies that influenced remediation programs. The following review of literature is divided into explicit sections. The first section explores project specific information related to this specific study. Next, a theoretical background is used to support the concept of self-efficacy and remediation for adolescent students during the transition from elementary to middle school. Moreover, there is a section exploring the legislation that has led to the creation of remediation classes for the purposes of schools needing to meet the federal mandates of Adequate Yearly Progress derived from the *No Child Left Behind Act*. Research related to remediation is also examined in a section with the last section giving an overall summary of the outlined review of related literature.

The purpose of this casual comparative study was to determine whether a remedial mathematics course given to low performing students significantly increased standardized test scores by comparing students' seventh grade Criterion Referenced Competency Test (CRCT), a standardized state mandated test. These tests scores were used, while adjusting for variation in capability using their sixth grade CRCT scores. This study examined the mathematical achievement of students as the participants in the remediation mathematics course by comparing their scores on the seventh grade CRCT, while adjusting for variation in capability using their sixth grade CRCT scores. Students from a middle school in Northeast Georgia were examined using sixth grade scores from 2009, 2010, and 2011 matched to the student's seventh grade scores from 2010, 2011, and 2012. The CRCT student scores from their seventh grade year are assigned to the remediation program were compared to students that were not assigned to a remediation program. A one-way ANCOVA was used to examine any difference in the mean

math scores of each group, while adjusting for the previous year's scores. Also, this study examined the mathematical achievement of economically disadvantaged students and non-economically disadvantaged students in the remediation mathematics course, as well as gender.

Theoretical Framework

The theoretical framework drawn on in this study is Bandura's social cognitive theory and self-efficacy theory. Bandura (1986) stated, "what people think and feel about themselves affects their own behavior" (Burney, 2008, p. 131). Social cognitive theory is based on the importance of dynamic interactive process to explain how humans function (Burney, 2008).

Social cognitive theory. According to Burney (2008), social cognitive theory "ascribes a central role to cognitive processes in which the individual can observe others and the environment, reflect on that in combination with his or her own thoughts and behaviors, and alter his or her own self-regulatory functions accordingly" (p. 130). Social cognitive theory emphasizes a dynamic interaction among three sources, those being environmental, behavioral, and personal factors used to explain human functioning (Burney, 2008). All three of these factors play in a student's role at school every day. According to Burney (2008), Bandura viewed, "individuals as agents involved in their own development" (p. 132). Also Burney (2008) stated, "Human learning should be more proactive than reactive and we should consider modifications to the students' social environment in order to influence processes and competencies that improve performance and well-being" (p. 133). Social cognitive theory and self-efficacy theory both include ideas based on how a person feels he or she can accomplish a task.

Self-efficacy. Bandura (1982) explained self-efficacy as "how people judge their capabilities and how, through their self-perceptions of efficacy, they affect their motivation and behavior" (p. 122). Self-efficacy beliefs are the foundation of how people feel, make choices,

think, and motivate themselves (Burney, 2008). Students who are in remediation classes often see themselves as incompetent in math and see a remediation mathematics class, instead of a connections class, as a threat. "People fear and tend to avoid threatening situations they believe exceed their coping skills, whereas they get involved in activities and behave assuredly when they judge themselves capable of handling situations that would otherwise be intimidating" (Bandura, 1977, p. 194). After low performing math students experience repeated failure, they eventually come to the belief that mathematics competency is only for a few good students (LeSage & Smith, 2006). These repeated negative experiences in learning lead to low self-efficacy (Bandura, 1989). When students continuously receive poor marks in mathematics, they lose confidence in their own abilities and "low-efficacy children attribute their failure to low ability, an attribution that does not encourage them to try again" (Miller, 2011, p. 244). Bandura (1977) stated,

Efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences. The stronger the perceived self-efficacy, the more active the efforts. Those who persist in subjectively threatening activities that are in fact relatively safe will gain corrective experiences that reinforce their sense of efficacy, thereby eventually eliminating their defensive behavior (p. 194).

As children construct their own expectations of themselves, the source that they use the most is the success or failures of prior attempts that are similar in nature (Bandura, 1989). Thus, students need guidance to regain their confidence and mathematics remediation is a way for students to begin building success in mathematics. "High self-efficacy is essential for persisting in the face of rejection" (Miller, 2011, p. 244) Burney (2008) stated, "Positive self-efficacy is

built upon a strong base of knowledge and skills” (p. 133). According to past studies conducted by Pintrich and Maehr (2002) and Schunk and Zimmerman (1998), self-regulatory skills are teachable, and therefore can lead to increases in achievement and student motivation.

Self-efficacy is a personal factor that can be influenced or changed (Rosen, Dalton, Lennon, & Bozick, 2010). According to Pasterelli, Caprara, Barbaranelli, Rola, Rozsa, & Bandura (2001), there are three main sources of self-efficacy, those being family, peers, and school. Schools and the teachers can have an affect on students’ and their self-efficacy. Pastorelli et al. (2001) stated,

During a child's formative period, teachers serve as important contributors to the formation of a child's intellectual efficacy. Children’s appraisals of their capabilities are heavily affected by the way teachers evaluate their performances and help them to develop self-regulatory skills in managing learning activities (p. 88).

Students in remediation classes may be a few grades below grade level, but should feel some success in these classes designed specifically for those students weak in mathematics (Witzell & Riccomini, 2007).

Moreover, when students believe in their ability to grow, this causes a powerful influence in their academic performances (Usher & Pajares, 2005). As students work at their own grade level, they build their confidence and will increase their effort, knowing that they can succeed. Usher and Pajares (2005) suggested that, "Students who believe they can succeed academically tend to show greater interest in academic work, set higher goals, put forth greater effort, and show more resilience when they encounter difficulties" (p. 126). Therefore, self-efficacy is a

fundamental structure in which students can build not only skills in the academic area, but also the personal skills needed to become successful in their education.

Mathematics and self-efficacy. Students who struggle with mathematics may have a low self-efficacy. “Self-efficacy beliefs are informed only when experienced events and the results of actions are cognitively appraised” (Usher & Pajares, 2006, p. 126). Akin & Kurbanoglu (2011) stated, “across ability levels, students whose self-efficacy is higher are more accurate in their mathematics computation and show greater persistence on difficult items than do students whose self-efficacy is low” (p. 4). Pajares (2002) found, “Regardless of ability level, children with high self-efficacy completed more problems correctly and reworked more of the ones they missed (p. 117).

In a more recent article where implicit math-gender stereotypes in female and male children as adolescents, by Steffens, Jelenec, and Noack (2010) it was found that adolescent girls display a stronger implicit gender stereotype than do boys during adolescence. In fact, through their research study, the findings suggested that due to the gender stereotypes present early on, even in later life, the gender stereotype is an important factor for females to dropout of math-intensive fields when choosing a career.

Accordingly, Steffens, Jelenec, and Noack (2010) found that “Boys’ higher math self-concepts relative to girls’ are particularly pronounced in adolescence, and they exceed by far actual performance differences” (p. 947). When coupled with other research in the field of math and gender self-efficacy, it was recently found that explicit math gender stereotyping exists as early as fourth grade. Through this internalization at a young age, girls suffered when the gender stereotyping is activated in the classroom environment (Steffens, Jelenec, & Noack, 2010).

Self-efficacy and the middle school student. The middle school student is between the grades of no lower than fifth grade and no higher than eighth grade (Dusek & Arbolino, 2005). These are the years the students begin to depend more on their peer opinions and actions than their families (Holmes-Lonergan, 2006). Holmes-Lonergan (2006) found, “one estimate is that not counting time spent in class in school, teenagers spend about 22 hours per week with their friends-often more time than they spend with their families” (p. 981). How students interact at school and home can play a role on students’ self-efficacy. Self-efficacy is not what type of skills a student has, but has more of a role with how that student feels he or she can accomplish with a particular task (Liu, Hsuan, Cho, & Schallert, 2006). Self-efficacy is domain specific according to Bandura (1986) and one should be cautioned as to generalize self-efficacy (Liu et al., 2006). Usher and Pajares (2005) stated,

In most school systems, Grade 6 is the year when the personalized environment of elementary school shifts to the more impersonal, institutional environment of middle school. This shift leaves many early adolescents struggling to reestablish their sense of self and reevaluating their academic self-beliefs (p. 130).

The middle school years are pivotal in that middle school students and their adolescent friends’ influence on the creation of their self-efficacy (Usher & Pajares, 2006).

Usher and Pajares (2006) study consisted of 263 students entering into middle school. From their study, they found that girls reported that social persuasions were more powerful than mastery experience with creating higher self-efficacy towards academic (Usher & Pajares, 2006). Usher and Pajares warn that tracking students in lower level tracks may be detrimental to those students. According to Usher and Pajares (2006), “Students who were below-level in reading also reported fewer mastery experiences, vicarious experiences, and social persuasions, as well

as higher physiological arousal and lower academic self-efficacy, than did students who were above reading level” (p. 138).

Mathematics Remediation

Remediation classes are designed to help students learn information with which they have gaps; this in turn alone should help students gain higher self-efficacy. By the time students reach middle school, a student's weaknesses can be identified, and possibly an intervention can be put into place for the student to aid in their success for the transition years between elementary and middle school. In 2003, The National Association of Education Progress reported that between 23% and 32% of students in the 4th and 8th grades are below the basic level of performance (Witzel & Riccomini, 2007). Furthermore, Witzel & Riccomini's (2007) study recommended that in order for a student's progress to be maximized and for the achievement gap to close between high performing and low performing students, teachers should "...maximize the effectiveness of their current mathematics curriculum by designing adequate and appropriate modifications to increase the mathematical achievement of all students" (p. 13). Also, remediation classes offer peer modeling. According to Appelbaum and Hare (1996), "The effects of modeling are related to the similarity between the model and the observer" (p. 36). Students can improve their "self-efficacy beliefs through the vicarious experiences of the observing the actions of others" (Usher and Pajares, 2006, p. 126). Bandura (1993) suggested that, "Seeing people similar to oneself succeed by sustained effort raises observers' beliefs that they too possess the capabilities to master comparable activities required to succeed" (p. 72). When a student in a remediation class observes a peer with like abilities succeed in a difficult academic task, this can boost the self-efficacy of both students. This occurs because the student conducting the task and the student observer both may also believe that they can accomplish the academic task at hand (Schunk & Meece, 2005).

It is also important to note that not only does remediation exist in our K-12 public schools, but many community colleges continue to remediate students who are not ready for the first math class in college, college algebra, based upon entrance exams. A study (Bahr, 2008) was conducted in 107 community colleges in order to compare the effects of long-term academic outcomes of students who remediate successfully as compared to those students who achieve college mathematics without remedial classes. A particular attention to self-efficacy was tested among the participants. Bahr's study indicated that in regards to college remediation programs in the mathematics curriculum, both groups of students in the comparison groups had comparable outcomes and Bahr's findings suggested that "...remedial math programs are highly effective at resolving skill deficiencies" (p. 420). Additionally, Bahr's (2008) study revealed that for the majority of students who remediate, the outcome is not favorable and that further research is needed to "identify the obstacles that hinder the remedial process for so many" (p. 421).

Transition to Middle School

Based upon previous studies conducted by Asplough and Harting (1995), it can be stated that during the grade levels of the fifth through eighth grade, most students will in fact have a decreased achievement due to the transition from a self-contained classroom into a more departmentalized building, such as a middle school building. From their research findings, the academic loss was the greatest for the fifth and the eighth grade students during the middle school years. Additionally, it is during these transition years that students often experienced a decline in academic self-efficacy as well (Eccles, 2004). Coupled with added anxiety about relationships with peers, increased academic rigor, and personal pubertal changes, students experiencing an educational transition may be more likely to place all of their attention on everything except academics (Asplough, 1998). Eccles (2004) also suggests that this decline of academic self-efficacy is due to the mismatch "between adolescents' changing developmental

needs and the school environment as a likely cause” (Usher, 2009, p. 279). Usher (2009) also found, “students with high mathematics self-efficacy also reported having high levels of achievement in mathematics, and students with low self-efficacy recounted their poor performance and struggles” (p. 308).

The definition of an academic transition is defined by Schiller (1999) as the “process during which institutional and social factors influence which students’ educational careers are positively or negatively affected by this movement between organizations” (p. 216-217). During the transition to the middle school, grade six, a transition year, it is postulated that not only does this add to students’ sense of sufficiency or insufficiency in the subject of mathematics, but it is also a time of students’ realization of developmental differences (Lau & Nie, 2008). In Lau & Nie’s study, performance goals and mastery achievement in mathematics goals that emphasize social comparisons can “negatively impact” a student’s engagement in the activity and ultimately, students will disengage themselves from the task at hand when the mathematic experience has a relationship with social comparisons and competition.

Numerous studies have been conducted on the transition years, namely the transition from elementary school to middle school and the transition from middle school to high school (Smith, 2006). Additionally, research shows that prior achievement in academics is a robust predictor of future performance in those same academics (Smith, 2006); therefore, it is imperative that students during an educational transition have equitable opportunities to succeed academically in order to have the best prospect for their future educational career.

Legislation

Every election year politicians have proposed new laws in an effort to improve the education system in our country. In 2001, legislators passed the *No Child Left Behind Act* (NCLB) which called for stronger accountability for schools, more freedom for states and

communities, research based instruction, and school choices for parents (U.S. Department of education, 2008). The condition of education has been drastically altered by the landmark *No Child Left Behind Act of 2001*. The law, in essence, is a current updated adaptation of the 1965 Elementary and Secondary Education Act (ESEA), which ended in 2007. Currently, there are still questions as to how the reform will affect American education (Grey, 2010).

As public schools across the nation plan to meet these requirements, they must find ways to implement strategies and programs to ensure that their schools meet these mandated requirements, and to show growth on standardized test scores. Since mathematics is one of the targeted content areas of focus, administrators and teachers have searched for and put into practice many different programs trying to raise their students' scores to meet the rigorous standards set forth by the *NCLB* to meet Adequate Yearly Progress (AYP). Some of these schools have put into place a remediation program designed to help struggling or at risk students master these required standards.

School accountability. When *NCLB* called for stronger accountability for schools, this required states to work to close achievement gaps and for the success of each student to meet academic proficiency. In Georgia, the Criterion-Referenced Competence Tests (*CRCT*) was created to measure student progress toward meeting the performance standards of reading, language arts, and mathematics. This standardized test was designed to measure student mastery of the Georgia Performance Standards (*GPS*). The students' performance on the *CRCT* was classified into three categories: *Does Not Meet Expectations*, *Meets Expectations*, and *Exceeds Expectations* (Georgia Department of Education, 2010). The state uses this data to help determine if schools are making AYP. In order for schools to make AYP, schools need to implement evidence based interventions that can help students score above the "Does Not Meet

Expectations." Through monitoring schools' test scores, the state utilizes a report card that indicates the Adequate Yearly Progress (AYP) of each school and each school district. Any school that fails to make AYP is required by *NCLB* to make improvements or face sanctions (Adams, 2011). If a school does not make AYP for two consecutive years, that school then is placed on *Need of Improvement* list. Each year after the school has been placed on the *Need of Improvement* list, different options are available to the parents of the children and the school must face a restructure. After five consecutive years on the Need of Improvement list, the school could be taken over by the state (US Department of Education, 2008). If a school system wants to have control over its schools, then schools must make sure that students meet the standards on the CRCT so that the school can make Adequately Yearly Progress.

School responses to legislation. As many schools begin to fall short of meeting the requirements of AYP, the schools began to look for interventions to help students meet academic proficiency. Administrators and teachers searched for strategies to help their low achieving students and many used Lubienki's (2007) suggestion of using strategies that increase meaning and understanding. Schools began to invest in traditional tutoring programs, even though research has shown that peer tutoring can improve academic performance and attitude towards mathematics without the investment of outside tutors (Topping et al., 2011).

Additionally, some schools looked at summer school programs as another possible intervention. With the emergence of the remediation programs as another source for schools to help students meet academic proficiency, many schools invested in an intervention to aid struggling students (Woodward & Brown, 2006). Although some schools may use a combination of interventions, most schools use at least one intervention to help their low performing students meet the academic proficiency standards.

Not only do many schools use intervention strategies, but they also use data to drive the decision making about the interventions. Many schools use the previous years' test results to drive the curriculum decisions for low performing students. According to Marsh, Pane, & Hamilton (2006) the concept of using data in schools that want to continue to improve their academic outcomes is not a novel idea. In fact, they state, "In recent years, the education community has witnessed increased interest in data-driven decision making (DDDM)-making it a mantra of educators from the central office, to the school, to the classroom" (p. 1). Their research was conducted to make clear the ways in which school districts use data to drive their policies. In the research study, *Making Sense of Data-Driven Decision Making in Education*, Marsh, et al. (2006), it was discovered that due to the rigorous demands of accountability, one key focus of using data for instructional purposes is to discover students who may need more assistance in specific subject areas. They state,

Across all of the studies, test results were commonly used to identify struggling students and to develop interventions and supports. Some districts used progress test results to identify students that may need tutoring and other remedial services to help them achieve proficiency on state tests (p. 8).

The idea of using data to make curriculum decisions has become a national event and is pervasive in Georgia as well.

In Georgia, a new Statewide Longitudinal Data System (*SLDS*) has been implemented to aid school systems with data analysis as well as with accountability (Georgia Department of Education, 2012). According to the mission of the testing and assessment webpage, The Georgia Department of Education denotes the purpose of Georgia's assessment program is "...to identify students failing to achieve mastery of content, to provide teachers with diagnostic information,

and to assist school systems in identifying strengths and weaknesses in order to establish priorities in planning educational programs” (para 1). The SLDS is available to not only school leaders, but if the technology is in place in the schools, through a computer program, teachers can access this data on individual students as well (Georgia Department of Education).

Moreover, Decker & Bolt (2008) maintain that school reform in the way of assessments to drive curricular decisions leads to a better alignment of the curriculum, standards, instructions, and even classroom assessments for students. In Georgia, the criterion- referenced tests (CRCT’s) taken in core subjects at the middle school level is the measure that schools use for the report card in Georgia, and subsequently, for the reporting of Adequate Yearly Progress for the *NCLB* requirements (Georgia Department of Education, 2012).

High-stakes testing

High-stakes testing has been used as far back as 200 BC, when the Chinese used tests to help eliminate patronage and the tests allowed for open access to the civil services (Madaus & Russell, 2011). High-stakes tests are used in many countries such as England, France, and Italy and are linked to financial rewards (Madaus & Russell, 2011). Some teachers may feel that these tests are guiding their curriculum and how they teach the material. In one sense, they would be correct. There are two factors as to why policy makers are attracted to high-stakes tests as a way to prove accountability. Madaus & Russell (2011) state,

Two facts help explain why policy-makers are attracted to testing as a solution to problems in society and education. First, policy-makers realize they cannot directly regulate instruction in classrooms, but they can indirectly influence instruction by attaching rewards or sanctions to the results of mandated tests.

Policy-makers have always been aware that stakes tied to a test force teachers to adjust instruction to prepare students for the test (p. 21).

The CRCT is the Georgia state-mandated high-stakes test that is used for federal funds and it is the essential criteria that will determine if a school has made AYP (Georgia Dept. of Education, 2010).

High-stakes testing has been linked to federal funding for the past six presidential terms. According to Smith & Fay, “To call for accountability is to assert a political right- to demand that a particular individual or institution assume some responsibility and demonstrate it in a certain form” (2000, p. 335). High-stakes tests are usually created by each state and measures each state’s specific standards, not national standards. Horn (2003) analyzed data from the National Assessment of Education Progress (*NAEP*) and found that although students had high-stakes test scores, these scores did not compare to increased learning. Sometimes these high-stakes test scores can be misleading. For example, Colorado claimed that almost 80% of the fourth graders were proficient in mathematics, while Missouri claimed only about 8% of their fourth graders were proficient in mathematics. However, if the scores from the National Assessment of Educational Progress were studied in more detailed, both states scored between 20% and 22%, roughly the same (Noddings, 2004).

Not only has AYP had an effect on how schools instruct, remediate, and use interventions in schools across the nation, but advances in the ever changing global community have also created a stir for reform. Due to the demand for more workers to enter into the fields of Science, Technology, Engineering, and Mathematics, better known as STEM, America’s schools must strive to meet the needs of the workforce of the 21st century. According to Furner & Gonzalez-DeHass (2011), mathematical anxiety is a common obstacle for students in meeting performance goals that relate to mathematical tasks. In analyzing students’ weaknesses in mathematics, Furner & Gonzalez-DeHass (2011) state, “...math avoidance is a serious malaise of our time and

that it has many causes, which can be grouped under three headings: societal, familial, and cultural influences; pedagogy; and curriculum” (p. 3). In seeking answers to the problem of why students have mathematics anxiety, Furner & Gonzalez-DeHass assert that some instructional factors may cause the anxiety as early as students’ first years in school. In analyzing components that aid in the reduction of the fear of mathematics, the National Council of Teachers of Mathematics (2006) issued educational practices that may decrease or even prevent mathematics anxiety. The practices urge schools and teachers to accommodate for different learning styles and design the experience in the mathematics classroom to foster a positivity among self, while creating a varied testing environment and encouraging different social approaches to acquiring mathematics skills.

The ever changing educational reform is a constant in our nation with an even newer reform on the horizon being implemented currently. President Barack Obama’s new reform to *NCLB* is the *Race to the Top* also known as *The American Recovery and Reinvestment Act of 2009 (ARRA)* provided \$4.35 billion for this reform (U.S. Department of Education, 2012). The U.S. Department of Education awarded grants to eleven states and the District of Columbia (U.S. Department of Education, 2012). All states were invited to apply for the *Race to the Top* Grant. President Obama’s speech at the U.S. Department of Education headquarters in Washington stated:

This competition will not be based on politics, ideology, or the preferences of a particular interest group. Instead, it will be based on a simple principle- whether a state is ready to do what works. We will use the best data available to determine whether a state can meet a few key benchmarks for reform- and states that outperform the rest will be rewarded with a grant. Not every state will win and

not every school district will be happy with the results. But America's children, America's economy, and America itself will be better for it (U.S. Department of Education, 2009, para. 2).

Georgia is one of those states granted monies for the four-year program. Georgia was granted 400 million dollars to be used among the 26 school districts that were awarded as *Race to the Top* schools (Badertscher N. & McWhirter C., 2010). With these grants, the expectation is that new and improved innovations will lead the way in science, technology, engineering, and mathematics (STEM) fields (U.S. Department of Education, 2012). The *Race to the Top* Initiative was funded with over four billion dollars from the federal government and given to states that were willing to implement radical reform (United States Department of Education, 2012). According to the Georgia Department of Education (2012), waivers for the accountability section of *NCLB* would be granted to those schools that were *Race to the Top* identified schools. According to Dr. John Barge, Georgia's State School Superintendent, "Georgia was awarded \$400 million to implement its *Race to the Top* plan and the State Board of Education has direct accountability for the grant" (Georgia Dept. of Education, 2012, para 4).

Transition Years

Educational researchers have been studying the transition from elementary to middle school since the late 1970's, and a variety of researchers have concluded that the transition for many students deem academic decline (Akos, Creamer, & Masina, 2004). In an article published in the *Middle School Journal* titled, "On Target Transitioning into Middle School," the researchers (Mullins & Irvin, 2000) concluded that "The potential to positively influence the transition may reside in the interventions or protective factors offered by elementary and middle schools" (p. 1).

Additionally, research in the area of school transition years for students, elementary school to middle school and middle school to high school, indicate that transitions cause anxiety in many students, thus when coupled with adolescent development issues, transitions can lead to academic losses (Cauley & Jovanovich, 2006). Furthermore, Cauley and Jovanovich (2006) indicate the need to prepare students for transitions and create effective transition programs is imperative,

Students who experience the stresses of numerous changes often have lower grades and decreased academic motivation, and they eventually drop out of school. Schools can prepare students for the transitions by becoming aware of students' needs and by taking a proactive role in addressing those needs (p. 15).

Other changes such as puberty, relationships with peers, emotional and social development and the development of higher order thinking skills only add to students' decreased motivation in school (Cauley & Jovanovich, 2006).

In order to bridge the gap for these students in transition, Chapman & Sawyer (2001) found that students who were already experiencing school failure during middle school, and were placed in a program that gave them extra academic and personal support had changes in their academic performance as well as attitudes about school. They state, "Research suggests that patterns of achievement throughout the early adolescent years can predict school achievement in the 12th grade" (p. 236).

In an ex- post facto study conducted by Alspaugh (1998), it was found that students who made a transition from elementary school at 5th grade to a middle school in 6th grade had an achievement loss. "A statistically significant achievement loss associated with the transition from elementary school to middle school at 6th grade was found, as compared with k-8 schools

that did not have a school-to-school transition at 6th grade" (p. 20). One area in which students struggle at the middle school level is the fact that in elementary school the focus is more task oriented, whereas in middle school the focus is on performance. Other indicators are related to declines in self-esteem and self-perception that occur during these pubescent years (Alspaugh, 1998). Additionally, Alspaugh's (1998) research found that doubled transitions, such as a transition in 6th grade and again in 9th grade for students, resulted in a double jeopardy circumstance which may have factored in a higher dropout rate. Alspaugh states, "The students attending larger schools tended to experience more transitions than the students in smaller schools. The schools with two transitions had higher dropout rates than the schools with only one transition" (p. 24). Implications of Alspaugh's research are relatively simple: "...students placed in relatively small cohort groups for long spans of time tend to experience more desirable educational outcomes" (p. 25).

Notably, according to Chapman & Sawyer (2001), "To help students experiencing school failure, many schools have incorporated programs that provide students with extra academic and personal support" (p. 235). To aid students during the transition and create more prospects for academic success in middle school, programs that incorporate more opportunities for success are vital.

Related Remediation Research

Recent research into the remediation programs has presented insight into this ever growing and changing intervention. Many remediation programs with drill and repetition for the basic skills have become an increasingly popular fix to low student performance in mathematics (Bottge, Rueda, Serlin, Hung, & Kwon, 2007), and more students need mathematics remediation more than any other subject (Bahr, 2007). Parkhurst et al. (2010) stated,

Students who can complete basic math computations problems with rapidity are likely to expend less time and effort on math activities and have less math anxiety. Consequently, those with greater basic-fact fluency are more likely to choose to engage in math activities, which further enhance skills (p. 111).

This has given rise to many technology programs, like *Compass Odyssey*, which is a program that emphasizes the repetition of basic computations before moving the students into the higher order thinking skills involved in solving real world problems. Students need to be able to solve these higher order problems to be successful in life. According to Axtell, McCallum, Mee Bell, and Poncy (2009), "the need for higher levels of math competence has increased in this technology-based world, and a lack of knowledge, understanding, and skill development can close doors for students" (p. 526).

There are three different times that remediation programs occur in Georgia. Some remediation programs occur after school and are supported with the monies of a grant, an example is the 21st Century Program. Some remediation classes occur during the summer, as a summer school program. Another type of remediation class can occur during the school day by replacing a student's connection class, which is their elective class, with a remediation class. These remediation program classes are designed to meet at least 50 minutes per day and assist students in meeting academic expectations in the Georgia Performance Standards while providing extra assistance and practice on the students' weak areas (Governor's Office of Student Achievement, 2007). While there exists some research on mathematics remediation programs, more research is needed (Adams, 2011).

Remediation Programs. In the state of Georgia there are programs used as interventions for low performing students. One such program available to non special education students is

the *Remedial Education Program*. The *Remedial Education Program (REP)* is a state funded remedial program and can be utilized by schools per a set criteria by the Georgia Department of Education for students achieving below performance level. Qualification for *REP* in the middle grades is stated as students must meet two of the criteria for the *REP* program. The criteria is that the formal student support team has documented evidence and has recommended the student be placed in the program, the student has been retained in the grade he or she is enrolled, the student is eligible for Title I or Chapter I services, and/or the student's CRCT score was in the "Does Not Meet" category on the Criterion Referenced Competency Test. Due to the strict guidelines set forth by the Georgia Department of Education, schools may not have more than 25 percent of the school's population in the Remedial Education Program (Georgia Department of Education, 2011 c).

According to the guidelines of The Georgia Department of Education (2011) "Remedial Education Programs Grades 6-12", the program can be designed in a variety of ways, such as reduced class size, augmented class model, parallel block scheduling, summer remediation, or other approved models as proposed to the Georgia Department of Education by application. The concept with the REP intervention design models is, "The use of REP funds shall provide supplemental instruction above and beyond those services provided by the state for regular classroom instruction" (p. 6).

Accordingly, studies on equity education challenge schools to find a challenging curriculum instead of a "track" style program for struggling students. Woodward & Brown (2006) suggest that many studies of equity in the mathematics area focus on ethnically diverse and low-income students. Their research postulates that the findings from these studies

"...indicate that challenging mathematics programs-which emphasize conceptual understanding, problem solving, and communication-have promise for minority students" (p. 151).

Small Class Size. In the field of education, one intervention established to improve academic achievement, especially for low achievers, is that of a reduction in class size (Konstantopoulos & Chung, 2009). According to Konstantopoulos & Chung (2009), positive effects of smaller class size have been documented in several studies with low achievers having additional encouraging results. They state,

Specifically, these studies demonstrated that the average student achievement in small classes (15 students on average) was significantly higher than that in regular classes (22 students on average), and these findings suggest that reducing class size is a promising intervention that increases academic achievement, on average, for all students (p. 126).

Evidence that small class size benefits students is difficult to research (Englehart, 2007). Even with the cost associated with reducing the size of a class, many schools choose to implement a smaller class size as an intervention to close the achievement gap for low performing students (Nye, Hedges & Konstantopoulos, 2000). Slavin (1989) defines the search for the effects of smaller class size as a metaphorical journey. He states,

The search for substantial achievement effects of reducing class size is one of the oldest and most frustrating for educational researchers. The search is approaching the end of its first century; eventually, it may rival the search for the Holy Grail in both duration and lack of results (p. 99).

Once again, it is another debate in education where evidence supports both sides of the issue; it depends on which side one wishes to prove as to whether the evidence will be conclusive (Englehart, 2007).

The effects of class size on academic achievement have been well researched with over one hundred experiments conducted. One of the more important pieces of research to draw from is that of Project STAR. Project STAR (Student-Teacher Achievement Ratio) was a Tennessee research project designed to research class size effects in Tennessee public school systems (Nye, Hedges & Konstantopoulos, 2000). Through Project Star, it was determined that class size had positive benefits on average for all students and showed that low achieving students made gains on the student population in the middle of the achievement distribution, but the high achievers benefited even more from small class sizes (Konstantopoulos, 2008). Englehart (2007) suggested that the, "Analysis of the STAR data upon completion of the project showed that the average effect of small classes was significant and positive in both reading and math at every grade level included in the study" (p. 457). Even though Project STAR has given promising results, it has faced criticisms about its validity because of the "fact that class size is an incredibly complicated construct. It may be influenced by a host of factors that determine its effects" (Englehart, 2007, p. 455). Although it has been a challenge to isolate class size in itself, it appears that class size is an important factor in improving students' academic achievement (Owoeye & Yara, 2011).

Economically disadvantaged students. The economic struggles over the past few years have created more economically disadvantaged students. In 2010, more than two in five children were considered to be low-income, and one in ten children were considered to live in extreme poverty (Redd, Karver, Murphey, Moore, & Knewstubb, 2011). Schools are required to meet the needs of

economically disadvantaged students by closing the achievement gap between these groups of students and their peers (U.S. Department of Education, 2008). Feder (2009) suggested that poverty may be the most important variable in student performance.

The well-known author of *Teaching with Poverty in Mind*, Eric Jensen (2009), proposed that fifty to seventy percent of a student's environment contributes to the behaviors and performance of our students as they "may get so easily frustrated that they give up on a task when success was just moments away" (p. 19). Jensen postulates that one of the detrimental effects that poverty has on children is that since the child's caregivers are "overworked, overstressed, and authoritarian with children" (p. 15) they fail to provide the solid foundations that children need to grow up emotionally healthy. The needs of children under the age of three are having a reliable caregiver who gives unconditional love, guidance, and support, along with ten to twenty hours of harmonious interactions between the parent and the child, in a safe predictable environment. Unfortunately, caregivers of children in poverty are not able to provide these essential needs due to many factors, but the most prominent being the parent's work hours. The practical guide that Jensen authored maintains that poverty can lead to social dysfunction in four unique ways: "emotional and social challenges, acute and chronic stressors, cognitive lags, and health and safety issues" (Jensen, 2009 p. 14). Additionally, it has been established that of these social dysfunctions, a child's self-esteem and self-worth has the most bearing on their educational achievement in later years.

Fortunately, according to Jensen (2009) schools can do something about students who live in impoverished homes. One of the strategies Jensen suggests in his guidebook is that of an enrichment mindset. Enrichment opportunities from the educational community can be anything from Head Start programs, Pre-Kindergarten programs, educational training on how to build

relationships, and ultimately provide quality educational opportunities for this student population. However, one of the factors that Jensen discusses in his book for schools not to do is that of an enrichment program that focuses only on drill and practice and one that eliminates or reduces the time this student population spends in arts, sports, or physical education.

Regrettably, the Remedial Education Program in place throughout middle schools in the state of Georgia does use the students' connections class period time, which is their elective class, which consists of art, music, or physical education.

Understanding how economically disadvantaged students think through and solve problems is important to learning how to remediate and facilitate learning in this student population. Lubienski (2007) proposed that economically disadvantaged students "seemed resistant to learning mathematics through problem solving and discussion" (p. 54) because they view the situations differently from other students. Students in this sub-group should be instructed in programs that meet the specific needs of this type of learner.

Hence, the remediation programs that consistently focus on the basics may be more beneficial to the economically disadvantaged students because "mathematical achievement is particularly important to our efforts to promote equity because it serves as a gatekeeper to high-status occupations and can provide a powerful ladder of mobility" (Lubienski, p. 55). Therefore, through the use of remediation, economically disadvantaged students may be able to open doors to improve their future (Bahr, 2008).

According to the Governor's Office of Student Achievement (GOSA), the unemployment rate has risen in Georgia to 10.5% in 2010. This unemployment rate also means a greater number of economically disadvantage students. With the economic struggles in our nation over the past few years, schools are also required to meet the needs of these new economically

disadvantaged student by the *NCLB* to "close the achievement gap between disadvantage children and their more advantaged peers" (U.S. Department of Education, 2008). The American Psychological Association (2011) stated that, "Society benefits from an increased focus on the foundations of socioeconomic inequities and efforts to reduce the gaps in socioeconomic status in the United States" (p. 1). Therefore it is important to examine the impact of remediation classes on both the economically disadvantaged students and the non-economically disadvantaged students.

Gender Roles

Women's role in society has changed greatly over the last forty years, as women are now earning more college degrees than men and are exceeding men in many occupational fields (Meece, Glienke, & Burg, 2006). Even with this information, gender role stereotypes may still be prevalent in education. Meece, Glienke, and Burg (2006) state that, "Boys report stronger ability and interest beliefs in mathematics and science, whereas girls have more confidence and interest in language arts and writing (p. 351). They continue to report that girls outperform boys at all age levels of the National Assessment of Educational Progress (NAEP) (Meece, Glienke, & Burg, 2006) and "girls earned significantly higher final grades in Algebra I, English, and Social Studies than did boys" (Duckworth & Seligman, 2006, p. 201).

With more and more research available today about gender inequalities and mathematics in our society, the shift for a curriculum in mathematics that teaches for social justice is emerging. According to Bartell (2011), when students are taught with gender equity in mind, the outcome of the product will not only help students succeed in the classroom, but also in society as well. Bartell states, "Thus, education should help students analyze oppression and critique inequities, highlight how these issues connect to their lives, and engage them in challenging those inequitable structures" (p. 3).

Moreover, gender can be a complicated issue for a researcher when looking only at gender data for a specific grade level. When looking at the comparison of gender data, the age of the student needs to be taken into consideration as boys are far more likely to be retained or held back, making boys slightly older on average than girls in the same grade level (Buchmann, DiPrete, & McDaniel, 2008). Factoring in the maturation guide with girls and boys, this may complicate data analysis and skew the results of the research (2008).

In 2008, a research study centered on the performance of fifteen year old boys and girls on the Program for International Student Assessment showed that, "In mathematics, boys in total outperformed girls on the math test, but the study concluded that girls are actually as good in mathematics as boys in 'gender-neutral' societies where women and men have similar rights and opportunities" (Rycik, 2008, p. 98).

The realization that females can perform as well if not better than their counterparts has led to a push for gender segregation (Rycik, 2008). Rycik (2008) states that,

At the middle and secondary level, the push for single-sex classes comes in part from the belief that students will achieve more because they are less distracted by the need to impress the opposite sex. More generally, the trend to single-sex classes appears to be at least partly the result of a desire for "quick fix" reform (p. 100).

However, other research suggests that gender segregation may lead to animosity among the gender groups (Greig, 2011). According to Greig (2011), in the research article, *Boy-only classrooms: gender reform in Windsor, Ontario 1966-1972* an analysis of the data from same-sex classrooms in the 1960's and 1970's revealed that,

...boys in the all male class have very strong feelings against girls... and this could present difficulties when the boys are returned to mixed class. This point confirms current research that has shown all-boy classrooms have long been identified as "breeding grounds" for "virulent sexism" (p. 137).

Even though gender segregation is once again a current strategy for reform, some researchers criticize the movement due to the lack of preparation for the coeducational world.

Many proponents of mixed-sex classrooms argue that good teachers will use instructional practices that are tailored to each student's unique individual needs (McNeil, 2008). In fact, the controversy of gender segregation was demonstrated in Georgia when a school tried to implement single-gender classrooms. McNeil (2008) states, "In Georgia, a school district's plan to assign some or all of its students to single-gender classrooms outraged many parents and caught the attention of the American Civil Liberties Union" (p. 22). Consequently, the school district did not follow through with their plans for single-gender classrooms.

For years, gender differences in the area of mathematics has stereotypically favored boys over girls in performance, and some researchers have statistically confirmed that boys score higher than girls on standardized tests in mathematics (Kimball, 1997). More recently, a study conducted by Georgiou, Panayiotis, & Kalavana (2007) examined the differences in mathematics performance, attitudes towards mathematics, and how students attributed their mathematical performance. The study used participant students just entering the eighth grade; the average age of students was 14.2. Contradictory evidence was found to be the outcome with the results yielding data that revealed students who had positive attitude toward the mathematical task did not always have a higher achievement score on the task. It was also found on the mathematics task used within this study, there were no differences found among boys and girls pertaining to

the achievement of the mathematical task, but only in the explanation of their performance on the mathematical task. Since the results of Georgiou, Panayiotis, & Kalavana's (2007) study were in conflict with the position of other researchers in the field, the researchers conclude that "further research is needed" (p. 339).

Summary

As public schools across the nation plan to meet the requirements of *No Child Left Behind Act* where all students must meet national benchmarks by the year 2014 (U.S. Department of Education, 2008), administrators and educators must find ways to implement strategies and programs to ensure that their schools meet these mandated requirements. Also, schools must show growth on standardized test scores. Since mathematics is one of the targeted content areas of focus, administrators and teachers have searched for and put into practice many different programs trying to raise their students' scores to meet the rigorous standards set forth by the *NCLB Act* to meet Adequate Yearly Progress. Some of these schools have put into place remediation programs designed to help struggling or at risk students master these required standards.

As schools begin to make great efforts in trying to meet the national requirements, many have opted to take a proactive approach by identifying weaknesses in students and creating a specialized remediation plan for those student groups before greater gaps occur. Typically, the remediation programs are targeted for the two main content areas of reading and mathematics. Ideally, these programs are designed to provide extra support and additional practice for the skills students will need to master the content of standardized tests, which, ultimately, will determine whether or not the school will meet the required mandates of Adequate Yearly Progress set forth by *No Child Left Behind*.

Additionally, due to the economic recession within the last few years, a greater number of economically disadvantaged students come to school more than ever before. Therefore, it is important to examine the impact of remediation classes on the economically disadvantaged students. Many studies show that a relationship does exist "between the percentage of students receiving subsidized lunches and the adjusted pass rates on these test thus showing that students' socioeconomic status (SES) is related to their achievement" (Baker & Johnston, 2010, p. 194).

Another factor, gender, which can also play a role in student achievement, will be studied through this research. Even though the data from past research is often conflicting, a recent trend seems to be emerging that females may be moving to the forefront in all the fields, including science and mathematics (Steffens, Jelenec, & Noack, 2010). The issues between achievement in mathematics and gender with struggling students have not been qualified; however, through this research study, an exploration of gender and achievement in a mathematics remediation program can be analyzed.

As schools spend more and more money on remediation programs to help all students meet the NCLB requirements of 2014, schools need to know if these programs are working and if the socioeconomic and gender gaps are being closed. The principle of equity, the concept that all students should have a challenging and coherent curriculum in mathematics in our schools, for every student is an important part of The National Council of Teachers of Mathematics national standards (2011). Therefore this concept must be explored through research and a thorough analysis of which programs work and which programs must be reorganized to optimize student potential in our nation's schools.

While highlighting specific differences found, if any, this study provides insight into remediation programs at the middle school level. Through this research study, the addition of

valuable information in the growing body of literature allows administrators, educators, and all stakeholders in the education of struggling students to improve upon the decision making process for the curriculum of remediation programs. Additionally, this study examined academic achievement of students in a mathematics remediation program during the important transition years of their middle school education, and also provides insight into specific subgroup populations such as low socio-economic status and gender and how remediation programs affect those sub-groups in comparison to their counterparts.

CHAPTER THREE: METHODOLOGY

As public schools across the nation plan to meet the requirements of the *No Child Left Behind Act (NCLB)*, schools must find ways to implement strategies and programs to ensure that their schools meet these mandated requirements and to show growth on standardized test scores. Since mathematics is one of the targeted content areas of focus, administrators and teachers have searched for and put into practice many different programs trying to raise their students' scores to meet the rigorous standards set forth by the *NCLB* to meet Adequate Yearly Progress (*AYP*). Some of these schools have put into place a remediation program designed to help struggling or at risk students master these required standards. Many schools utilize the student's elective class time to provide this remediation in the form of a remediation mathematics course in addition to the student's regularly scheduled mathematics course. With the economic struggles in our nation over the past few years, schools are also required to meet the needs of these new economically disadvantaged students by the *NCLB* to "close the achievement gap between disadvantaged children and their more advantaged peers" (U.S. Department of Education, 2008, para. 6). Therefore it is important to examine the impact of remediation classes on both the economically disadvantaged students and those who are non-economically disadvantaged students.

For this study, a casual-comparative research design was used to determine whether a remedial mathematics course given to low performing students can significantly increase standardized test scores by comparing students' seventh grade Criterion Referenced Competency Test (CRCT) scores, while adjusting for variation in capability using their sixth grade CRCT scores. Also, this study examined the mathematical achievement of economically disadvantaged students and non-economically disadvantaged participants in the remediation mathematics course by comparing their scores on the seventh grade CRCT, while adjusting for variation in capability using their sixth grade CRCT scores. Lastly, this study examined the mathematical

achievement of students based on the gender of the students that participated in the remediation math course. Moreover, a comparison was made between boys' test scores in comparison to girls' test scores on the CRCT.

Research Design

A causal-comparative research design was used to determine if remedial mathematics courses influence seventh grade students' standardized test scores and if differences existed for economically disadvantaged and gender for remediation students. Using this non experimental causal-comparative research design, it was possible to look at the differences between remediation classes and performance on the CRCT. According to Glatthorn & Joyner (2005) casual-comparative research "...attempts to establish cause-and-effect relationships. However, the researcher has much less control over the independent variable and cannot use randomness in selection and assignment" (p. 100). Although this type of research design does not lend itself to making strong conclusions (Gall, Gall, & Borg, 2010), it is valuable to help discover relationships in education when it is not ethical or not possible to manipulate the independent variable (Ary et al.,2010).

In this case, it was not possible to withhold the independent variable, remediation classes, from students as the schools have already implemented the remediation program. Random assignment was also not practical as the administration of the school uses the CRCT results to identify at risk students and schedules those students into the remediation program. Furthermore, the use of economically disadvantaged students and gender as independent variables justified the use of a causal-comparative research design as the manipulation of these variables was not possible.

The remediation teacher, chosen by the school to administer the treatment, was a certified mathematics teacher. This teacher has been the remediation teacher since 2006 and the

curriculum and pacing guide did not change between 2007 and 2012. The placement of students into remediation was based on the previous years' CRCT data and teacher recommendations. All students who received the additional mathematics remediation course in place of an elective class, along with their regularly scheduled mathematics course, was considered to be in the treatment group. All other students who are not enrolled in a mathematics remediation class are considered to be in the control group. Data was collected on both the control and the treatment groups. An ANCOVA was used to help in adjusting for a selection threat to validity because of using nonequivalent groups and for pre-existing differences in the groups (Ary et al., 2010).

Research Questions

Research Question 1. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores.

Research Question 2. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics

remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores.

Research Question 3. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores.

Variables in this Study. When looking for a variance between remediation classes and CRCT scores, there cannot be an "actual manipulation of the independent variable by the researcher" (Gall, Gall, & Borg, 2010, p. 306). In this case, the independent variable was the remediation program and the dependent variable was the CRCT scores. The control group was those students that are not participating in a remediation class. For research question 1, the independent variable was the remediation group and compared the remediation group to the non-remediation group through statistical testing to determine if there was an overall difference between the remediation groups by year, an overall significant change from pre-test to post-test, and a significant interaction by group and time. Moreover, the researcher analyzed pre-test results and determined whether subsequent statistical testing was needed. In the second research question, the independent variables were the status of the remediation students as either economically disadvantaged or non-economically disadvantaged. Also, in the second research

question, the independent variables were the gender of the remediation students as either male or female. In the spring each year students are administered the CRCT, the data from this test was used to measure the group equivalency of the students in both the treatment and control groups.

Remediation program classes were designed to meet at least 50 minutes per day and assist students in meeting academic expectations in the Georgia Performance Standards (Governor's Office of Student Achievement, 2007). The school where this study took place utilizes students' elective course time as the time in which the remediation class was scheduled. This mathematics remediation course was in addition to the student's regularly scheduled mathematics class. Since different strategies could exist within the remediation classes that cannot be controlled for, these were considered extraneous variables. An internal threat could be experimental mortality due to treatment or control students withdrawing from the research school and enrolling into a different school, or students moving into the research school and being placed into a remediation class. To control for this, these students were excluded from the data. The Hawthorne effect should not affect the outcome of the study because of the novelty of being in a special remediation class should have worn off throughout the duration of the year long remediation class.

Participants

A convenience sample was used in this study and focused on students enrolled in the remediation program. This study examined seventh grade students from a school in a rural Northeast Georgia school system. The treatment group comprised of all those students who were enrolled for the duration of the school year in a remediation class that was offered during the school day in replacement of a connections class, which was their elective class. The control group was comprised of students that are not enrolled in a remediation class during the school day in replacement of a connections class. Only students who were continuously enrolled at this

school from the beginning of the year until the spring CRCT were used in the study. Permission from the school system and Liberty University's Institutional Review Board was obtained before the collection of any data.

Setting

The students who participated in this study are seventh grade middle school students located in rural Northeast Georgia. This study focused on the treatment of mathematics remediation courses that were offered during the school day as a class that meet at least 50 minutes per school day during students' elective class time. The public school in the study offered remediation classes as an elective, in addition to a regular mathematics classes that meet 60 to 70 minutes per day. The purpose of the remediation class was to help at risk students to meet the standards assessed by the CRCT. The school's approach to the remediation program utilized strategies such as test-taking strategies, use of manipulatives, confidence building, and kinesthetic learning. The enrollment of each seventh grade year was as follows: 2009-2010 school year enrolled 298 students, 2010-2011 school year enrolled 295 students, and 2011-2012 school year enrolled 293 students. Together these three school years had 886 students of which 425 were male and 461 were female. The ethnic breakdown of the population average consisted of 1.1% Asian/Pacific Islander, 1.7% African American, 2.3% Hispanic, 0.3% American Indian or Alaskan Native, 92.3% Caucasian, and 2.3% some other race. The economically disadvantaged student that received free or reduced lunch was over 50% for all three school years (GOSA, 2011).

Instrumentation

When using the CRCT, there were "several concerns in determining the reliability and validity of test scores" (Gall, Gall, & Borg, 2010, p. 211). In criterion-referenced test, students are measured on the mastery of test standards, and even if every student answers a certain

question correctly, it is considered an appropriate question as opposed to norm referenced test where these questions are excluded from the results to create a great variability among the individuals (Gall, Gall, & Borg, 2010). The Georgia Department of Education (2011 b) states that the CRCT is valid because of the test development process. In the creation of any test, there must be a clear purpose (Gall, Gall, & Borg, 2010). "In the case of the CRCT, the state legislature has identified the purpose to be a measure of how well students have mastered the state's curriculum" (Georgia Department of Education, 2011 b, p. 1). Since there are multiple forms of the CRCT, they are equated to "make sure that the tests are of equal difficulty" (p. 3). The reliability of the CRCT is established as it uses Cronbach's alpha reliability coefficient and the standard error of measurement (SEM) (Georgia Department of Education, 2011 b, p. 4). The sixth grade CRCT Cronbach's alpha for mathematics is .92 and the SEM is 3.26, while the seventh grade mathematics portion of the CRCT Cronbach's alpha is .92 and the SEM is 3.1 (Georgia Department of Education, 2011 b, p. 4).

Procedures

Before the collection of data could occur, permission from the Liberty University Institutional Review Board (IRB) was obtained. To obtain this permission, the researcher gained approval from the researcher's dissertation committee and filed an application to the review board. Once received, the IRB committee staff suggested revisions that needed to be made and returned for the application to move forward. Then the IRB members examined the application and requested any revisions that needed to be made. When the revisions were made by the researcher, the IRB members made the final decision to allow the researcher to continue forward. With permission granted from the IRB members, the researcher gained permission from the school system to use their students' unidentifiable data and began the collection process.

Using each year's data, the students were identified as those students enrolled in a mathematical remediation course, and students not enrolled in a mathematics remediation course. The treatment group was also subdivided into students who were economically disadvantaged or non-economically disadvantaged. Students in the remediation group were also divided according to gender. Then the spring CRCT test data was collected on those students and analyzed.

Data Analysis

A one way analysis of covariance (ANCOVA) was used to examine the difference in mean mathematics CRCT scores between the students in the treatment group and the control group, while adjusting for previous mathematical achievement. Additionally, the researcher analyzed pre-test results and determined whether subsequent statistical testing was needed. The previous year's CRCT data was used as a control variable since the students in the two groups could differ in mathematical knowledge prior to the treatment (Adams, 2010). An ANCOVA helped in adjusting for a selection threat to validity because of using nonequivalent groups and for pre-existing differences in the groups (Ary et al., 2010). A second ANCOVA was used to examine the difference in mean scores based on a remediation student's economically disadvantaged status, while adjusting for previous mathematical achievement. Finally, a third ANCOVA was used to examine the difference in the mean scores based on the gender of the remediation students. A two-way mixed factorial ANOVA was used to determine if there is an overall difference between the remediation groups, an overall significant change from pre-test to post-test, and a significant interaction by group and time. Upon analysis for all research questions, the researcher also determined if further statistical testing measures such as an ANCOVA or a t-test are necessary. Histograms were conducted to insure that no normality assumptions were violated, and Levene's test was used to assess the homogeneity of variances to assure that all tests and results were reported correctly.

CHAPTER FOUR: RESULTS

The purpose of this study was to determine whether an additional remedial mathematics course, substituted for an elective course, for low performing students significantly increased standardized test scores by comparing at risk students' seventh grade Criterion-Referenced Competency Test scores, while adjusting for variation in capability using their sixth grade Criterion-Referenced Competency Test scores as a pretest measure. The dependent variable was the student's test score on the Criterion-Referenced Competency Test during their seventh grade year and the control variable was the student's test score on the Criterion-Referenced Competency Test during their sixth grade year. The independent variable was whether or not a student received a remediation class defined as an additional mathematics class offered during the school day that replaced a connections class such as physical education, art, music, band, and other exploratory classes. To control for preexisting achievement, the student's sixth grade Criterion-Referenced Competency Test was used as a control variable. Additionally, this study examined the mathematical achievement of economically disadvantaged students and non-economically disadvantaged students enrolled in the remediation mathematics course during the year of remediation. Finally, this study examined the mathematical achievement of seventh grade at risk remediation mathematics students based on gender.

Participants

Seven-hundred seventy-five students completed the study at a rural middle school in Northeast Georgia. The middle school where the study took place is comprised of grades six, seven, and eight with an approximate population of nine hundred students during the years of 2008-2011. The Criterion-Referenced Competency Test (CRCT) test scores from students' sixth grade year served as the pretest variable. The CRCT test scores from the students' seventh grade year served as the posttest variable. All seventh grade students enrolled in the rural middle

school between the years of 2008-2011 in Northeast Georgia were the participants in this study. In order to utilize a longitudinal data collection process, this study examined CRCT scores from the school years between 2008 and 2011 using student-level data matched from the sixth grade CRCT scores to the seventh grade CRCT scores. The two comparison groups were those seventh grade students who were placed into a mathematics remediation class based upon at risk test scores for the student's sixth grade CRCT, in comparison to those students who were not in a mathematics remediation class during the years 2008-2011. Students placed in remediation classes had a mean score of 795, five points below the cut of score for "Meets the Standards" of 800. The students were categorically scheduled in one of two groups by the administration of the school; those students who received the remediation program and those students who did not receive the remediation program.

Due to the administrators of the school placing the students into the remediation program based on CRCT results from the previous sixth grade year, random assignment could not be utilized for this study.

Sample Descriptive Statistics

The descriptive statistics for the participants' continuous and discrete study variables are listed in Tables 1 and 2, respectively. The average student scored 847.179 ($SD = 29.275$) on the seventh grade Math CRCT and 825.314 ($SD = 42.948$) on the sixth grade Math CRCT. Approximately half (391, 50.5%) of the participants were male. Three-hundred ninety-six (51.1%) were not considered economically disadvantaged, and 379 (48.9%) were considered economically disadvantaged. A majority (656, 84.6%) of students did not participate in the remediation class.

Table 1. *Descriptive Statistics for Continuous Study Variables*

Variable	<i>n</i>	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>
7 th Grade Math CRCT	775	764.000	950.000	847.179	29.275
6 th Grade Math CRCT	775	181.000	950.000	825.314	42.948

Table 2. *Descriptive Statistics for Discrete Study Variables*

Variable	<i>n</i>	<i>%</i>
Gender		
Female	384	49.5
Male	391	50.5
Economically Disadvantaged		
No	396	51.1
Yes	379	48.9
7 th Grade Math Remediation Class		
No	656	84.6
Yes	119	15.4

Research Questions and Hypotheses

The following section details the analytical approach utilized to assess the study's research hypotheses. All statistical tests were conducted at $\alpha = .05$.

Research Question 1. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics

remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores.

A one-way ANCOVA (analysis of covariance) was conducted to determine if there was a significant difference between students who received a mathematics remediation course and students who did not receive a mathematics remediation course on post-test CRCT scores (seventh grade) after adjusting for participants' pre-test scores CRCT scores (sixth grade). Post-hoc tests were performed for significant ANCOVA findings using paired-samples t-tests (one for each group) to determine if there was a significant change from pre-test to post-test for both groups. The ANCOVA is appropriate (Stevens, 2002; Tabachnick & Fidell, 2007) when comparing two or more groups on a continuous dependent variable while adjusting for one or more continuous variable(s). Mathematics remediation (yes vs. no) was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate.

An ANCOVA was used to evaluate differences on post-test achievement scores while statistically adjusting for the students' pre-existing differences on mathematics achievement. This strategy allowed the researcher to assess the impact of the remediation course on mathematics achievement while eliminating students' pre-existing differences on mathematics skill, thus eliminating it as a potential confounding variable in the statistical model.

The following ANCOVA testing procedures were utilized. First, the data were screened for outliers prior to assessing the statistical assumption. The students' post-test mathematics achievement scores were standardized by group, and the resulting scores were utilized to identify outliers in the data. According to Tabachnick & Fidell (2007), a data point is considered an outlier when the absolute value of the standardized score is greater than 3. This process revealed four outliers in the data. These students were removed from the analysis before testing the statistical assumptions.

The next step in the analysis was to assess the statistical assumptions. Histograms of the participants' post-test scores were used to assess the normality assumption. The distributions of the non-remediation class and the remediation class are displayed in Figures 1 and 2, respectively. Both distributions were approximately normal. In addition, the sample size was greater than 50 for each group, so normality of the sampling distributions was approximately normal as defined by the central limit theorem.

Figure 1. Distribution of Non-remediation Students' Post-test Mathematics Achievement

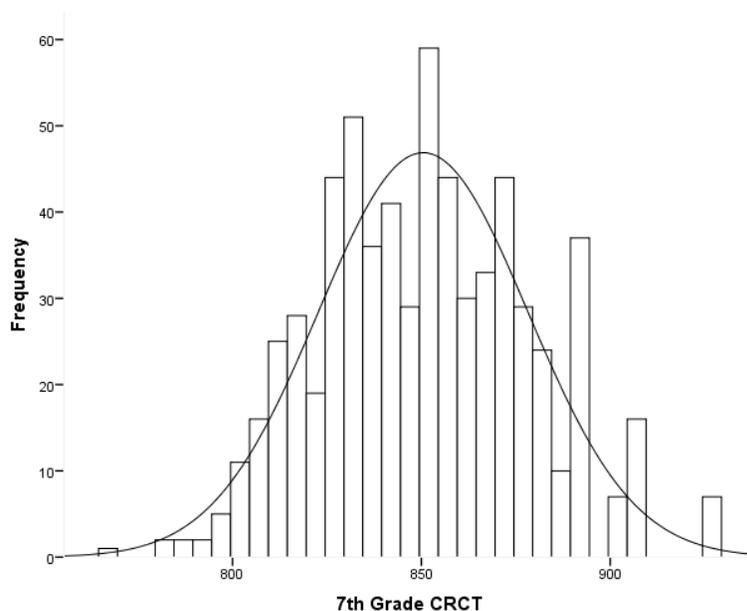
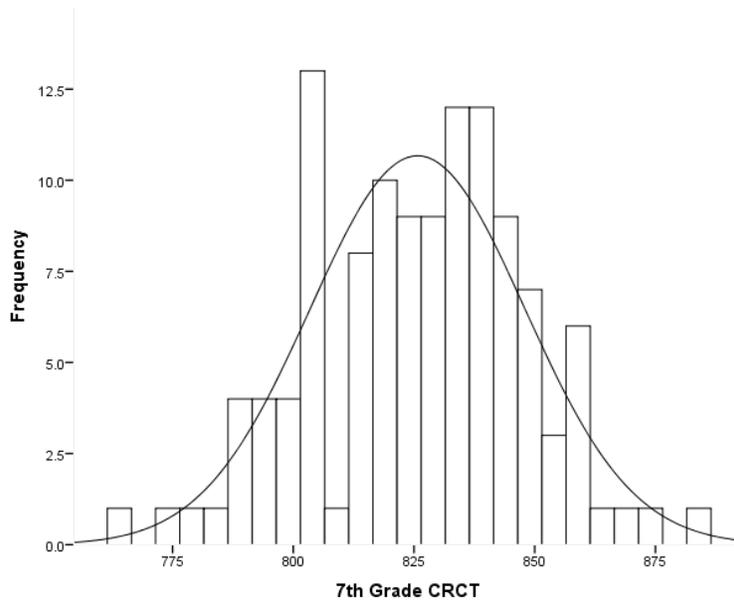


Figure 2. Distribution of Remediation Students' Post-test Mathematics Achievement



The next step involved assessing the homogeneity or error variances and equality of covariance of regression slopes assumptions. Levene's test was not significant, indicating the two groups had equal error variances (i.e., homogeneity of variances) on post-test mathematics scores, $F(1, 769) = 1.901, p = .168$. Lastly, the final assumption of ANCOVA is homogeneity of regression slopes which is assessed with an F test on the independent variable X covariate interaction term. The term was not significant, indicating the equality of regression slopes, $F(1, 767) = 3.664, p = .056$. This indicates the relationship between pre-test and post-test math scores, was consistent for the two remediation groups.

The unadjusted and adjusted means are listed in Tables 3 and 4, respectively. The ANCOVA test statistics are listed in Table 5. The ANCOVA revealed a significant difference between the non-remediation students ($M = 848.980, SD = 0.970$) and remediation students ($M = 833.860, SD = 2.346$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 768) = 34.645, p < .0005 (\eta^2 = .043, \text{power} = 1.00)$. Interestingly, the difference

between the group means changed dramatically after adjusting for pre-existing differences on mathematics achievement. After adjusting for pre-existing academic achievement using the sixth grade CRCT scores as a covariate, the group means between the remediation and non-remediation reveal a reversal (Table 4). However, the statistical significance of the effect size revealed only 4% of the variability in the students' post-test mathematics achievement scores can be attributed to the remediation after adjusting for the students' pre-test mathematics achievement. Thus, the researcher rejected the null hypothesis for Research Question One.

Table 3. *Unadjusted Mathematics Scores*

Remediation Group	Test					
	Pre-test			Post-test		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Remediation	119	795.084	13.541	119	825.731	22.240
No Remediation	652	830.468	44.054	652	850.463	27.739

Table 4. *Adjusted Mathematics Scores*

Remediation Group	Test					
	Pre-test			Post-test		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Remediation	119	795.084	13.541	119	848.980	0.970
No Remediation	652	830.468	44.054	652	833.860	2.346

Table 5. *One-Way ANCOVA on Post-test Mathematics Achievement*

Source	SS	Df	MS	F	Sig.
Group	20,951.101	1	20,951.101	34.645	.000
Error	464,439.934	768	604.739		
Total	553,280,806.000	771			

Furthermore, as an exploratory data analysis measure, the researcher conducted a two (time) X two (group) mixed (Stevens, 2002; Tabachnick & Fidell, 2007) factorial ANOVA (analysis of variance) to address any longitudinal changes and to determine if those changes were consistent for the two groups. Time (pre-test to post-test) was the within-subjects independent variable, and group (remediation vs. no remediation) was the between-subjects independent variable. The factorial ANOVA was used to assess the time and group main effects and the time X group interaction to determine if a statistically significant difference on students' mathematics CRCT across time (pre-test to post-test) and between groups (remediation vs. no remediation) existed. The results of this factorial ANOVA for Research Question One appear below and are further discussed in Chapter Five, the results section of this research study.

Levene's test was significant for the pre-test or post-test scores, $F(1, 769) = 10.047, p = .002$ and $F(1, 769) = 8.944, p = .003$, respectively. This indicates the error variances were inconsistent across levels of the independent variable (i.e., heterogeneity of variances). Box's test was also significant, which indicates the relationships among the pre-test and post-test scores were inconsistent across the groups (i.e., unequal covariance matrices), $F(3, 571,362.595) = 57.539, p < .0005$. The sample sizes for the between-subjects groups were larger than 50, so normality was assumed given the central limit theorem.

Model Main Effects

The descriptive statistics and ANOVA coefficients are listed in Tables 6 and 7, respectively. The ANOVA revealed a significant within-subjects main effect from pre-test to post-test, $F(1, 769) = 7.661, p = .006 (\eta^2 = .010, \text{power} = 1.00)$. The participants' scores increased significantly from pre-test ($M = 825.006, SD = 42.808$) to post-test ($M = 846.646, SD = 28.395$). The tests also revealed a significant between-subjects main effect by group, $F(1, 769) = 109.996, p < .0005 (\eta^2 = .125, \text{power} = 1.00)$. This indicates that there was an overall difference among the groups on the dependent variable scores. The remediation group ($M = 795.084, SD = 13.541$) scored significantly lower than the non-remediation group ($M = 830.468, SD = 44.054$).

Table 6. *Descriptive Statistics for Model 1b*

Time	Group	<i>N</i>	<i>M</i>	<i>SD</i>
6 th Grade CRCT	No Remediation	652	830.468	44.054
	Remediation	119	795.084	13.541
	Total	771	825.006	42.808
7 th Grade CRCT	No Remediation	652	850.463	27.739
	Remediation	119	825.731	22.240
	Total	771	846.646	28.395

Table 7. *Factorial ANOVA Test Statistics*

Source	<i>Df</i>	<i>F</i>	Sig.	η^2	Power
Within-Subjects					
Time	1	173.165	.000	.184	1.00
Time X Group	1	7.661	.006	.010	.76
Error	769	(745.213)			
Between-Subjects					
Group	1	109.996	.000	.125	1.00
Error	769	(1,653.152)			

Note. Number in parentheses mean square for corresponding term

Model Interaction

Lastly, the factorial ANOVA was utilized to assess the time X group interaction term. The interaction was statistically significant, $F(1, 769) = 7.661, p = .006 (\eta^2 = .010, \text{power} = .76)$. This indicates that the change from pre-test to post-test was not consistent for the two remediation groups. Thus, further post hoc tests were conducted to untangle the interaction term. Two paired-samples t-tests (one for each group) were conducted to determine if there was a significant change from pre-test to post-test for both groups. The paired t-tests for both groups are listed in Table 8. The tests revealed significant increases from pre-test to post-test for the non-remediation and remediation groups. The test scores for the non-remediation group increased by 19.995 points from pre-test to post-test, and the test scores for the remediation group increased by 30.647 points from pre-test to post-test.

Table 8. *Paired t-test Comparisons for Time X Group Interaction*

Group	<i>Mean Difference</i>	<i>SD</i>	<i>df</i>	<i>T</i>	<i>Sig.</i>
No Remediation	19.995	40.949	651	12.468	.000
Remediation	30.647	21.499	118	15.550	.000

Again, the researcher rejected the null hypothesis for Research Question One; however, due to the complexity of the data analysis and statistical results of Research Question One, further discussion of the exploratory statistical testing above and other confounding variables that were not controlled for as part of this research study such as school size, school leadership paradigm, school location and culture, parental involvement, class size and teaching methods are discussed in Chapter Five.

Research Question 2. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores.

A one-way ANCOVA (analysis of covariance) was conducted to determine if there was a significant difference between economically disadvantaged students who received a mathematics

remediation course and students who were non-economically disadvantaged and received a mathematics remediation course on post-test CRCT scores (seventh grade) after adjusting for participants' pre-test scores CRCT scores (sixth grade). Socioeconomic status (non-economically disadvantaged vs. economically disadvantaged) was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate.

The ANCOVA testing procedures described above were utilized for this analysis. First, the data were screened for outliers prior to assessing the statistical assumptions. The data screening process revealed 1 outlier in the data. This participant was removed prior to assessing the statistical assumptions. The distributions for the non-economically disadvantaged and economically disadvantaged groups are displayed in Figures 3 and 4, respectively. The histogram for the students who were non-economically disadvantaged revealed a slight negative skew. This indicates the extreme (i.e., infrequent) scores were on the high end of the scale. The distribution for the students who were economically disadvantaged was approximately normal. In addition, the sample size was greater than 50 for this group, so normality of the sampling distribution was approximately normal as defined by the central limit theorem.

Figure 3. Distribution of Non-economically Disadvantaged Students' Post-test Mathematics Achievement

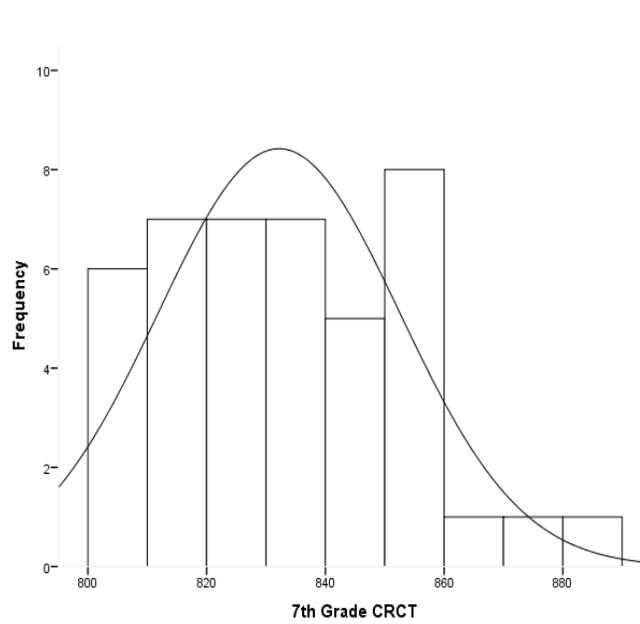
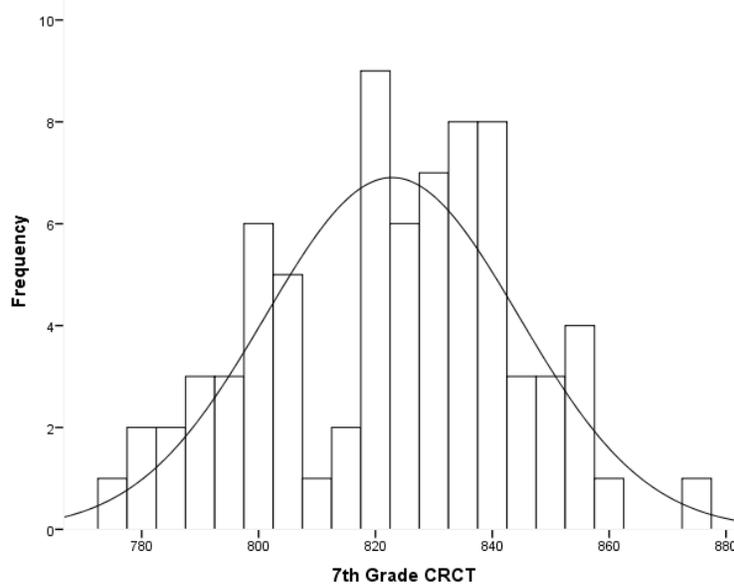


Figure 4. Distribution of Economically Disadvantaged Students' Post-test Mathematics Achievement



The next step involved assessing the homogeneity of error variances and equality of covariance of regression slopes assumptions. Levene's test was not significant, indicating the two groups had equal error variances (i.e., homogeneity of variances) on post-test mathematics scores, $F(1, 116) = 0.234, p = .629$. Lastly, the final assumption of ANCOVA is homogeneity of regression slopes which is assessed with an F test on the independent variable X covariate interaction term. The term was not significant, indicating the equality of regression slopes, $F(1, 114) = 0.073, p = .787$. This indicates the relationship between pre-test and post-test math scores was consistent for the two socioeconomic groups.

The unadjusted and adjusted means are listed in Tables 9 and 10, respectively. The ANCOVA test statistics are listed in Table 11. The ANCOVA revealed a significant difference between the non-economically disadvantaged ($M = 831.641, SD = 3.020$) and economically disadvantaged students ($M = 823.166, SD = 2.286$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 115) = 5.003, p = .027 (\eta^2 = .042, \text{power} = 1.00)$. Unlike the previous model, the difference between the group means did not change dramatically after adjusting for pre-existing differences on mathematics achievement. However, only 4% of the variability in the students' post-test mathematics achievement scores can be attributed to socioeconomic status after adjusting for the students' pre-test mathematics achievement. Thus, the researcher rejects the null hypothesis. Various other confounding variables such as: school size, school leadership paradigm, school location and culture, parental involvement, class size and teaching methods were not controlled for as a part of this research study. Further discussion of these confounding variables is investigated in Chapter Five.

Table 9. *Unadjusted Post-test Mathematics Scores*

Socioeconomic Group	<i>n</i>	<i>M</i>	<i>SD</i>
Non-economically Disadvantaged	43	832.186	20.370
Economically Disadvantaged	75	822.853	21.660

Table 10. *Adjusted Post-test Mathematics Scores*

Socioeconomic Group	<i>n</i>	<i>M</i>	<i>SD</i>
Non-economically Disadvantaged	43	831.641	3.020
Economically Disadvantaged	75	823.166	2.286

Table 11. *One-Way ANCOVA on Post-test Mathematics Achievement*

Source	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>Sig.</i>
Group	1,957.901	1	1,957.901	5.003	.027
Error	45,007.851	115	391.373		
Total	54,524.373	117			

Research Question 3. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a

mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores.

A one-way ANCOVA (analysis of covariance) was conducted to determine if there was a significant difference between female and male students who received a mathematics remediation course on post-test CRCT scores (seventh grade) after adjusting for participants' pre-test scores CRCT scores (sixth grade). Gender (female vs. male) was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate.

The ANCOVA testing procedures described above were utilized for this analysis. First, the data were screened for outliers prior to assessing the statistical assumptions. The data screening process failed to reveal any outliers in the data. The distributions for the females and males are displayed in Figures 5 and 6, respectively. Both distributions were approximately normal. In addition, the sample size was greater than 50 for each group, so normality of the sampling distributions was approximately normal as defined by the central limit theorem.

Figure 5. Distribution of Females Students' Post-test Mathematics Achievement

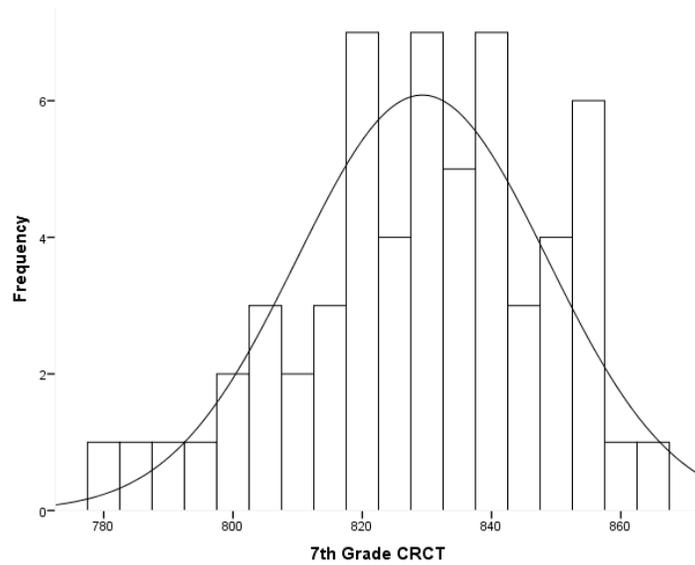
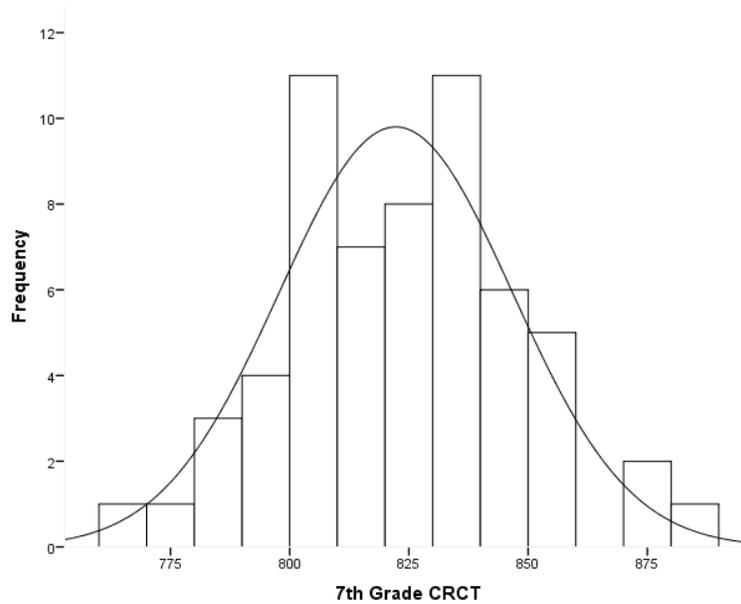


Figure 6. Distribution of Males Students' Post-test Mathematics Achievement



The next step involved assessing the homogeneity or error variances and equality of covariance of regression slopes assumptions. Levene's test was not significant, indicating the two groups had equal error variances (i.e., homogeneity of variances) on post-test mathematics

scores, $F(1, 117) = 2.113, p = .149$. The independent variable X covariate interaction term was not significant, indicating the equality of regression slopes, $F(1, 115) = 3.207, p = .076$. This indicates the relationship between pre-test and post-test math scores was consistent for the females and males.

The unadjusted and adjusted means are listed in Tables 12 and 13, respectively. The ANCOVA test statistics are listed in Table 14. The ANCOVA failed to reveal a significant difference between the females ($M = 828.351, SD = 2.715$) and males ($M = 823.155, SD = 2.692$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 116) = 1.83, p = .178 (\eta^2 = .016, \text{power} = .27)$. The difference between the group means decreased after adjusting for pre-existing differences on mathematics achievement. However, only 2% of the variability in the students' post-test mathematics achievement scores can be attributed to gender after adjusting for the students' pre-test mathematics achievement. Thus, the researcher fails to reject the null hypothesis. Various other confounding variables such as school size, school leadership paradigm, school location and culture, parental involvement, class size and teaching methods were not controlled for as a part of this research study. Further discussion of these confounding variables is investigated in Chapter Five.

Table 12. *Unadjusted Post-test Mathematics Scores*

Gender	<i>N</i>	<i>M</i>	<i>SD</i>
Female	59	829.271	19.348
Male	60	822.250	24.422

Table 13. *Adjusted Post-test Mathematics Scores*

Gender	<i>N</i>	<i>M</i>	<i>SD</i>
Female	59	828.351	2.715
Male	60	823.155	2.692

Table 14. *One-Way ANCOVA on Post-test Mathematics Achievement*

Source	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>Sig.</i>
Group	791.606	1	791.606	1.833	.178
Error	50,084.722	116	431.765		
Total	58,367.395	118			

Summary

The purpose of this study was to determine whether an additional remediation mathematics course, substituted for an elective course, for low performing students could significantly increase standardized test scores by comparing at risk students' seventh grade Criterion-Referenced Competency Test scores, while adjusting for variation in capability using their sixth grade Criterion-Referenced Competency Test scores as a pretest measure. Data collected from 775 students' CRCT test scores between the school years of 2008-2011 were used to analyze the three research questions of the study.

For Research Question One, a one-way ANCOVA was utilized to determine statistical significance between students who were placed in an additional seventh grade mathematics course for remediation and those seventh grade students who did not have an additional mathematics course; there was a statistical difference between the non-remediation students and

the remediation students on post-test mathematics achievement while adjusting for their pre-test scores; however, the effect size was small. In further analyses of the means (Table 4), the dramatic change for the group means after adjusting for pre-existing differences signify students in the remediation group had a higher mean on the post-test after adjusting for pre-test score, which implicated further analysis using the covariate as an interaction term. Similarly, the non-remediation group also revealed a change in group mean on the post test results; this group's mean illustrated a decrease after adjusting for the pre-existing differences. Moreover, due to the results, the researcher conducted another statistical measure for Research Question One which consisted of a factorial ANOVA test. In analyzing this data, the researcher was further informed about the statistical significance of both the remediation group and the non-remediation groups. Thus, the researcher rejected the null hypothesis for research question one and provides an auxiliary explanation in Chapter Five of the results.

For Research Questions Two and Three, the researcher conducted a one-way ANCOVA for both research questions to determine if there was a statistical significant difference between students in the remediation group post-test scores (seventh grade) who were economically disadvantaged and those who were not, as well as, was there a statistical significance difference between girls' and boys' for students who received a mathematics remediation course after adjusting for participants' pre-test scores CRCT scores (sixth grade). Socioeconomic status (non-economically disadvantaged vs. economically disadvantaged) and gender was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate (i.e., control variable). For both Research Questions, a statistical significance was found; however, the effect

size was small. Thus, the research rejected the null hypotheses for Research Question Two but failed to reject the null for Research Question Three.

In Chapter Five, the results are discussed further. Additionally, implications related to the findings of the study will be discussed, and further conclusions will be drawn in Chapter Five as well.

CHAPTER FIVE: SUMMARY AND DISCUSSION

In this study, the researcher examined whether or not the implementation of a remediation program in mathematics during the seventh grade year had an effect on student achievement as measured by the Criterion Referenced Competency Test. The researcher also examined whether or not socioeconomic status and gender differences would affect the significance, if any, of the remediation students in the program. This final chapter of the dissertation will assist the reader in that the researcher will restate the problem and review the methods of the study. Moreover, the researcher will provide a summary of the results and a discussion of the findings of the research. Additionally, a thorough dialogue about the limitations of the study will be presented. Finally, implications of the study will be discussed and a synopsis of this research study will conclude the chapter.

Restatement of the Problem

In Georgia, school administrators are seeking ways to meet state and federal academic achievement goals in order to continue to receive federal funds. Many changes have been made in the education arena over the last few years that impact schools' success rating. Students who are not meeting the standards are falling further behind as they leave elementary school and begin middle school. In fact, the number of students, on average, that did not meet the standards on the Criterion-Referenced Competency Test between the years of 2009 and 2011 was 16.3% males, 11.7% females, and 19.3% economically disadvantaged, and 6.3% non-economically disadvantaged (Georgia Department of Education, 2011 a). The students' test scores within the subgroups of gender and socio-economic status are part of the measures used to determine whether or not a school meets Adequate Yearly Progress (AYP) goals; therefore, it is imperative

that stakeholders within the educational community continue to find ways to help these students become successful learners in today's educational systems.

Review of Methodology

A causal-comparative research design was to determine if remedial mathematics courses influence seventh grade students' standardized test scores and if differences exist for economically disadvantaged and gender for remediation students. Using this non-experimental causal-comparative research design, it was possible to look at the differences, if any, between remediation classes and performance on the CRCT. Data was collected and analyzed from a total of 775 students in one rural middle school. All of the participants were in seventh grade.

Research Question 1. Is there a difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in mean scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and students who did not receive a mathematics remediation course after adjusting for participants' pre-test scores.

Research Question 2. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between students who received a mathematics

remediation course and are economically disadvantaged versus students who received a mathematics remediation course who are non-economically disadvantaged after adjusting for participants' pre-test scores.

Research Question 3. Is there a difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores?

H₀: There will not be a significant difference in means scores on the seventh grade Criterion-Referenced Competency Test between female students who received a mathematics remediation course and male students who received a mathematics remediation course after adjusting for participants' pre-test scores.

Summary of Results

The descriptive statistics for the participants' continuous and discrete study variables are listed in Tables 1 and 2, respectively. The average student scored 847.179 (SD = 29.275) on the seventh grade Math CRCT and 825.314 (SD = 42.948) on the sixth grade Math CRCT. Approximately half (391, 50.5%) of the participants were male. Three-hundred ninety-six (51.1%) were not considered economically disadvantaged, and 379 (48.9%) were considered economically disadvantaged. A majority (656, 84.6%) of students did not participate in the remediation class.

A one-way ANCOVA (analysis of covariance) was conducted to determine if there was a significant difference between students who received a mathematics remediation course and students who did not receive a mathematics remediation course on post-test CRCT scores (seventh grade) after adjusting for participants' pre-test scores CRCT scores (sixth grade). The

ANCOVA is appropriate (Stevens, 2002; Tabachnick & Fidell, 2007) when comparing two or more groups on a continuous dependent variable while adjusting for one or more continuous variable(s). Mathematics remediation (yes vs. no) was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate. The ANCOVA revealed a significant difference between the non-remediation students ($M = 848.980$, $SD = 0.970$) and remediation students ($M = 833.860$, $SD = 2.346$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 768) = 34.645$, $p < .0005$ ($\eta^2 = .043$, power = 1.00). Interestingly, the difference between the group means changed dramatically after adjusting for pre-existing differences on mathematics achievement. After adjusting for pre-existing academic achievement using the sixth grade CRCT scores as a covariate, the group means between the remediation and non-remediation reveal a reversal (Table 4). However, the statistical significance of the effect size revealed only 4% of the variability in the students' post-test mathematics achievement scores can be attributed to the remediation after adjusting for the students' pre-test mathematics achievement. Thus, the researcher rejected the null hypothesis for Research Question One.

A one-way ANCOVA (analysis of covariance) was conducted to determine if there was a significant difference between economically disadvantaged students who received a mathematics remediation course and students who were non-economically disadvantaged and received a mathematics remediation course on post-test CRCT scores (seventh grade) after adjusting for participants' pre-test scores CRCT scores (sixth grade). Socioeconomic status (non-economically disadvantaged vs. economically disadvantaged) was the between-subjects independent variable, students' post-test mathematics achievement was the dependent variable, and students' pre-test mathematics achievement was the covariate (i.e., control variable).

The ANCOVA revealed a significant difference between the non-economically disadvantaged ($M = 831.641$, $SD = 3.020$) and economically disadvantaged students ($M = 823.166$, $SD = 2.286$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 115) = 5.003$, $p = .027$ ($\eta^2 = .042$, power = 1.00). Unlike the previous model, the difference between the group means did not change dramatically after adjusting for pre-existing differences on mathematics achievement. Only 4% of the variability in the students' post-test mathematics achievement scores can be attributed to socioeconomic status after adjusting for the students' pre-test mathematics achievement. Thus, the researcher rejects the null hypothesis. Various other confounding variables such as: school size, school leadership paradigm, school location and culture, parental involvement, class size and teaching methods were not controlled for as a part of this research study.

Lastly, for Research Question Three, a one-way ANCOVA was conducted to assess the differences, if any, between males' and females' CRCT scores in the remediation mathematics course after adjusting for participants' pre-test scores. The ANCOVA failed to reveal a significant difference between the females ($M = 828.351$, $SD = 2.715$) and males ($M = 823.155$, $SD = 2.692$) on post-test mathematics achievement while adjusting for their pre-test scores, $F(1, 116) = 1.83$, $p = .178$ ($\eta^2 = .016$, power = .27). The difference between the group means decreased after adjusting for pre-existing differences on mathematics achievement. However, only 2% of the variability in the students' post-test mathematics achievement scores can be attributed to gender after adjusting for the students' pre-test mathematics achievement. Thus, the researcher failed to reject the null hypothesis.

For all Research Questions One, Two, and Three, the CRCT was the measure for student achievement. The first Research Question addressed whether or not there was a significant

difference between students' mean scores on the CRCT based upon whether or not the student participated in the mathematics remediation class as an additional mathematics course during their seventh grade year. Students who did not participate in the mathematics remediation course served as the control group for this research question. Both the remediation groups' and the non-remediation groups' CRCT scores for their sixth grade year served as a pre-test measure and the control variable.

For both Research Questions One and Two, the researcher found statistical significance; therefore, the researcher rejected the null hypothesis for both questions. For Research Question Three, whether females and males in the remediation group had a statistical significant difference between mean scores while adjusting for pre-existing differences, the researcher did not find statistical significance after examining the statistical tests; thus, the researcher failed to reject the null hypothesis for Research Question Three.

Discussion

The literature reviewed in Chapter Two revealed a gap in the area of mathematics remediation during the middle school transition years. There was a lack of informational research about an additional mathematics class as a remediation tool during the middle school years as well. This study sought to discover whether at risk students who were given an additional mathematics class as an elective course during their connections time at school were making academic gains as measured by the Criterion Referenced Competency Test. This study will add literature in the field of remediation mathematics during the middle school transition years.

Moreover, a vast amount of research literature in the field of Social Cognitive Theory and the Theory of Self-Efficacy suggested that during these transitional years from elementary school

to high school, a student's social environment and learning experiences can lead to a higher or lower self-efficacy which, consequently, can affect a student's success in learning. Usher and Pajares (2005) conclude that students making the shift from elementary school to middle school are continuously evaluating and reevaluating their self worth and their academic worth as they find ways to fit into the norms of their environment.

Indeed, the effect size of Research Question One was small; however, when the means of the two groups are compared, the interaction between the groups' means was a ten point inversion when adjusting for the pre-existing academic achievement. In the unadjusted post-test Criterion Referenced Competency Test group means, the remediation group mean was 825.731, while the non-remediation group's mean was 850.463 (see Table 3 & 4). This is not surprising because the fact exists that the remediation group was in the at-risk predetermined area. However, after one year of remediation, and adjusting for the pre-existing academic achievement, the remediation groups' mean score was 848.980, while the non-remediation group's mean was respectively, 833.860. This inversion of means, where the remediation group shows more gains and even surpasses the non-remediation group's mean scores, substantiates that the remediation group is gaining ground and closing the gap in academic achievement. Again, self-efficacy could also be a potential factor when examining the gains being made by this group of students. Additionally, the small learning environment of the remediation classes due to class size could potentially be responsible for the interaction found between the non-remediation group and the remediation group.

Due to this surprising interaction, an exploratory statistical test was conducted to determine the difference of the means between the two groups. Therefore, the research conducted a 2 (time) X 2 (group) mixed factorial ANOVA (analysis of variance) to explore any

longitudinal changes and determine if those changes were consistent for the two groups. The factorial ANOVA was utilized to assess the time and group main effects and the time < group interaction to determine if a statistically significant difference on students' mathematics Criterion Referenced Competency Test (CRCT) across time (pre-test to post-test) and between groups (remediation vs. no remediation) existed.

This exploratory statistical test revealed that the remediation group's mean score upon entering the remediation program was 795.084, which is below the threshold of "Meeting the Standards" and is labeled as "Does Not Meet the Standards" for Georgia's Performance Standards. After the seventh grade year of remediation, the remediation group's mean score on the seventh grade CRCT rose to a mean score of 825.731, which not only "Meets the Standard" benchmark of 800, but closes the gap on the state average for those three years in the state of Georgia. The average mean score for the seventh grade CRCT for the years of 2010, 2011, and 2012 for the state of Georgia was 834.33 (Georgia Department of Education, 2013). This discovery in the exploratory statistical testing not only validates the remediation program as increasing academic achievement, but it also shows gains toward closing the achievement gap for at-risk students are being made with this group of participants.

Socioeconomic status has long been a source of debate for lower performing students in mathematics and reading courses. One study conducted by Arslan (2013) found that the socioeconomic status of students affected the students' self-efficacy and their performance in school academics. He found that students with high socioeconomic status reported that the mastery experiences they encountered increased their self-efficacy when learning new material, while students with lower socioeconomic status increased their self-efficacy with use of vicarious experiences and social predictors. Remediation classes contain a smaller class size

compared to that of a regular education class size number of students. More importantly, all of the students in the remediation courses have a common goal, which is to improve their Criterion Referenced Competency Test scores in mathematics. To be considered for placement in the class, the students scored within a predetermined at-risk range 810 or below on the CRCT. This also places the remediation group of students within the same mastery level in mathematical concepts; thus, the group dynamics could potentially be influenced by the homogeneous grouping of the class. Furthermore, the instructor may differentiate between the various students' socioeconomic statuses and provide for classroom experiences to improve their self-efficacy in different ways. If the instructor employed various techniques to improve students' self-efficacy, such as mastery, vicarious experiences, and social pressure, then self-efficacy of all students may have increased. If the self-efficacy is increased, then achievement is proposed to increase as well.

In addition, there are clearly very few research studies that examine gender differences in the elementary and middle school grades, but numerous studies are found on gender differences at the high school level (Parekh, 2011). In a research study conducted by Parekh using schools in New York, she states, "Very little work has directly measured the achievement gap between boys and girls in elementary and middle schools, and even less has analyzed its evolution over academic careers in these grades" (p.3). This study adds to the research in the field about the gender gap in mathematics in the middle grades. Before statistical testing began with the study, when looking at the samples of males and females placed in the remediation classes, 59 males and 60 females were the sample population; this shows that there was equality in gender for at risk students who were placed in mathematics remediation at the middle school level in this one particular school district. Consequently, based upon the results of this study, there is indication

that the gender gap is closing, and for at-risk students in a remediation mathematics course, the variability of the mean scores between males and females in remediation courses was not statistically significant.

The results of this study, based upon the student achievement measure of the CRCT, implied that an additional mathematics remediation course during the middle school years does have an impact student learning in a positive way. However, this study's results also imply that gender is not a factor for determining student achievement as measured by the CRCT for students who are placed in an additional remediation class during the middle grades.

Limitations

There were several factors that could lead to potential influences on the results of the study. The limitations of sample size could have had a negative impact on the data results. The rather large sample size that was utilized in this study lends to the fact that, where significance was found with Research Question One, the power of the significance was $F(1, 768) = 34.645, p < .0005$ ($\eta^2 = .043$, power = 1.00), as well as for Research Question Two $F(1, 115) = 5.003, p = .027$ ($\eta^2 = .042$, power = 1.00). This could be attributed to the large sample size, $n=775$, in the study. Since the entire seventh grade class was under investigation to study the effects of the additional remediation course, the two comparison groups were rather large with 119 participants in the remediation group and 656 in the non-remediation group. Gall, Gall and Borg (2007) maintain, "A researcher is more likely to obtain a large effect size in a sample when there is a large effect size in the population" (p. 144).

Interestingly with this study, the sample size could have had a potential impact on the power of the significance found in the data results. Some studies have shown that a sample size could be too large, "The average projected burden per participant remains constant as the sample

size increases, but the projected study value does not increase as rapidly as the sample size if it is assumed to be proportional to power or inversely proportional to confidence interval width. This implies that the value per participant declines as the sample size increases and that smaller studies therefore have more favorable ratios of projected value to participant burden” (Bacchet, P., Wolf, L.E., Segal, M.R. and McCullough 2005).

In this case, it is the difference of the means between the two groups that is obvious; and even though significance was found, the small effect size could be due to a large sample population. Although this type of research design does not lend itself to making strong conclusions (Gall, Gall, & Borg, 2010), it is valuable to help discover relationships in education when it is not ethical or not possible to manipulate the independent variable (Ary et al., 2010). Thus, with this study, the sample size could have had a potential impact on the power of the significance found in the data results.

Another sample size limitation lies within the area of repeat participants in the remediation group classes. The researcher was not able to conduct statistical testing for achievement based on whether a student had received remediation for more than one year. One limiting factor for this was because the sixth grade was located off-campus in the elementary schools spread over the school district for the school year of 2008-2009. Therefore, some students who received remediation in the sixth grade elementary school’s program may have also been in the middle school’s seventh grade remediation program. This was a factor that could not have been compensated for in population grouping, statistical testing, or results reporting; too many variables would have been involved to create accurate groupings for this to be examined. Additionally, the number of repeat remediation students may have been less than thirty; therefore, the researcher would not have been able to utilize statistical testing due to sample size

limitations as well. If the researcher could have used this sample population, the results could have potentially impacted the significance and allowed the researcher to understand a clearer impact for which the remediation mathematics class was responsible.

Moreover, another limitation of this study lies within the fact that this study was conducted within one rural northeast Georgia middle school with a unique demographic population. Also, this school has structured the remediation program in such a way that students who have performed within the predetermined at risk level, which is 810 or below, on the Criterion Referenced Competency Test during the spring administration of their sixth grade year, those students are placed in an additional mathematics course the following year. The predetermined factor of the CRCT score is decided upon by administration, and the additional remediation course replaces a student's elective or connections course. This arrangement of how students are chosen is unique to this school for mathematics remediation purposes.

A final limitation of this study is the sampling method; the convenience sample used for this study can also be a limitation. The participants' data used in the study were all from the one middle school located in the North Georgia area. The remediation class data were from one grade level, seventh grade, with one teacher facilitating the remediation for the entire three years of data collection. The setting of the school is from a non-diverse rural setting; whereas the seventh grade participants represented the collective whole of the school; the majority population were white/ non-Hispanic (with 48.9% were considered economically disadvantaged). There was also a normal distribution for the gender portion of the study; that is, 49.5% of the sample participants were female with 50.5% of the sample participants being male.

Implications

There are several dynamics that educational stakeholders can learn from this study to ensure that at risk students in mathematics at the middle grades level are successful, and the gap between them and their counterparts becomes less, or even absolves completely. According to Bandura's Social Learning Theory, how adolescents learn from and apply meaning to their social environment during the pivotal transition years from elementary to middle school contributes to a portion of whether or not the achievement gap is closed for students in a remediation mathematics course.

This study's findings suggest that an additional mathematics course in the seventh grade does indeed aid in closing the achievement gap for at-risk students. Significance was found for both Research Questions One and Two, with the interaction between the two groups asserting that the achievement gap does decrease when an additional remediation course is implemented during the seventh grade year.

Since some research points to students' sensitivity about their surroundings, another position to consider within the remediation mathematics programs are the environmental factors of school climate, teachers' attitudes, and relationships students develop with their teacher as well as peers. In fact, in a recent study, Wang et al. (2009) states, "Students' perceptions of the school environment and its impact on their psychosocial and academic adjustment have received increasing attention in recent years (p. 100). The participants in this study were assigned an additional remediation course as a means to improve achievement on their mathematics Criterion Referenced Competency Test. This class is designed to have a smaller number of students and care is chosen to provide a teacher that builds relationships with students in a positive manner. This being said, the theory of self-efficacy, in which students believe they can accomplish a task,

may have played a role in the results of this study. Consequently, educational stakeholders must revisit environmental factors within their remediation programs to ensure students' self-efficacy is being fostered in a positive way within the social interactions of the remediation classes.

Recommendations for Future Research

Based on the findings from this study and the associated review of literature, there are several recommendations for further research for the topics of gender and socio-economic status for struggling mathematics students in the middle grades. One of the first recommendations would be to conduct the study involving several middle schools in the state of Georgia due to the common state standards that are taught and tested in Georgia. This would eliminate one remediation program over another, as long as they follow similar criteria of class sizes at 18 students or less, and an additional 55 minutes extra time as a remediation intervention on mathematics. Also, by using several middle schools, the study's results would add more literature in the field about mathematics remediation in the middle grades.

A longitudinal study would also strengthen the results of this study as well as provide more insight into remediation during the middle school years. It would be of great value to follow the participants of this study to determine whether the same participants in this study were in remediation classes during the high school years, or if they never needed remediation courses in mathematics during future grades. Also, it would be enlightening to discover what percent of those students graduated from high school and took education one further step by attending college; and whether or not, if in college, those same students were required to take remediation courses during their college freshman year.

Certainly, one area of this study that does indeed require further examination is that of the gender gap concept. The review of the literature postulated that multiple gender issues exist for

students learning mathematical concepts from as early on as first grade (Rycik, 2008). However, the results of this study, coupled with more current research in the area of gender equity in education, suggest the gender gap among male and female students is closing and according to the results of this study, are not of significance to those at risk students in remediation.

In fact, Parekh (2011) warns schools that are thinking of restructuring classrooms at an attempt to close this gap advising that it is possible the gap does not exist in mathematics any longer as it once did. Parekh states that, “Interestingly, in math, the gender gap has grown smaller over time, indicating girls are catching up to boys, while the reading gap has increased as girls have outpaced boys since 1992” (p. 1) which disputes earlier research reports about the situation of the gender gap in mathematics. For this study, the question of a gender gap in mathematics was examined for the remediation groups; however, the significance was not statistically sound to reject the null hypothesis; therefore, the researcher concluded that gender was not a factor in determining student achievement based upon CRCT scores. Moreover, for the unadjusted and the adjusted mean scores for male and female at-risk remediation students, the female groups’ mean scores were higher in both cases. Thus, the literature in the field is contradictory as to the gender gap issue in the mathematics classrooms and must be examined further with middle grades remediation programs.

Additionally, for future studies of this nature it would certainly be helpful to expand the research to include the types of instructional strategies utilized in the remediation classroom by the remediation teacher. This information could be useful in determining instructional practices and curricular decisions for not only weak mathematics students, but also for any students struggling with any mathematics concepts in any type of classroom. Thus, the findings of such a

study could potentially be generalized to all middle school mathematics educators and students alike.

Conclusion

This study was conducted in a rural Northeast Georgia school where an additional mathematics course was given to at risk students in the seventh grade. The researcher found that remediated students, in comparison to non-remediated students, have statistical significance in mean scores based upon the Criterion Referenced Competency Test in seventh grade. The researcher also discovered that within the sub-group of students in low Socio-Economic Status, there was also a statistical significant difference in mean scores. However, statistical significance was not found within the sub-group of gender, where girls were compared to boys within the remediation group, which indicates the gender gap is closing among at risk students.

The results of this study will be a valuable addition to aid educational stakeholder when trying to design remediation programs for low achieving mathematical students in the middle grades. While it is important to continue striving toward an improvement in academic achievement, it is equally important to remember that, by initiating success in the classroom among low performing students, this same success can lead to an improvement in self-efficacy during the adolescent years. The findings could result in better decision making for schools across the nation in trying to increase student achievement with low performing middle school mathematics students.

Future research in this field will support and validate the need for remediation programs at the middle school level and provide insight on how to spend taxpayer dollars wisely. In the age of accountability for schools across the nation, it is important to foster success with

meaningful and purposeful goals that focus on achievement for the student, the school, and ultimately, the future.

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Appendix A: IRB Approval letter

LIBERTY UNIVERSITY

INSTITUTIONAL REVIEW BOARD

November 4, 2013

Jason Nix

IRB Exemption 1711.110413: The Effects of a Seventh-Grade Mathematics Remediation Course on Student Achievement as Measured by the Criterion-Referenced Competency Test

Dear Jason,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(4), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

Fernando Garzon, Psy.D.
Professor, IRB Chair
Counseling

(434) 592-4054