

SINGLE-SEX EDUCATION VERSUS COEDUCATION IN NORTH GEORGIA

PUBLIC MIDDLE SCHOOLS

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

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## ABSTRACT

Catherine Danielle Blake. SINGLE-SEX EDUCATION VERSUS COEDUCATION IN NORTH GEORGIA PUBLIC MIDDLE SCHOOLS (under the direction of Dr.Leldon W. Nichols) School of Education, Liberty University, July 2012.

The U.S. Department of Education is giving more liberties to school districts to offer single-sex schools in order to adequately serve the needs of students. The purpose of this quantitative causal-comparative study was to test the theory of students' performances based on their educational environment by comparing students who received instruction in a single gender classroom in a public middle school compared to students who received instruction in a mixed gender classroom in a public middle school. The achievement test, Georgia Criterion Referenced Competency Test, was used with each site school. There were two years of data collected with the standardized test and was utilized as a pretest and posttest in all subtests areas. The data were compared as whole group, females to females, and males to males. The findings in the study showed that there were significant differences for the whole group in reading, science and social Studies. There were also significant differences in the males in science, and social studies; females showed significant differences in math, reading, science, and social studies.

*Keywords*, single-sex education, coeducation, achievement test, Georgia Criterion Referenced Competency Test, standardized test

## DEDICATION

I would like to thank my family, friends, and colleagues for their support through this process. I would not be here today if I did not have you in my life.

To my husband Josh, I want to thank you for your constant support through this process. You are my best friend and I would not have been able to complete this without you. You are wonderful and I love you so much.

To my son Noah, thank you for being a wonderful little boy. You came in the middle of this process but you have been such a wonderful addition to my life. I am thankful each day I see your sweet smile and melts my heart. I love you with all my heart.

To my mother Sandra, thank you for your constant support. You have always encouraged me to do my best. Thank you for being a wonderful mom.

I want to thank Dr. Leldon Nichols. Thank you for being my dissertation chair, leading me through this process, being patient with me, and your kindness throughout. I truly appreciate all you have done for me.

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## List of Abbreviations

Analysis of Covariance (ANCOVA)

Criterion-Referenced Competency Test (CRCT)

Department of Education (DOE)

Georgia Performance Standards (GPS)

Mississippi Curriculum Test (MCT)

National Association for Single-Sex Public Education (NASSPE)

National Consortium of Examination Results (NCER)

## CHAPTER ONE: INTRODUCTION

### Background

The United States Secretary of Education, Margaret Spellings (2009), noted that the achievement gap between genders and ethnicity has widened, causing intense repercussions for society, the economy, and families. This gap between boys and girls has educators pondering ideas such as separation of sexes in the classroom (Tyre, 2006). In fact, there is an increase in the popularity of single-sex classes within the coeducational setting (Jackson & Smith, 2000). Educators are continuously looking for new tools to assist them in handling problems such as behavior in the classroom and academic performance, specifically with boys (Tyre, 2006). Tyre recognized that teachers need ideas more than ever with the increased emphasis and stress placed on school performance which is measured by students enrolled in accelerated classes and test scores. She knew standardized tests have become common, especially since testing begins at age six. With this pressure, curricula have been designed to be more rigorous, Tyre found that some states even go as far as dictating what teachers are to teach and how to teach it. The idea of single-sex education becomes more prevalent as a result of better performance, so much in fact that it is “growing faster than evidence to support” it (Morse, 1998). This popularity is supported by the fact that boys are different from girls, biologically, developmentally and psychologically (Tyre, 2006). Knowing and understanding these differences could assist teachers in learning how to teach and bring the best out of everyone (Tyre, 2006). If we could know the students’ performance academically in each content area, based on gender, this could potentially allow educators to focus on areas of need. One region in particular that has implemented such a program

is north Georgia. This research will present the students' progress in the site school by obtaining their standardized test scores from the previous year, then assessing their progress in the single-sex environment using their standardized test scores from the current year.

### **Problem Statement**

Achievement gaps have been evident in education for some time; however, there are many different opinions about how to solve problems in education. There is much research to support the idea that there is a difference in the way boys and girls learn and how it directly impacts their performance in the classroom (Gurian, 2001). With this recognition, Federal rules have been revised to allow public schools to create single-sex classes and schools (Department of Education, 2006) in hopes of improving achievement and diversifying classroom instruction and educational opportunities.

Research in countries such as Australia, Canada, New Zealand, Ireland, USA, and the UK have resulted in very little evidence related to consistent advantages or disadvantages of either single-sex education or coeducation (Smithers & Robinson, 2006). Smithers and Robinson had difficulties comparing "like with like since in most Western countries single-sex schools are a small special group and differ in ways other than in gender of their intake" (2006, p.5). Since the focus has shifted towards male students due to their recent poor performances on standardized tests, specifically in English, there have been more "experimentations with single-sex classes" (Smithers & Robinson, 2006, p.6). Currently, hundreds of studies have been focused on single-sex education; however, there is still "insufficient sound empirical evidence concerning the

consequences of single-sex versus coeducational schooling” (Bigler & Signorella, 2011, p. 663).

A number of schools have taken this opportunity and offered single-sex classes in public schools; one such example is located in north Georgia. With the push to try single gender classes, there is a lack of evidence about how effective this treatment may be versus the typical coeducation setting generally offered in public schools. Research supporting single-sex education exists but little evidence comparing student performance in single sex classrooms to that of students in coeducational settings, specifically in public schools is evident. Even further, there is very little research to support that this method is effective in public middle schools in the north Georgia region. “Whether to mix or separate the sexes in education is an issue which arouses strong feelings, but on which there is little conclusive evidence. Herein lies the paradox: people ‘know’ one or the other is better but cannot prove it” (Smithers & Robinson, 2006, p.7).

### **Purpose Statement**

The purpose of this quantitative causal-comparative study was to test the theory’s environmental surroundings during academic instruction by comparing students who received instruction in a single gender classroom in a public middle school compared to students who received instruction in a mixed gender classroom in a public middle school. In the first site school, the students received all core class instruction with their same sex peers but then received opportunities to interact with opposite sex peers during lunch and non-academic classes. This program has been implemented school wide for two consecutive years. In the second site school, the students received all academic and non-academic classes in a coeducational setting. This study looked at the progress the

students made in a single-sex environment compared to a neighboring school that delivers classroom instruction in a coeducational setting. The study attempted to identify whether there was a difference in the students that received single-sex education as opposed to those students that received a coeducational education.

The site school implemented the single-sex environment at the sixth grade level for incoming fifth graders. The students had received coeducational instruction until this point and not only transitioned into middle school but also were separated by gender in academic classes. The teachers involved in this transition were required to teach both gender classes although there was very little training involved in this piloted program.

The tool chosen to measure the academic progress of each group was the Georgia Criterion-Referenced Competency Test (CRCT). This is a test given each year in the spring to all students in every grade level to measure students' knowledge on the Georgia Performance Standards (GPS). The results of this test are used to measure the academic achievement of the students as well as the performance of the classes, teachers, schools, and systems. This ultimately reflects the academic success of the state as well as when comparing it nationally. The CRCT has subgroups which allow students to see not only their individual strengths and successes but also their weaknesses. This tool is used to measure the quality of education each school provides and could eventually determine teachers' salaries.

The study attempted to answer the question of whether or not the gender make-up of a classroom has a direct effect on the students' retention of knowledge measured by and reflected in the Georgia's CRCT. This information was collected in sixth grade for

all content areas in the spring of 2008 and again in seventh grade in all content areas in the spring of 2009.

The study looked at the concerns that teachers have with their classrooms and students. Some of these concerns included the constant distractions that the opposite gender created, thus distracting students from the academic content. Also, different learning styles needed to be addressed for the success of students. There were also diverse ways of teaching each gender to allow for the best retention of the academic knowledge. Finally, classrooms were made up of different temperaments of students and this could possibly be attributed to the gender make-up of the environment. The teachers involved in the study at the first site did not have to learn new standards but did need to investigate their own teaching strategies. One technique that may have worked for one gender of students may not work for the opposite gender of students. In regards to the second site, the teachers continued their typical method of teaching since the demographics did not change in their classroom. The teachers at both sites that were involved in this study were experienced. These teachers were highly qualified and had students in previous years who passed the state assessment with “meets expectations” and “exceeds expectations”.

Two schools participated in the study. The first site school is in one county which offered classes based on gender and is located less than ten minutes away from the second site school (of a different county) where students received instruction in a coeducational setting. Both counties are considered rural and most of the employment is industrial. Overall, both counties support the schools and fund them adequately. Despite the free education offered and the push for post secondary education, there is a

growing number of families with limited education that pass along the lack of enthusiasm to their children towards the importance of education. This results in students displaying less and less interest towards school and their academic progress. The first and second site schools are Title I schools, which means that over 35% of the students that attend each school live in poverty and are eligible for free or reduced lunches.

The schools in the study do not have a strong percentage of ethnically diverse population. In the first site, the demographics indicate that students are predominantly White, 92%, and similarly the second site has a 90% Caucasian student enrollment. The minorities at both schools are less than ten percent, with only 5% black, and less than 2% in the areas of Asian, Hispanic, and Multiracial (Barge, 2010).

The study compared the sixth grade students' CRCT scores at the first site receiving single-sex education to the sixth grade students' CRCT scores at the second site receiving instruction in a coeducational setting. For each group, the fifth grade CRCT scores were used as a pretest and to compare their progress over a year using their sixth grade CRCT scores. For the next year, the sixth grade CRCT scores were used as the pretest and then compared to their progress over the next year by using their seventh grade CRCT scores. In each year's analysis, the content areas in the CRCT scores were compared to determine if the gender make-up had a direct impact on the progress students made. The theory was that when students were not distracted or influenced by the opposite-sex peers, they would do better in their academic classes, thus rendering better academic success as measured on a state-mandated test such as the CRCT. Should the results have supported this assumption, then it would provide data to counties that this is a good method to implement in schools to help positively impact the success



of students in academics. The counties would need to provide adequate training to the staff in order for teachers to successfully implement this strategy. If there was no significant difference found between the groups, then the researcher would conclude that there was no direct correlation between the gender make-up of a class and academic success on a state mandated standardized test.

### **Research Questions**

The study attempted to answer the following questions by collecting and evaluating data from the experimental and control group.

Research Question 1: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 2: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 3: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 4: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 5: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 6: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 7: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 8: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup>

grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 9: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 10: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 11: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 12: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 13: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 14: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 15: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

### **Research Hypotheses**

The results from the research questions were obtained and rejects or fails to reject the null hypotheses:

Research Hypothesis 1: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation

setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 2: There will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 3: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

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Research Hypothesis 5: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 6: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 7: There will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 8: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

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Research Hypothesis 10: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving

instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 11: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

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Research Hypothesis 13: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 14: There will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 15: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

### **Identification of Variables**

In this study, the independent variable is the group of students receiving academic instruction in a single gender classroom in a public middle school located in north Georgia. This group of students attended a feeder elementary school offering a coeducational setting, and then attended the treatment site for sixth and seventh grade receiving instruction in a single-sex classroom.

The dependent variable in this study is the group of students receiving academic instruction in a mixed gender classroom in a public middle school located in north Georgia. This group of students attended a feeder elementary school offering a coeducational setting and then continued to receive this type of instruction in sixth and seventh grade.

The curriculum used by the teachers was identical for the independent and dependent variable. The teachers of both groups in this study followed the GPS generated by the state. To assess the knowledge of the standards, the Georgia CRCT was administered by the state annually to both groups. The results from the state assessment were broken down into specific domains identifying the student's knowledge of the standards taught. The three levels were exceeded, met, or did not meet (Georgia



Department of Education, 2008). The results were tracked for two consecutive years for both groups.

### **Definition of Key Terms**

**CRCT:** Criterion Reference Competency Tests, an assessment “designed to measure how well students acquire the skills and knowledge described in the Georgia Performance Standards. The tests yield information on academic achievement at the student, class, school, system, and state levels. This information is used to diagnose individual student strengths and weaknesses as related to the instruction of the GPS, and to gauge the quality of education throughout Georgia.” (Barge, 2010 p.1)

**GPS:** Georgia Performance Standards “provide clear expectations for instruction, assessment, and student work” which are defined as “the level of work that demonstrates achievement of the standards, enabling a teacher to know how good is good enough.” The GPS are able to “isolate and identify the skills needed to use the knowledge and skills to problem-solve, reason, communicate, and make connections with other information” as well as “tell the teacher how to assess the extent to which the student knows the material or can manipulate and apply the information” (Barge, 2011 p.1).

**Single-Sex Education:** “refers most generally to education at the elementary, secondary, or postsecondary level in which males or females attend school exclusively with members of their own sex” (Policy & Program, 2005, p.1).

**Title I:** “to ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments” (Barge, 2010 p.1). Qualifications are determined by federal programs such as census completed by

students families, number of students receiving free and reduced lunch, on Temporary Assistance for Needy Families, and/or Medicaid eligibility and must exceed 35% of the population attending the school (Barge, 2010).

## **CHAPTER TWO: REVIEW OF LITERATURE**

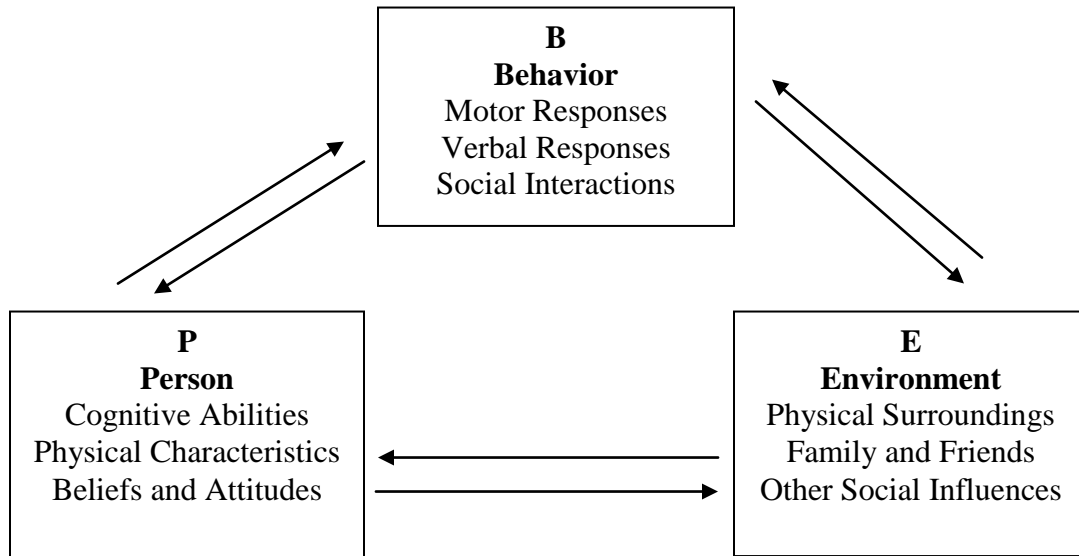
### **Introduction**

This section reviews the literature that supports the study. It is arranged in categorical topics beginning with the theoretical framework. The review of literature explores the concept of single-sex education as well as coeducational education. The review also includes an analysis on gender-based brain research and how it relates to education. The analysis investigates and identifies the benefits and challenges both male and females encounter in an educational setting.

### **Theoretical Framework**

The Social Cognitive Theory, a concept created by Albert Bandura was introduced in the 1960s (Bandura & Bussey, 2004). This theory governs “gender development and psychological functioning” (p.691). Bandura places a focus on cognitive processes, which includes how children and adults function cognitively with their social occurrences. This theory also looks at these specific cognitions and how they influence behavior and development. He began this theory with the idea of modeling as an outline of social learning. Later, he added other important ideas such as reciprocal determinism and self-efficacy. His work has motivated research on learning and behavior, especially focusing on developing methods for promoting behavior change. Bandura found that “children patterned their behavior more after same sex than they did after other sex models; this occurs irrespective of children’s level of gender consistency” (Bandura & Bussey, 2004, p.362) Prior to “analyzing the development of different human capabilities,” the causation should be briefly reviewed (Bandura, 1989b, p.2). “Social

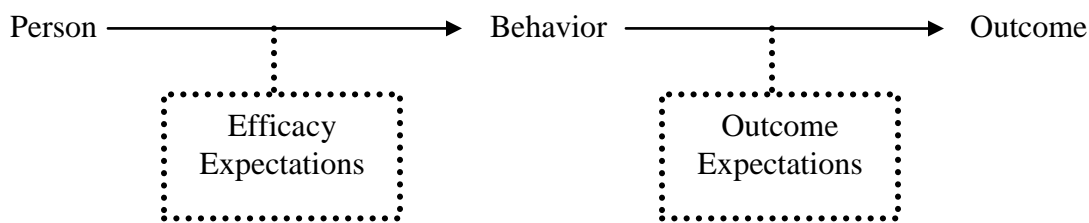
cognitive theory favors a model of causation involving triadic reciprocal determinism (p.2). Reciprocal determinism consists of three factors that interact simultaneously. The reciprocal interaction includes environment, personal factors, and behavior but it does not mean one's influence on another is of equal strength (Bandura, 1989a). Bandura observed that some influences were stronger than others and that they may not take place concurrently (1989a). Actually, the three components' interactions will differ depending on the individuals, the specific behaviors that are being observed, and the situation in which the behavior is being observed (Bandura, 1989a).



*Figure 1.* Reciprocal Determinism (Bandura, 1986)

Self efficacy is a person's belief regarding "their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, p.73). This concept looks at the individual and their central role for evaluating the changes needed in situations that pose fearful or avoidant behavior (Bandura, 1977). Bandura believed that a person's perception of "self-efficacy

influenced the choice of behavioral settings” and what people feared and most likely avoided were threatening situations that exceeded their coping skills (Bandura, 1977, p.193). This fear and avoidance had a direct influence on the activities a person chose to participate in and the settings they wanted to be in (Bandura, 1977).



*Figure 2.* Self Efficacy (Bandura, 1977, p. 193)

### **History of Public Single-Sex Schools**

For over a decade, there has been a drastic increase in single-sex public education in the United States (Weil, 2008), but it is more common and popular internationally in such areas as Australia, Belgium, South Africa, New Zealand, and the United Kingdom (Moore, Piper, & Schaefer, 1993). “The United States has had a long-standing of tradition public schools that educated girls and boys together” (Bigler & Signorella, 2011, p.659). Factors such as financial prohibition and feminist movements have influenced the United States to continue with this tradition of coeducation and as a result, the private schools were the only ones that were offering single-sex education (Bigler & Signorella, 2011). Title IX of the Education Act Amendments of 1972 also placed limitations and restrictions on education because of the statement, “No person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be

subjected to discrimination under any education program or activity receiving federal financial assistance” (U.S. Department of Labor, 1972). In 2006, there were revisions made to Title IX in connection with No Child Left Behind Act which endorsed federal funding for innovative educational programs including single-sex schools and programs offered single-sex classes within coeducational schools (Nondiscrimination, 2006). With this amendment of regulations, the U.S. Department of Education intended to explain in detail how single-sex education could be provided with Title IX with the following memo:

The new regulations provide for a new exception to the general prohibition against single single-sex classes and extracurricular activities. Under the former regulations, single-sex classes were generally prohibited in a coeducational school with specific limited exceptions, such as for sex education classes and contact sports in physical education classes. The new regulations retain the specific exceptions from the former regulations and add a new exception, which permits a recipient to provide single-sex nonvocational classes and extracurricular activities based on the recipient’s “important objective.” Each single-sex class or extracurricular activity must be based on the recipient’s important objective (Monroe, 2007, p.1).

The public single-sex schooling has had development in the past decade in the United States (Bigler & Signorella, 2011). This growth of single-sex education in the public sector has been influenced by several factors including numerous publications and books highlighting the fact that females are being adversely affected by education in a coed environment (Bigler & Signorella, 2011). Bigler and Signorella found that with this

information surfacing, many female political leaders and influential people viewed all girl schools as “safe havens from the sexism of coeducational classrooms” (2001, p.661). Another factor supporting the influx of single-sex education was the highly publicized failure of the American students in comparison to the successful overall achievement of international students (Dillon, 2010). This phenomenon has plagued the presidential leaders such as Reagan, Bush and Obama who have vowed to come up with a reformation to the struggling education system (Jackson, 2009). The third factor that influenced the reformation of the education system was the “development of sophisticated neuroimaging techniques within the field of psychology, which has spurred claims of major differences between men’s and women’s brains” (Bigler & Signorella, 2011, p.661).

The National Association for Single-Sex Public Education (NASSPE) has seen increases in single-sex schools and classes within a coed school (NASSPE, 2011). From 2002 with twelve schools listing as single-sex to an anticipated 110 in 2011 and coed schools offering single-sex classes increasing from 51 in 2003 to 405 in 2011, NASSPE has been tracking the increase of the popular uprising in education reform. (NASSPE, 2011).

### **Single-Sex versus Coeducational Education**

The vast majority of public education has been delivered through a coeducational setting for nearly all of our nation’s history which has been the norm for primary and secondary schools (RMC Research Corporation, 2008). The United States Department of Education found that methods of instruction have been scrutinized in order to find the best overall practices that will render the greatest results; however, these methods may be

more effective with one gender than the other (2008). A general feeling is that “coeducational schools are ‘bad’ for girls and ‘good’ for boys” (Jackson & Smith, 2000, p. 410).

Single-sex education is becoming a clearer option to “American Association of University of Women and the Feminist Majority Foundation and David Sadker from American University” because they feel that females are suffering in coeducational classes (Bracey, 2006, p.52). AAUW has reviewed the literary research and decided that the qualities that existed in single-sex classes needed to exist in any classroom in order to be more effective (Bracey, 2006). Another supportive idea that favors single-sex education is that although some favor coeducation as the better choice, there is the idea that female students do not receive the needed attention and support that could be offered in a single-sex classroom (Bracey, 2006). It is more common that teachers, unaware of their behavior, pay attention to males and are more helpful to them (Bracey, 2006). Single-sex education can also offer the opportunity for boys and girls to learn differently and maximize learning (Bracey, 2006). Leonard Sax, “founder of the National Associations for Single Sex Public Educations lays out differences in the ways that boys and girls see, hear and draw” (Bracey, 2006).

There are overwhelming benefits for single-sex schools for both sexes (Kelly, 1996). Kelly found that girls demonstrate higher achievement in foreign languages, mathematics, and language arts as well as history (1996). Although the results are not as overwhelming for the boys’ achievement, they are still significant in language arts and foreign languages (Kelly, 1996). Also, there is evidence that single-sex schools offer subjects that are customarily viewed as gender inappropriate (Jackson & Smith, 2000).



For example, in a coeducational school, girls typically chose English as a higher level class but in a single-sex school, girls were more likely to choose a higher level of mathematics (Jackson & Smith, 2000). Over 15 states are experimenting with offering single-sex education to students whether is it only after-school workshops focusing on math and designed for girls or reading clubs for boys or separate academic classes for content areas such as math and science (Zwerling, 2001).

Aside from academics, researchers have looked at students' self esteem within a single-sex environment. Cairns found that the single-sex atmosphere fostered an advantage associated with self-esteem as well as locus of control (Cairns, 1990). Along with self perceptions, gender stereotyping has been a major factor within a coeducational setting and it has decreased in single-sex classrooms (RMC Research, 2008). Valerie Lee and Helen Marks researched sex stereotyping and found that this occurred at the same frequency in a coeducational setting as it did in a single-sex setting, leading them to conclude that separation of peers had little impact on labeled gender roles (Lee & Marks, 1994). On the contrary, there are many that feel coeducation offers students diversity, a more realistic view of what the real-world will be like in relevance to social interaction, and better preparation for opposite sex interaction (Dale, 1969).

There is a growing trend to offer single-sex education in public schools. Nationwide, 37 states are offering single-sex education in over 400 public schools in the United States (McNeil, 2008). Such schools that are offering students the choice of attending single-sex classes for academic content is one like Hudson Middle School in upstate New York (Spielhagen, 2006). With this choice and the ability to still interact with the opposite sex for lunch and nonacademic classes, 75% of the student population

at Hudson Middle School have chosen to take single-sex classes (Spielhagen, 2006). The students' feedback was that this setting was "most effective when classes are designed to address students' developmental needs" (Spielhagen, 2006, p. 68). This setting was more appealing to younger students, but as they got older the students desired coeducational classes (Spielhagen, 2006). Students stress that it is important to feel "emotional, intellectual, and physical safety," which was a problem in the boys' classes due to bullying but was solved with reconfiguration of boys in each class (Spielhagen, 2006, p.72).

The principal of Kingstree Junior High school, located in a small, rural town in South Carolina, separated genders in classes as a desperate attempt to improve test scores and drastically reduce discipline problems (McNeil, 2008). This middle school is currently one of 97 schools embracing single-gender education in South Carolina which is spreading in many areas including poor and wealthy and urban and suburban districts (McNeil, 2008). In 2008, Jim Rex, State Superintendent of Education, reported that 25% of public schools in South Carolina could possibly offer single-sex education, meaning over 15,000 students could have the opportunity for this type of program (McNeil, 2008). Rex believes this option is low cost and can be a strategy that could make a difference now rather than waiting for vouchers or waivers to be approved and issued to allow students to attend other schools in the district (McNeil, 2008).

Another school in South Carolina, Killian Elementary School located in Columbia has been offering single-gender classes to 4<sup>th</sup> and 5<sup>th</sup> graders (McNeil, 2008). McNeil reported that the school's discipline reports dropped drastically with boys since they began the separation of genders in 2006 (2008). During the 2006-2007 school year, there

were 14 suspensions with the males and in 2007-2008, only two (McNeil, 2008). The teachers also noticed differences among the groups (McNeil, 2008). McNeil reported that in mathematics, due to power struggles, boys worked in partners whereas the girls could work in groups (2008).

Single-sex education is believed to be a possibility to make better achievement gains but it is the structure of the school that has the greater influence (Hoffman, Badgett, & Park, 2008). In fact, “studies that have found positive achievement outcomes attributable to the single-sex environment have all dealt with single-sex schools rather than classes” (Haag, 2000, p. 3). There has been evidence to support educational gain in single-sex environment as compared to coeducational instruction, but the bulk of studies, specifically those in the United States, have compared single-sex religious or private schools with public coeducational schools (Marsh, 1989 and Riordan, 1985).

Recently, a meta-analysis was conducted concerning the effects of single-sex education compared to coeducational education with almost half comparing public schools to private schools and a third were comparison between public schools (DOE, 2005). There have been methods to exclude preexisting differences, but these may not be as adequate to control for natural differences (DOE, 2005). Mael and his colleagues conducting the meta-analysis for the U.S. Department of Education believing these problems can contradict or complicate the findings that could benefit or demote single-sex education (2005). The results of the studies found that the academic gains for single-sex education was 35%, two percent for coeducation, 53% no difference, and 10% was mixed results (DOE, 2005). For post secondary performances, 75% of the students

showed no difference among coeducational instruction and single-sex instruction with only 25% showing the instruction had some effectiveness (DOE, 2005).

Regardless of the above results, there is overwhelming evidence that supports single-sex education over coeducation instruction with better benefits to students' academic achievements (Robinson & Gillibrand, 2004). Researchers have associated single-sex education with positive attitudes, specifically with academics, and an increase in academics (Marsh, 1989).

Educators' perceptions of the environment of the classrooms are also very important when considering which would be better. Teachers have offered their opinions pertaining to single-sex classrooms and these have been very positive (Martino et al., 2005). Educators have expressed that they have rather enjoyed teaching classrooms with only girls, giving them the opportunity to address issues such as academic risk-taking and encourage their engagement in the content (Parker & Rennie, 2002). Parker and Rennie interviewed educators in Australia and confirmed that females benefited from single-sex classes partly due to the fact that girls were able to be free from the criticism from the males, especially concerning their appearance (2002).

Regarding the male classes, educators had different perceptions of the all boy classrooms (Hoffman et al., 2008). Educators "tended to enjoy the casual nature of interactions with boys and the opportunity to build relationships" (Hoffman et al., 2008). The male single-sex classes enabled teachers to focus on weaknesses boys tended to have, including organizational skills and writing (Parker & Rennie, 2002). Problems surfaced with managing behavior in all male classes and it was believed the presence of females in the classroom muted the rowdiness (Jackson & Smith, 2000).

## **Developmental Differences between Genders**

Michael Gurian has studied the differences between genders, specifically focusing on neuro-biology and brain research. He studied the developmental differences in genders through the stages of growth and found remarkable discrepancies between the male and female. During pre-birth, the male fetus develops testosterone, is typically more active, develops the cortex slower; whereas, a female fetus develops estrogen, is less active in the womb, and develops the cortex faster (Gurian, 2001).

In order to further understand the differences between male and female performance, one has to look at the gestational developmental differences that exist between the genders. One of the most notable differences that Gurian found between the genders during the gestational development was the size of the corpus callosum in the brain which was much larger in the female (2001). This is important is because the brain is divided into two hemispheres or halves, referred to as the left and right hemisphere or left and right brain (MacNeilage, Rogers, & Vallortigaro, 2009). The hemispheres communicate with one another through commissural fibers, “nerve fibers that cross the midline and interconnect similar regions of the cerebral hemisphere” (Rourke, 1995, p. 21). The Corpus Callosum fibers form the connection of the “myelinated fibers which form both the floor of the hemispheric fissure and much of the lateral ventricles” (Rourke, 1995, p. 28). The fibers allow for better “cross-talk between the hemispheres of the brain” as well as “quicker development in the prefrontal lobes” (Gurian, 2001, p. 27). This affects the executive decision making and sensory processing (Gurian, 2001).

Gurian continued to study the differences in the genders during infancy and found notable variations. With the infant male, he typically preferred structural toys, was

easily angered, exhibited more activity, and was less bothered by shrill noises (Gurian, 2001). In contrast, the female infant preferred cuddly toys, was easily saddened, demonstrated longer interest in toys but was less active, and was less tolerant to loud noises (Gurian, 2001). During the toddler stage, Gurian discovered the differences continued and became more evident. In the males, typically the first word was later than a female, he was more physically impulsive and less able to multitask, and had better auditory memory (Gurian, 2001). The female, however, had stronger vocabulary than boys, was better at visual memory, and was better at multitasking (Gurian, 2001).

At the preschool and kindergarten stage, the male brain was one-directional where the female brain cross-talked between the hemispheres (Gurian, 2001). Gurian found that males at this age have a shorter attention span, express emotions through action, and are more interested in objects than people (2001). On the other hand, females expressed emotion through words, exhibited sensitivity toward people, and had fewer speech problems (Gurian, 2001).

In elementary years, the differences progressed and became more evident. In the early years of elementary school, males' "hypothalamus functions to keep hormonal levels even" where as the females' functions fluctuate (Gurian, 2001, p. 36). The hypothalamus controls most of the functional and behavioral activities including body temperature, expressions of emotion, and regulations of sleep (Driessler & Baldock, 2010). Gurian also found males were mathematical, had a 95% chance of being considered hyperactive, and were "able to separate emotion from reason" (2001, p.36). Females at this age read earlier and better, demonstrated strength in verbal ability including grammar and vocabulary, and had superior hearing (Gurian, 2001). In the later

years of elementary school, Gurian found that males continued to show strength in mathematics but were more likely to need remedial reading whereas females needed help to solve math problems. During this same time, both genders began to express hormone increases, but the females had puberty changes earlier than the opposite sex (Gurian, 2001).

During the middle school years, there was an increase in hormone changes in both genders. In the male population, the testosterone hormone increases which is an aggression-inducing chemical (Gurian, 2001). Gurian found that the “amount of male hormone relates directly to success at traditional male tasks” and the same is true with estrogen in the female population (2001, p.37). The males were also 50% more likely to be retained a grade in school during this time than the opposite sex (Gurian, 2001).

Gurian also found a substantial number of differences between the male and female population during the high school years. He observed that males concentrated more on career considerations, whereas females were concentrating on intimate personal relationships, which attributed to a focus on appearance and social acceptance based on beauty and friendships (2001). Males had a dramatic increase in their IQ scores between the ages of fourteen and sixteen; however, the females dropped off in middle school and did not rise until high school (Gurian, 2001). The matriculation rate is also higher for females than males (Gurian, 2001).

There are differences in the brain from the naked eye, revealed with MRIs (Good et al., 2001). Good and her colleagues discovered that male brains were asymmetrical between the two hemispheres when split down the center, whereas females were more symmetrical (2001). The MRIs revealed the female brains had more grey matter as

opposed to white matter, with a higher concentration in the newer part of the brain known as the neocortex (Good et al., 2001). Good found that the male brains revealed the opposite in the MRIs with more white matter than grey with the majority of it in the older areas of the brain, also known as the entorhinal cortex (2001).

Through studies, the organization of the brain has also revealed differences between the genders (Frederikse, Lu, Aylward, Barta, & Peralson, 1999). Frederikse along with her colleagues discovered male brains were asymmetric opposed to female brains, confirming Good's findings (1999). Frederikse reported that there were sizeable sex differences in the higher association cortex, which was responsible for complex mental operations (1999). Also, there were differences in the "higher-order multimodal convergence integrating all aspects of mental function" which contained cognitive and emotional experiences (Frederikse et al., 1999, p.896)

Not only are there differences in the structure of the brain, there are differences in the process of information when listening, reading, or during emotional experiences. Joseph Lurito, a neuro-radiologist, conducted a study where he had volunteers of both genders listen to a novel by John Grisham (Phillips, Lowe, Lurinto, Dzemidzic, & Matthews, 2001). During the novel, he mapped the areas of the brain with an MRI and tracked what areas of the brain lit up (Phillips et al., 2001). Lurito discovered that women used both hemispheres to process language; men only used the left hemisphere (Phillips et al., 2001).

Research on the development of a boys' and girls' brain has revealed that hormones have an influence on the way we learn (Tyre, 2006). She began with scientists starting with the fetus, investigating the male and female brains. Tyre found that during



the “first trimester, a boy’s fetus begins producing male sex hormones that bathe his brains in testosterone for the rest of his gestation” (2006). Tyre also found that prenatal exposure to the male hormones has a direct effect on the way children play. This could impact girls, specifically ones with mothers that have “higher levels of testosterone during pregnancy” (Tyre, 2006, p. 3). She concluded that female fetuses exposed to this are “more likely to prefer playing with trucks than playing with dolls”. Adversely, when boys are exposed to female hormones, “their spatial skills dropped but the verbal skills improved” (Tyre, 2006, p.3).

Tyre has also looked at the development of the brain, comparing and contrasting boys with girls. In the brain, the scientists looked at the prefrontal cortex, the “knobby region of the brain directly behind the forehead that is believed to help humans organize complex thoughts, control their impulses and understands the consequences of their own behavior” (Tyre, 2006, p.4). Dr. Jay Giedd, a “child and adolescent psychiatrist and chief of Brain Imaging in the Child Psychiatry Branch at the National Institute of Mental Health” (Wallis, 2004) conducted brain scans on girls and found that this region of the brain reaches the maximum thickness at no later than the age of eleven, and continues to mature over the next ten years (Tyre, 2006). Dr. Giedd found boys’ prefrontal cortexes to be delayed by 18 months (Tyre, 2006).

Dr. Deborah Yurgelum-Todd, a Harvard Neuropsychologist, conducted fMRIs, functional magnetic resonance imaging, instead of MRIs (Wallis, 2004). The difference is that MRIs reveals brain structure while “fMRI actually shows brain activity while subjects are doing assigned tasks” (Wallis, 2004, p.6). She looked at traces of activity in the brain and “tested the activity pattern in the prefrontal cortex of children between ages

eleven and 18” (Tyre, 2006, p. 4). She found that teenage girls process data and information faster and are more accurate; however, this gain is temporary (Tyre, 2006). By the age of 18, boys and girls showed similar processing speeds with the same levels of accuracy (Tyre, 2006).

When looking at creating single gender classrooms, David Kommer looked at three specific areas of difficulty: brain theory, social differences, and appropriate classroom environment (2009). In the brain theory, he found that it was a consensus that boys and girls rationalize differently due to the various structures of the brain according to the gender. Kommer discovered the females’ left and right hemispheres have a greater connection as compared to the males, allowing girls to switch back and forth quickly and enabling them to multi-task easily. Michael Gurian, a family therapist and lecturer on brain-based research, found the myelin, a coating that transmits electrical impulses through the nervous system, increases as a person grows and occurs earlier in females than in males (Gurian, 2001).

Gurian also studied the developmental and structural differences between the boys’ and girls’ brains and found that female brains mature earlier than male brains (2001). He looked at the linguistic component of this development reaching a conclusion that, in fact, girls acquire complex verbal skills at a much faster rate, almost a year earlier than boys (2001). While studied this, Gurain discovered that the structural difference was the corpus callosum which was a “bundle of nerves that connects the right and left hemispheres; females were up to 20% larger than males” allowing them to have a better crosswalk between hemispheres (2001, p.27).

As well as linguistic progression, Gurain was able to conclude that girls have more development in their prefrontal lobes, occipital lobes where sensory processing occurs (2001). This means that females are able to utilize their senses better than males and take in more data with this. This inevitably enables girls to control impulse behavior and allow them to self-monitor emotions and outbreaks better than the opposite sex (Gurain, 2001). A difference in serotonin was found between boys and girls, indicating that males have less secretion of this chemical allowing them to be more impulsive and fidgety (Gurain, 2001). Also, Gurain discovered the females were more empathic to others needs due to the higher secretion of a chemical known as oxytocin (2001).

Researchers have found that in a preschool setting, girls often have superior verbal skills when compared to boys (Kommer, 2009). Also, in general, he determined that girls have better hearing when compared to their male counterparts. As the researcher studied the children, he derived that boys mainly use only the right side of the brain, making them spatially aware and enhancing their advantages in mathematics. Kommer concluded that since girls utilize both sides of their brain, they are more likely to advance in literacy.

### **Boys Benefits and Challenges**

When examining the National Consortium of Examination Results (NCER), it was found that boys do improve in two out of three of the academic subjects in a single-sex school, specifically an obvious difference in English and foreign languages (Jackson & Smith, 2000). During the Hudson Middle School trial of single-sex classes, “bullying reared its head among the seventh and eighth grade boys” (Spielhagen, 2006, p.72). It seemed that the boys tried to act tougher in front of the female peers and as a result, other

students were bullied (Spielhagan, 2006). Young men opted for the same sex classes thinking that the bullying would cease, but it seemed that mistreatment became more prominent in the all-boys class (Spielhagan). Other students had different views of the single-sex classes. A sixth grade boy at Hudson Middle School said “that he felt ‘more challenged’ in his all-boy classes because he enjoyed the competition with other boys” (Spielhagan, 2006, p. 71).

When studying how males react to single-sex environments, it has been reported that their perceptions are varied (Hoffman et al., 2008). Boys reported that they felt they received encouragement and felt they could respond, even to personal issues, without the mockery of the opposite sex (Hoffman et al., 2008). Unrelated to academics, male students enjoyed single-sex classes because they felt they could talk about athletics more openly (Martino, Mills, & Lindgard, 2005). On the other hand, males also enjoyed coeducation classes because they felt it was better to work females (Parker & Rennie, 2002). The boys also observed better behavior with the males when put in a classroom with females (Jackson & Smith, 2000).

During a study in Mississippi where a middle school piloted single-sex education as an option with their sixth graders, the science/computer teacher reported that the male single-sex group was more active than the single-sex females or coed group, and the achievement of this particular group was lower than the other two groups (Laster, 2004). Laster reported that the science/computer teacher had to do more redirection for the single-sex male group in order to keep them on task (2004).

The state of South Carolina has many schools that are implementing single-sex classes in the public schools. Teachers have reported discipline and instruction with boys

are more difficult than girls so tailoring the instruction to their interests are very critical (McNeil, 2008). One fifth grade teacher described boys as more active, always wanting to be mobile (McNeil, 2008). Boys in these classes reported that they enjoyed being away from girls and separated from their drama (McNeil, 2008).

### **Girls Benefits and Challenges**

Single-sex education can offer girls “an environment free of male domination” (Hoffman et al., 2008, p. 15). Research has found that females are at a disadvantage in a coed classroom because males tend to dominate and control the classroom culture, which has been the case from preschool all the way through high school (Hoffman et al., 2008). Female students have reported on numerous occasions that they feel males “harass them and dictated the flow of class,” specifically in secondary schools (Hoffman et al., 2008, p.15).

When examining the NCER, it was found that girls, on average, would do better in three out of four of the academic subjects in a single-sex school, specifically a marginal difference in content areas such as foreign language, sciences, and mathematics (Jackson & Smith, 2000). Another observation was made in a single-sex classroom of girls; it was found that females created a supportive atmosphere allowing students to engage in open conversation and discussions, which was drastically different from the coeducation classrooms (Jackson & Smith, 2000) due to the evidence that supports boys tend to monopolize the attention of the educator, physically and mentally (Mahony, 1985).

During a study conducted at a middle school in Mississippi where students were divided into single-sex and coed groups, the teachers reported that in the female single-

sex math/social studies classes they were “neat, organized, well-mannered, hard working, and seeming to bring out the best in each other” (Laster, 2004, p. 60). Laster reported that the teachers at this school during this study recommended that single-sex education continue due to the improvements on achievement and the rise in test scores (2004). In the science/computer classes, the teachers reported the females in the single-sex groups were “more open to ask questions, determined to make the highest grade on all tests, more motivated, and loving the challenge of the subject areas” (Laster, 2004, p.60).

At Hudson Middle School, the girls found benefits to the single-sex classes that promoted greater concentration (Spielhagen, 2006). These girls also “became more assertive about their interest in boys, expressed a feeling of bonding with their female classmates and enjoyed discussing issues about boys together” (Spielhagen, 2006, p. 72). A sixth grade girl at Hudson emphasized the intellectual safety she found in single-sex classes as well as freedom (Spielhagen, 2006, p. 71). Girls split their likes and dislikes with single-sex classes. Some students enjoyed the benefits of same sex classes, remarking that it provided better concentration, improving grades, and less fear of interaction (Spielhagen, 2006). Spielhagen found that other females complained that they were forced to take the classes because of their parents but said that the benefits outweighed the consequences (2006).

The state of South Carolina has many schools implementing single-sex classes within the public schools. At Beech Hill Elementary School in Charleston, South Carolina, James Hearn, a teacher of fifth grade students has learned many strategies when teaching single-gender classes (McNeil, 2008). Mr. Hearn recognized the female students are more traditional, interested in family relationships so he tailored his

instruction to make it more personal (McNeil, 2008). In Kingstree Middle school, a young lady in a single-sex math class recognized that it was easy to participate and speak up more (McNeil, 2008).

Female responses to single-sex education are “more consistent and optimistic than those of boys” (Hoffman, et al., 2008, p.16). A classroom environment scale was administered to Catholic high school students and was evaluated and the results revealed that girls felt that single-sex classes were more organized and orderly (Hoffman, et al., 2008). Hoffman also reported that girls “felt single-sex classes were less restrictive, more engaging, more interactive, and more methodical” (2008, p. 16). Females felt this classroom setup created less disruption to the learning environment and offered more support with a friendlier setting that encouraged participation rather than ridicule or teasing (Parker & Rennie, 2002). Coeducational classrooms made females feel disadvantaged and single-sex classrooms ceased the feeling of embarrassment of talking in front of classmates and asking or answering questions (Jackson & Smith, 2000).

### **Single-Sex versus Coeducational Studies and Results**

Brain research on girls and boys has found that there is a significant difference in their brain development (Laster, 2004). In fact, Laster reported females’ brains “have found to be three to four years ahead of boys from age seven to 22” (2004, p. 59). With this research surfacing and the push for increasing student achievement on limited budgets, a solution with little or no cost would be to offer gender specific classes to public schools (Laster, 2004).

A study using the Mississippi Curriculum Test (MCT) that was administered annually during the month of May observed and compared the results of groups of single-

sex groups to coed groups in content areas such as reading, language arts, and math during the 2003 academic school year (Laster, 2004). The design of the study wanted to observe “differences in boys’ and girls’ achievement when educated in single-sex or coed classes” (Laster, 2004, p.60). The study divided students into groups using a list that was computer generated with diverse representation but without special education students: 33 girls, 33 boys and a coed group of 33 sixth-grade boys and girls (Laster, 2004, p.60). The groups rotated through three separate teachers; “one teaching math/social studies, one science and computer, and one English/reading” (Laster, 2004, p.60). The students were able to mingle and interact with opposite sex members during nonacademic activities such as library, band, physical education, and/or music (Laster, 2004).

Laster reported that for there were no significant differences in the female scores on the reading portion of the test (2004). Both the single-sex and coed female group scored 100% on the reading portion of the test (Laster, 2004). For the male students’ performance on the reading portion of the test, there were differences (Laster, 2004). Laster reported that for the male single-sex group, 97% were at advanced and proficient levels with three percent at minimal and basic levels; whereas the male coed group only had 85% at advanced and proficient levels with 15% at minimal and basic levels (Laster, 2004).

For the language arts portion of the MCT, the females in the single-sex group had 87% placed in the advance or proficient levels with 12% falling in minimal and basic levels; whereas the coed groups had 84% placed in the advance or proficient levels with 16% placing in minimal and basic levels (Laster, 2004). This comparison of data rendered a slight difference among the two groups (Laster, 2004). In the same content



area, Laster reported that 88% of the males in the single-sex group scored in advanced or proficient levels with 12% in basic or minimal levels; whereas only 70% of the males in the coed group scored in advanced or proficient levels with 30% placing in minimal and basic levels (2004). This comparison showed a fairly large difference between the two groups (Laster, 2004).

For the math portion of the MCT, the female single-sex groups scored 94% in the advanced and proficient levels with six percent in minimal and basic levels (Laster, 2004). Laster reported that the females in the coed group scored 92% placed in advanced and proficient levels and eight percent in minimal and basic levels (2004). This data resulted in little difference between the two groups. For the male students in the single-sex classes, 85% placed at advanced and proficient levels with 12% falling in basic or minimal levels (Laster, 2004). For the males in the coed groups, Laster reported 90% hit the advanced or proficient levels with 10% falling into minimal and basic levels (2004). With regards to the male students in math, she reported that the coed groups outscored the single-sex groups (Laster, 2004).

A study was conducted in England of a school that offered single-sex teaching as the norm in a coeducational school which began in the early 70s (Younger & Warrington, 2002). Due to the longevity of the implementation of single-sex instruction, Younger and Warrington were able to “discuss the long-term effectiveness” of such instruction in the study (Younger & Warrington, 2002, p. 353). Younger and Warrington’s study was “an analysis of achievement levels in the school at 16+ over the 12-year period 1988-99 since the introduction of GCSE examination” (Younger & Warrington, 2002, p. 354). The school is unique in the fact that it has always educated boys and girls in single-sex groups

in years seven to nine, and have even had tutorial groups broken apart according to gender (Younger & Warrington, 2002).

The findings of the study supported single-sex within this particular school was “one factor which appears to contribute strongly to the high achievement levels of girls and boys and to the continuing rise of those achievement levels through time” (Younger & Warrington, 2002, p. 370). The data revealed the “percentage of boys within a year group achieving five A-C grades has increased from an average base of 34.7% in the three-year period 1988-90 to 59%” (Younger and Warrington, 2002, p. 356). This was a “proportional increase of 70% against the base year”; the national figure was 38.2% (Younger and Warrington, 2002, p. 370). During the same period, female students achieving the similar grades of five A-C “increased from 39.9% to 68%” (Younger and Warrington, 2002, p.357). This was a increase of 70.4% compared to the base year and drastically higher than the national figure of 43.9% (Younger and Warrington, 2002).

Younger and Warrington, through observations, examination of classroom interactions, along with interviews with faculty and students, confirm and support the single-sex classes as a better learning environment for girls and boys (2002). Younger did note that this was not a solution to fix issues of underachievement of boys (2002). Also, they wanted to reiterate that without proper staff development to accurately prepare educators of teaching and learning strategies, this method would be ineffective (Younger & Warrington, 2002).

The interest in single-sex education has piqued curiosity in educators in recent years, especially since “the *No Child Left Behind of 2001* authorized school districts to use local or innovative program funds to offer single-sex schools and classrooms

consistent with applicable laws” (U.S. DOE, 2008, p. ix). Additionally, Title IX was amended by the U.S. Department of Education allowing flexibility to schools to implement programs for single-sex education (U.S. DOE, 2008). With the revisions and amendments, the U.S. Department of Education anticipated an increase in public schools offering single-sex education and “contracted with RMC Research Corporation to conduct a descriptive study of existing single-sex public schools” (U.S. DOE, 2008, p. ix). The study evaluated questions covering student achievement in single-sex schools, outcomes, characteristics of schools offering single-sex education, benefits and disadvantages related with single-sex schooling, and studies that would advance the knowledge base with single-sex education (U.S. DOE, 2008).

The results of the study rendered mixed results with 53% null, not favoring coed over single-sex schooling, ten percent with mixed results, 35% in favor of single-sex school and only two percent for coed (U.S. DOE, 2008). During the visits to site schools, observers noted that there was little evidence to support modifications to the curricula to address certain needs for either gender (U.S. DOE, 2008). The observations reported that there were more positive academic and classroom behaviors among the students and teachers in the single-sex schools as opposed to the coed schools which were also supported by comments by administrators and teachers that single-sex classes have fewer distractions and improve students’ achievement (U.S. DOE, 2008). The educators continued to support single-sex schooling but favored the benefits of girls over boys because females had better peer interactions, behaviors both academically and emotionally, along with better order and control (U.S. DOE, 2008). Regarding behavior issues, high school teachers of single-sex classes rated student behavior less serious than

high school teachers of coed classes, but the opposite was true in middle school (U.S. DOE, 2008). During the study, observers found students in single-sex schools had more positive student interactions, displayed a greater respect for administrators and teachers, less classroom interruptions, and were better role models for other students (U.S. DOE, 2008).

The American Institute for Research prepared a systematic review for the U.S. Department of Education of single-sex versus coeducation schooling. In this review, there were many studies that were used for overall academic progress as well as specific content progress. With nine studies conducted for all academic progress, the results for all content achievement ranged from 67% supporting single-sex education, 22% rendering null results, and 11% supporting coeducation (U.S.DOE, 2005). Among these findings, the females' achievements were strongest in single-sex environments, yielding 63% gains as oppose to only 25% in coeducation (U.S. DOE, 2005). For the males, it was along the same lines showing more achievement in single-sex environment with 75% gains (U.S. DOE, 2005).

The studies ranged from private and religious high schools to public elementary schools. The studies that were used to distinguish whether there were gains in all-academic areas were mainly high schools. Among all these studies, one conducted in Australia compared a single-sex Catholic high school to a coeducational public high school and found that there were significant differences with the female scores in all-subject achievement test scores (Carpenter and Hayden, 1987). Another study comparing seniors in a single-sex Catholic school and a coeducational Catholic school found no significant difference in the overall achievement scores (Marsh, 1989). Across England,

a study compared single-sex and coeducational high schools and found no significant differences with the male students but some significant differences with the females, especially those with lower levels of academic achievements (Spielhofer, O'Donnell, Benton, Schagen, & Schagen, 2002). Another study conducted in New Zealand among single-sex and coeducational high schools found that there were significant differences with both males and females (Woodward, Fergusson, & Horwood, 1999).

The U.S. Department of Education had the research conducted for individual academic content areas. For mathematic achievement test scores, the studies were conducted in 14 high schools. The results showed that with all students, 56% had null results, 22% favored single-sex, 22% had mixed results, and 0% favored coeducation (U.S. DOE, 2005). When looking at only the female population for mathematics, 73% had null results, 27% favored single-sex, and 0% favored coeducation (U.S. DOE, 2005). The males had different results showing only 44% with null, 33% favoring single-sex, and 23% favoring coeducation (U.S. DOE, 2005).

Along with mathematics, other content areas were reviewed. In science achievement, ten studies in high schools found that 62% had null results, 25% supported single-sex, and 13% were mixed (U.S. DOE, 2005). For the females in science, 60% rendered null results and 40% favored single-sex (U.S. DOE, 2005). The males had 33% favoring single-sex and 67% produced null results (U.S. DOE, 2005).

With the language arts achievement, including reading, phonics, and writing, there were ten studies among high schools. The results found that overall, 70% had null results and 30% favored single-sex (U.S. DOE, 2005). The females showed only 12.5% favoring single-sex, another 12.5% with mixed results, and 75% with null results (U.S.

DOE, 2005). The males had 33% favoring single-sex, only 17% with mixed results, and 50% showing null results (U.S. DOE, 2005).

In the area of social studies, there was only one study that was conducted investigating the impact of single-sex compared to coeducational instruction and it was in a high school (U.S. DOE, 2005). The results favored overall a single-sex environment. The female students performed better in the single-sex school and the male students had null results (U.S. DOE, 2005). The reports confirmed with previous studies that there was little to no evidence that either treatment benefited or harmed the students' performances (U.S. DOE, 2005).

One of the most famous pilots of single-sex education in public schools was during the late 1990s in California (Bigler & Signorella, 2011). The Bush administration had lessened the restrictions on Title IX as part of the plan to better education and renewed interests in single-sex education (Hubbard & Datnow, 2005). Governor Pete Wilson of California "drafted legislation in 1997 that resulted in the opening of 12 single-gender public academies" offering students the option of single-gender education as a way to stimulate competition and present opportunities to students that felt restricted and needed another approach to the learning environment (Hubbard & Datnow, 2005, p.1). The intention that Wilson had was to design schools that focus on goals specific to the gender attending; math and science for females, and males' focusing on at-risk behaviors that would jeopardize completion of school (Datnow, Hubbard, & Woody, 2001). In 2001, only two of the 12 schools were still in operation and then the remaining two changed and are currently offering coeducation to students (Zwerling, 2001).

Datnow and her colleagues investigated California's single-gender pilot program for duration of three years, involving over 300 students from middle and high schools, including educators and parents in the six districts (Zwerling, 2001). There were positive and negative issues and factors that surfaced during the study. The positive experiences from this investigation were "the single-sex setting, financial support from the state, and the presence of caring, proactive teachers" (Hubbard & Datnow, 2005, p.127-128). Hubbard and Datnow documented that administrators sought resources and supported the curriculum although nontraditional to support an academic, personal, and practical environment (2005).

Many negative connotations are associated with gender specific schooling. One specifically is the traditional gender stereotypes that often reinforced in single-gender academies; boys were taught more regimented and traditionally whereas the girls were taught in nurtured and open environments (Zwerling, 2001). Zwerling noted during the study that there were mixed messages toward students regarding gender (Zwerling, 2001). For example, girls had restrictions on behavior and emphasis on clothing and appearance, whereas the boys were guided to assume they were the wage earners and needed to be strong, as they were emotionally stronger than females (Zwerling, 2001). Additionally, creating single-sex academies on some campuses caused a dichotomy among genders, continuing the belief that females were good and males were bad (Zwerling, 2001). Although there were less classroom distractions in the single-gender classes, Zwerling noted that harassment and teasing continued in coeducational settings where females were touched and received unwanted comments (2001).

## **Summary**

After reviewing the literature, the purpose of this study is to assess if the rise in offering single-sex instruction in education is beneficial to students to be successful. With the reformation to the education laws recently and the increase in concern of the success of our students, the implementation of new programs, curriculum, and instruction design are increasing. Single-sex versus coeducation instruction has been debated for the past few years as to whether one is more effective than the other. Organizations such as the AAUW favor single-sex education for female students. The educational research shows benefits for both males and females in specific areas for single-sex education.

Several public schools are jumping at the opportunity to implement single-sex instruction in a coed environment. With this increase in popularity, there have been many studies to compare the effectiveness of single gender instruction. The problem comes from comparing private or religious schools to public schools and determining if these are equivalent. Future studies are needed to assess the differences in the instructional environment and compare similar schools to evaluate the effectiveness.



## CHAPTER THREE: METHODOLOGY

### Introduction

The public education system as it currently stands is, for the most part, a coed based institution (RMC Research, 2008). Given that the education system is coed based, speculation surrounds the many distractions that can occur in a classroom setting, and one of the main distractions that is often noted is that of the opposite sex; i.e., girls distracting boys and vice versa (RMC Research, 2008). Though one can speculate that eliminating this distraction will enhance a student's performance, any guess is purely speculation (RMC Research, 2008). It is true that there are some private schools which offer same-sex education; however, to compare their results to that of a public school will be flawed due to the socio-economic barriers that are inherent when comparing private school results to that of public schools. The only way to truly evaluate the performance of single-sex education in a public school system is to actively measure same-sex performance in a public school against that of other coed public schools within the same geographic location. By measuring performance within the same geographic location, one can draw students, which are in all likelihood, from the same socio-economic background and are exposed to most of the same environmental factors. In the mountains of north Georgia, there are two contiguous counties, similar in socio-economic characteristics, which offer two distinctly different types of educational experiences for public school students. The first county offers a traditional coed based curriculum, while the second county in Georgia offers both a traditional coed based curriculum, as well as including one school that offers a single-sex classroom experience.

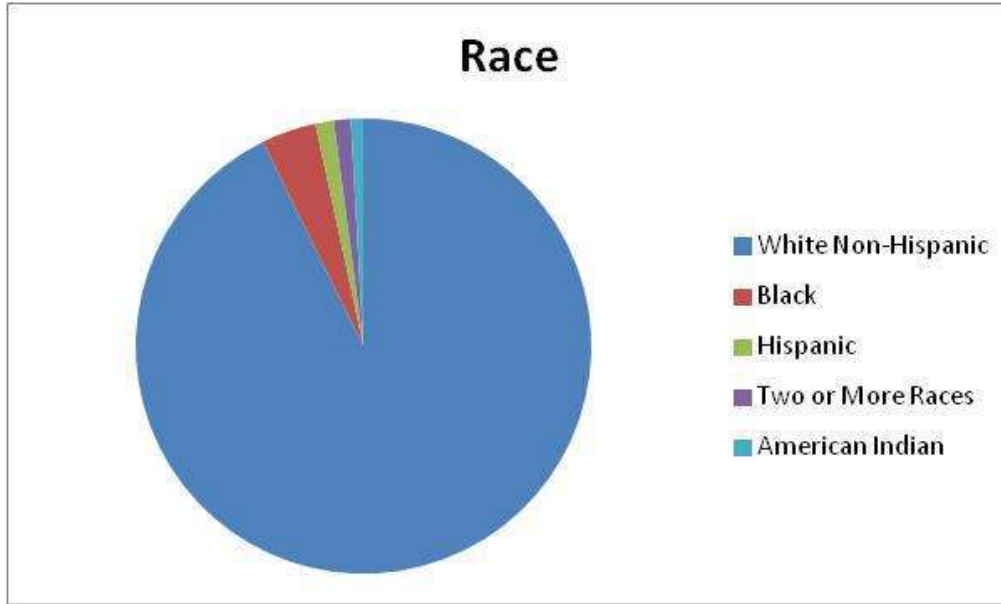
## **Design**

This quantitative causal-comparative study examined the two groups of students' achievement on the state assessment to ascertain if the performance in a single-sex classroom proved to be better than the performance in a coeducational classroom. There were three score sets used for each group: the fifth grade CRCT test scores from Spring 2007 (pretest), the sixth grade CRCT test scores from Spring 2008 (first year posttest, second year pretest), and the seventh grade CRCT test scores from Spring 2009 (second year posttest). The data collected were from the same group of students; over a span of two years. Once the data were obtained, a *t*-test was used to determine the difference of the mean score between the two groups. Next, an analysis of covariance (ANCOVA) was used to verify if the treatment (single-sex setting) bestows an advantage to one group enhancing the students' performance and supersedes the students who receive instruction in a coeducational setting (control group).

The data were used to compare the results of the male and female students receiving single-sex education. A *t*-test was used to determine the difference of the mean scores of the post-treatment scores between the male and female students that received single-sex education. After this test, an ANCOVA was used to verify if single-sex setting enhanced one gender over another in each academic area utilizing the post-treatment scores of the CRCT. Finally, the data were used to compare the results of the male and female students receiving coeducation. A *t*-test was used to determine the difference of the mean scores of the post-treatment scores between the male and female students that received coeducation. An ANCOVA was used to verify if coeducation

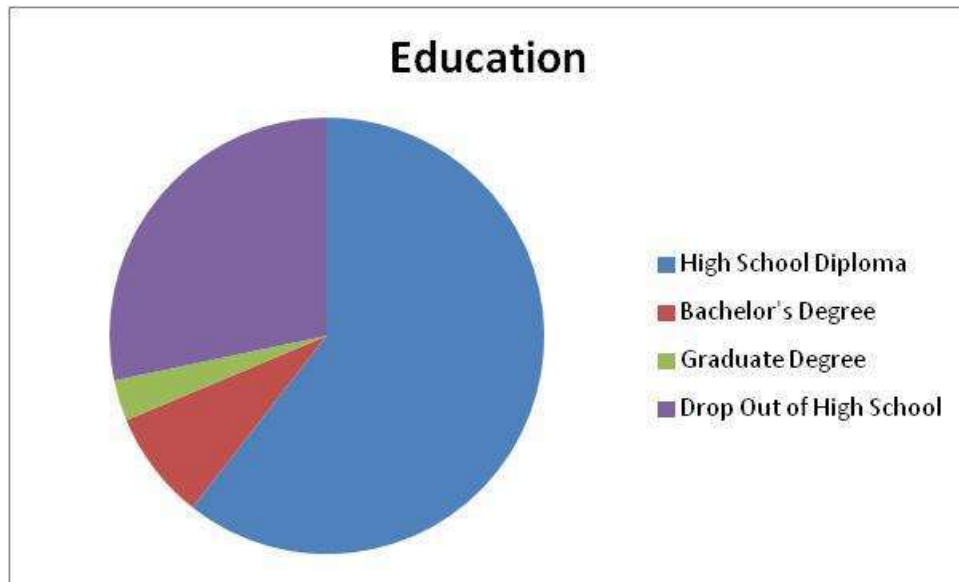
enhancing one gender over another in each academic area utilizing the post-treatment scores of the CRCT.

In northeast Georgia, a middle school in Catoosa county was chosen as the control site. With an estimated population of 3,400, the selected city is considered a small and rural, just south of the Tennessee border. The population is composed of a ratio of 44.5 to 55.5, men to women; races consisting of 92.9% White Non-Hispanic, 3.9% Black, 1.3% Hispanic, 1.2% two or more races, and, 0.9% American Indian (City-Data.com, 2008).



*Figure 3.1.* Ethnicity of Rossville, Georgia

The median household income calculated in 2007 was \$27,527, compared to the state's median income of \$49,136 (City-Data.com, 2008). Within this population, 60% obtained a high school diploma, 8% a bachelor's degree, and 3% continued towards a graduate degree leaving 28% dropping out of school before graduation; resulting in 20.3% residents earning income below the poverty level (City-Data.com, 2008).



*Figure 3.2. Highest Education Level in Rossville, Georgia in Percentage*

Some of the most common male occupations are supervisors, textile and apparel workers, truck drivers, laborers, metal and plastic workers, and construction workers. For females, some of the frequent fields for occupation are cashiers, apparel workers, record clerks, administration support workers, accountants, and waitressing (City-Data.com, 2008).

In Walker County, a middle school in Flintstone was the treatment site with an estimated population of 4,000 (City-Data.com, 2008). The composition of this population is 48.6% males to 51.4% females; races consisting of 96.4% White Non Hispanic, 1.9% Black, 0.26% American Indian, 0.5% Asian, 0.6% two or more races, and 0.17% other (City-Data.com, 2008).

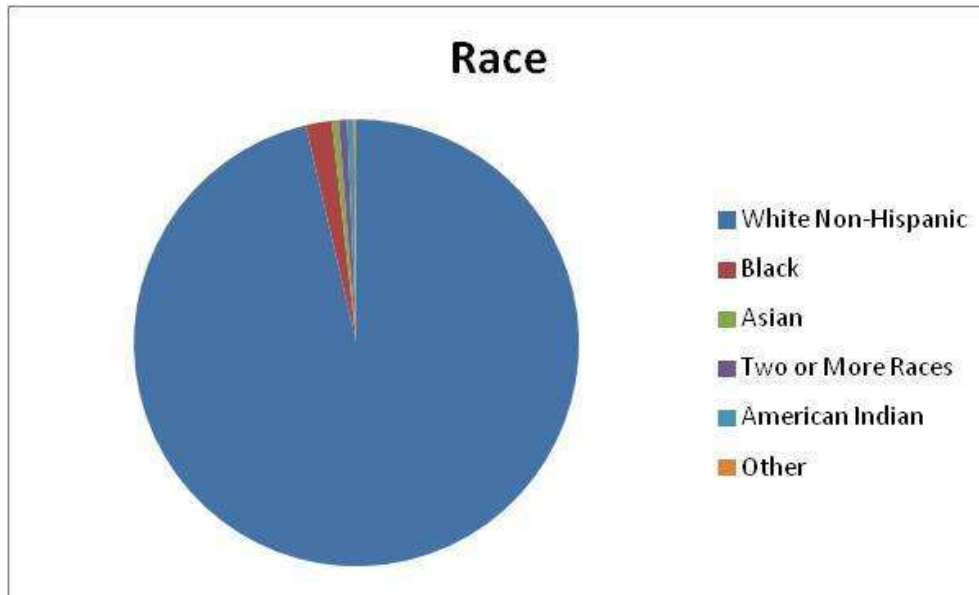
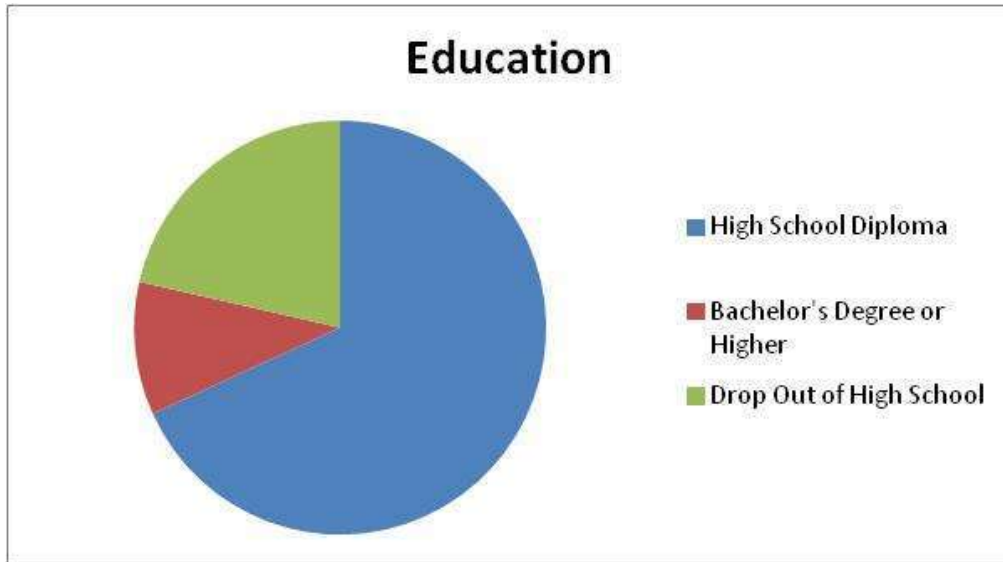


Figure 3.3. Ethnicity of Flintstone, Georgia

The median household income is \$47, 434, just below the median for the state, though 12.5% of the population earned an income below the poverty level, and 4.4% earned below 50% of the poverty level (City-Data.com, 2008). With only 66.8% completing high school, only 10.2% went on to receiving a bachelor’s degree or higher, limiting the job opportunities specifically to the 21% that never completed high school (City-Data.com, 2008).



*Figure 3.4.* Highest Education Level in Flintstone, Georgia in Percentage

For occupations, the most popular male jobs range from truck drivers, mechanics, textile workers, and grounds keepers; female jobs range from office and administration support, cashiers, and secretaries to teachers, nursing, and mental health aides (City-Data.com, 2008).

The purpose of this quantitative study was to determine if the results of single-sex education are significantly different from those of coeducation. The testing may prove that same-sex education may be detrimental, beneficial, or have no bearing over students' performance. The study was conducted at two different sites which includes two different schools in two different counties. The students that are in the first site received instruction in a coeducation setting (control group) and those at the second site received instruction in a single-sex setting (treatment group).

**Research Questions and Hypotheses in Null Form**

The study attempted to answer the following questions:

Research Question 1: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 2: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 3: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 4: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 5: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup>



grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting?

Research Question 6: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 7: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 8: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 9: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 10: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting?

Research Question 11: Is there a significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 12: Is there a significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 13: Is there a significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 14: Is there a significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a

coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

Research Question 15: Is there a significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting?

The results from the research questions were obtained and either rejects or fails to reject the null hypotheses:

Research Hypothesis 1: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 2: There will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 3: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a

coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 4: There will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 5: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 6: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 7: There will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 8: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 9: There will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 10: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 11: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 12: There will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction

in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 13: There will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 14: There will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

Research Hypothesis 15: There will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

### **Participants**

The two participating schools, separated by less than nine miles, have many similarities which enable the performance of the students to be compared. The treatment site is considered a rural middle school with three feeder elementary schools located in the small town of Flintstone, Georgia with a population of 576. This school is considered a Title I school, 71% on free and reduced lunch. The demographics of treatment school

are 92% White Non-Hispanic, 4% Black, and 2% Multiracial. The control site is also considered a rural middle school, but located in the neighboring town of Rossville, Georgia with a population of 750. The demographics of control school are 90% White Non-Hispanic, 4% Black, 2% Hispanic, 2% Asian and 2% Multiracial with 61% on free and reduced lunch. Being located in the same geographic region, both schools and students share many of the same social and economical characteristics. The majority of students that attend both sites can best be described as coming from an indigent background.

The students that participated in the study consisted of approximately 400 students, half in the treatment group and the rest in the control group. The students in the treatment group attended a feeder elementary school offering a coeducational setting, and then attended the treatment site for sixth grade and seventh grade receiving instruction in a single-sex classroom. The students in the control group attended a feeder elementary school offering a coeducational setting and then continued to receive this type of instruction in sixth and seventh grade. Each sample included all students in general education, encompassing those that receive special education services as well as gifted. The curriculum for both sites was identical due to the strict guidelines specified from the state. Students that had not attended the site schools for three consecutive years were excluded from the study.

### **Setting**

The participating schools, located in northwest Georgia, are no more than ten miles from each other. The schools were chosen because of the convenience to the research and the location to one another. The treatment school was selected due to the

implementation of single gender academic instruction in a coed public middle school. The control school was selected due to the typical implementation of coed academic instruction in a coed public middle school. The treatment group consisted of the entire grade and was tracked for two consecutive years. The instructional model remained the same throughout the two years and the students were exposed to single gender education the entire duration. The control group consisted of the entire grade and was tracked for the same two years. The control group received instruction in a coed setting during the duration of the study.

The setting in both sites was a middle school consisting of grades sixth through eighth. The administration in both schools consisted of one male principal and two assistant principals. Along with the administration, each school had a academic coach that had a strong influence curriculum instruction at each school.

### **Instrumentation**

The instrument that was used in the study is the Georgia Criterion-Reference Competency Test (CRCT) which is given annually to students in grades first through eighth. The standardized test was given at the end of the spring to evaluate the students' knowledge and understanding of the Georgia Performance Standards (GPS) generated by the state and taught be all public schools. These scores are utilized to measure students' annual progress, the teachers' effectiveness and competence, schools achievement, district's accomplishment and continuance with state progress. The summative assessment is composed of five areas: mathematics, reading, language arts, science, and social studies.



The validity of the tool used in this study is extremely important. The CRCT was evaluated in 2004 finding the following results: “total test reliabilities ranged from 0.79 to 0.86 for reading, 0.85 to 0.89 for English/language arts, 0.87 to 0.91 for mathematics, 0.89 to 0.90 for science, and 0.88 to 0.91 for social studies” (Georgia Department, 2008). The writers for the CRCT are professional content specialists that are purposely designing questions for the state assessment. The questions are peer reviewed and evaluated for overall clarity, assuring the questions are aligned with the GPS, and are age appropriate. The questions are designed to assess the content knowledge of the student by utilizing their abilities to apply higher order thinking skills. In an ever evolving curriculum, Georgia’s Technical Advisory Committee (TAC) meets quarterly to ensure and review test development and further implementation on a continuing basis (Georgia DOE, 2008)

There are two types of administration for the CRCT: Standard and Conditional. Standard testing is typical and most common rendering accurate results; Conditional test results are required consideration while interpreting the scores. For this study, any student that had conditional testing was excluded from the study. During the testing time selected by the individual school, students were allowed to makeup missed test due to absences.

Summary reports and end of the year reports were sent to schools indicating the overall performance of the student body, breaking down in subgroups and grades. The individual student’s results were also sent, specifying their raw score and the category in which the score falls. The three categories are does not meet expectations with scores below 800, meets expectations with scores between 800 and 849, and exceeds

expectation with scores above 850. If a student falls into the does not meet category for reading or mathematics, he or she will then need to retest during the summer term to try and pass the CRCT in the specific area.

### **Procedures**

For this study, each group that chose to attend the selected sites were utilized in the sample from a population of middle school students from two counties in northwest Georgia. For the treatment site, the students that attended participated in the single-sex classes during middle grades, within these classes were in diverse ability groups. In order for the students to participate in the study, attendance was required for three consecutive years, beginning in fifth grade at which time enrolled in a feeder school of the treatment site. For the control site, all students that attended were in coeducational classes, consisting of various learning abilities. The attendance policy and feeder school policy were applied for the control site as well.

Student and demographic information were exported from the data base utilized by the participating sites including gender, ethnicity, gifted, special education, and economic status. The previous information was charted, allowing an analysis of the characteristics of the participants for each site. CRCT scores were obtained from 2007, 2008, and 2009 from both sites. Within the groups, in order to count students achievement scores, they must have attended the schools for three consecutive years. If a student acquired a CRCT score in summer school, it was not counted towards the study because the study was measuring the sexual composition of the classroom for the course of the academic school year. If a student missed a portion of the CRCT during testing and had missing subtest data, the student was excluded from the study due to the lack of

accurate measurement for yearly progress. The scores were graphed and then broken down into subgroups according to the demographic information previously acquired. This data revealed the impact of the treatment site and control site on each subgroup. To ensure confidentiality for all participants, a numerical code was assigned to each student allowing for anonymity throughout the study. Prior to the study, consent from the principal at each site was obtained.

### **Data Analysis**

This type of research required the use of an ex post facto or causal-comparative study to evaluate the hypothesis regarding the relationship among the independent variable (sexual composition of each class) and the dependent variable (students' CRCT scores at the end of years' one and two) (Ary, Jacobs, Razavieh, & Sorensen, 2006). The students in the single-sex classes (treatment group) were compared to the students in the coeducation classes (control group). The hypothesis of this study was that there will be a significant difference in the achievement scores of the students receiving single-sex education versus students in a traditional coeducational classroom.

When the data were received from both sites (2007 scores for pretest, 2008 scores for posttest for year one and pretest for year two, and 2009 scores for posttest for year two), then an analysis of covariance (ANCOVA) was used to factor in preexisting differences that could be possible between the groups when using the causal-comparative study; regulating the scores of the CRCT for possible initial disparities of the extraneous variable (Ary et al., 2006). The SPSS software was utilized to obtain the resulting data from the ANCOVA.

## CHAPTER FOUR: FINDINGS

The purpose of this study was to determine whether students perform better in a same gender setting as opposed to a coeducational setting with regards to their academic performance on the Georgia Criterion Referenced Competency Test. This chapter explains the results of this study.

### **Data Analysis**

A quantitative causal-comparative study was used in this study to address three research questions presented in Chapter One. The three research questions are stated with statistical data information following each question. To begin to answer each research question, a two-sample assuming unequal variances *t*-test at the alpha 0.05 level was applied. Once the *t*-tests were run, an Analysis of Covariance at the alpha 0.05 level was applied to each research question. A test for homogeneity of regressions at the alpha 0.05 level was applied to the same research questions to establish that no assumptions were violated. The data were computed using Data Analysis in Microsoft Excel and Vassar Stats: Website for Statistical Computation.

### **Research Questions**

The first five research questions asked if there are any significant difference in the mean scores of the specified discipline section of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting. The first step to answer these questions was to run *t*-tests between the control group and the treatment group with the specified discipline

CRCT scores in 2007 to establish that in aggregate, both groups did not have significant differences entering into the study. With the first five research questions, there were no significant differences between the two groups within the disciplines.

The next step to answer the first five research questions was to run an ANCOVA to assess if there were any significant differences between the control and treatment group within disciplines of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade year, 6<sup>th</sup> to 7<sup>th</sup> grade year, and 5<sup>th</sup> to 7<sup>th</sup> grades. The results in the ANCOVA in table 4.1, indicated that there were significant differences between the control and treatment group for 5<sup>th</sup> to 6<sup>th</sup> grade with regards to their achievement in reading on the CRCT ( $p=.015$ ). The results in the ANCOVA in table 4.2, indicated that there were significant differences between the control and treatment group 5<sup>th</sup> to 7<sup>th</sup> grade with regards to their achievement in reading on the CRCT( $p=.021$ ).

Table 4.1

*ANCOVA Results of Reading Scores 5<sup>th</sup> – 6<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	1891	1	1891.00	6.02	0.015
Adjusted Error	82351	262	314.30		
Adjusted Total	84242	263			

Table 4.2

*ANCOVA Results of Reading Scores 5<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	1678	1	1678.00	5.37	0.021
Adjusted Error	81862	262	312.50		
Adjusted Total	83540	263			

The results in the ANCOVA in table 4.3, indicated that there were significant differences between the control and treatment group 5<sup>th</sup> to 6<sup>th</sup> grade with regards to their achievement in science on the CRCT( $p < .0001$ ). The results in the ANCOVA in table 4.4, indicated that there were significant differences between the control and treatment group 6<sup>th</sup> to 7<sup>th</sup> grade with regards to their achievement in science on the CRCT( $p < .0001$ ). The results in the ANCOVA in table 4.5, indicated that there were significant differences between the control and treatment group 5<sup>th</sup> to 7<sup>th</sup> grade with regards to their achievement in science on the CRCT( $p = .021$ ).

Table 4.3

*ANCOVA Results of Science Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	11248	1	11248.00	34.06	<.0001
Adjusted Error	86537	262	330.30		
Adjusted Total	97785	263			

Table 4.4

*ANCOVA Results of Science Scores 6<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	20694	1	20694.00	42.84	<.0001
Adjusted Error	1E+05	262	483.00		
Adjusted Total	1E+05	263			

Table 4.5

*ANCOVA Results of Science Scores 5<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	2794	1	2794.00	5.36	0.021
Adjusted Error	1E+05	262	521.60		
Adjusted Total	1E+05	263			

An ANCOVA was conducted to assess if there were any significant differences between the control and treatment group in the social studies portion of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade year. The social studies portion of the CRCT was not scored for the 7<sup>th</sup> grade year. The results in the ANCOVA in table 4.6, indicated that there were

significant differences between the control and treatment group with regards to their achievement in Social Studies on the CRCT( $p < .0001$ ).



Table 4.6

*ANCOVA Results of Social Studies Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	10806	1	10806.00	32.35	<.0001
Adjusted Error	87503	262	334.00		
Adjusted Total	98309				

The last step in answering the first research question was to run a test for homogeneity of regressions. For mathematics, the tests results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.709), 6<sup>th</sup> to 7<sup>th</sup> were (p=.807), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.167). For reading, the test for 5<sup>th</sup> to 6<sup>th</sup> were (p=.888), 6<sup>th</sup> to 7<sup>th</sup> were (p=.211), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.146). For language arts, the test for 5<sup>th</sup> to 6<sup>th</sup> were (p=.447), 6<sup>th</sup> to 7<sup>th</sup> were (p=.248) and 5<sup>th</sup> to 7<sup>th</sup> were (p=.447). For science, the test for 5<sup>th</sup> to 6<sup>th</sup> were (p=.807), 6<sup>th</sup> to 7<sup>th</sup> were (p=.888), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.888). For social studies, the test for 5<sup>th</sup> to 6<sup>th</sup> were (p=.065).

For research question one, the study fails to reject the following null hypothesis: there will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

For research question two, the study rejects the following null hypothesis: there will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of

middle school students receiving instruction in a single gender setting. Results showed there were significant differences between the control and treatment group in reading with 5<sup>th</sup> to 6<sup>th</sup> ( $p=.015$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.021$ ).

For research question three, the study fails to reject the following null hypothesis: there will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting.

For research question four, the study rejects the following null hypothesis: there will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences between the control and treatment group in science with 5<sup>th</sup> to 6<sup>th</sup> ( $p<.0001$ ), 6<sup>th</sup> to 7<sup>th</sup> ( $p<.0001$ ), and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.021$ ).

For research question five, the study rejects the following null hypothesis: there will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the group of middle school students receiving instruction in a coeducation setting and the group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences between the control and treatment group in social studies with 5<sup>th</sup> to 6<sup>th</sup> ( $p<0.0001$ ).

Research questions six through ten asked if there are any significant difference in the mean scores of the specified discipline section of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting. The first step to answer these questions was to run *t*-tests between the control group and the treatment group with the specified discipline CRCT scores in 2007 to establish that in aggregate, both male groups did not have significant differences entering into the study. With the five selected research questions, there were no significant differences between the two male groups within the disciplines.

The next step to answer research questions six through ten was to run an ANCOVA to assess if there were any significant differences between the control and treatment male groups within disciplines of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade year, 6<sup>th</sup> to 7<sup>th</sup> grade year, and 5<sup>th</sup> to 7<sup>th</sup> grades. The results in the ANCOVA in table 4.7, indicated that there were significant differences between the control and treatment group with regards to their achievement in reading on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade ( $p=.013$ ).

Table 4.7

*ANCOVA Results of Male Reading Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	1881	1	1881.00	6.38	0.013
Adjusted Error	41892	142	295.00		
Adjusted Total	43773	143			

The results in the ANCOVA in table 4.8, indicated that there were significant differences between the control and treatment group with regards to their achievement in science on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade (p=.016). The results in the ANCOVA in table 4.9, indicated there were significant difference between the control and treatment group with regards to their achievement in science on the CRCT from 5<sup>th</sup> to 7<sup>th</sup> grade (p=.002).

Table 4.8

*ANCOVA Results of Male Science Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means 0.016	2436	1	2436.00	5.92	
Adjusted Error	58482	142	411.90		
Adjusted Total	60918	143			

Table 4.9

*ANCOVA Results of Male Science Scores 5<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	5122	1	5122.00	9.95	0.002
Adjusted Error	73100	142	514.80		
Adjusted Total	78222	143			

An ANCOVA was conducted to assess if there were any significant differences between the control and treatment groups in the social studies portion of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade years. The social studies portion of the CRCT was not scored for the 7<sup>th</sup> grade year. The results in the ANCOVA in table 4.10, indicated that there were significant differences between the control and treatment group with regards to their achievement in social studies on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade (p=.024).

Table 4.10

*ANCOVA Results of Male Social Studies Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	1727	1	1727	5.22	0.024
Adjusted Error	46963	142	330.7		
Adjusted Total	48689	143			

The last step in answering the second research question was to run a test for homogeneity of regressions. For mathematics, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.842), 6<sup>th</sup> to 7<sup>th</sup> were (p=.141), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.227). For reading, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.863), 6<sup>th</sup> to 7<sup>th</sup> were (p=.023), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.221). For language arts, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.401), 6<sup>th</sup> to 7<sup>th</sup> were (p=1), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.038). For science, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.888), 6<sup>th</sup> to 7<sup>th</sup> were (p=.655), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.513). For social studies, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.358).

For research question six, the study fails to reject the following null hypothesis: There will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting.

For research question seven, the study rejects the following hypothesis but due to homogeneity of regressions, the question and hypothesis are not valid and therefore are thrown out: there will be no significant difference in the mean scores of the reading

portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting. Results from the ANCOVA showed there were significant differences between the males in the control and treatment group in reading with 5<sup>th</sup> to 6<sup>th</sup> ( $p=.013$ ). Results from the test for homogeneity of regressions for 6<sup>th</sup> to 7<sup>th</sup> grade were ( $p=.023$ ).

For research question eight, the study fails to reject the following hypothesis but due to the test of homogeneity of regressions, the question and hypothesis are not valid and therefore thrown out: there will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting. Results from the test for homogeneity of regressions for 5<sup>th</sup> to 7<sup>th</sup> were ( $p=.038$ ).

For research question nine, the study rejects the following hypothesis: there will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences in science with 5<sup>th</sup> to 6<sup>th</sup> ( $p=.016$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.002$ ).

For research question ten, the study rejects the following hypothesis: there will be no significant difference in the mean scores of the social studies portion of the Criterion-

Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the male group of middle school students receiving instruction in a coeducation setting and the male group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences in social studies with 5<sup>th</sup> to 6<sup>th</sup> ( $p=.024$ ).

Research questions eleven through fifteen asked if there are any significant difference in the mean scores of the specified discipline section of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting. The first step to answer these questions was to run *t*-tests between the control group and the treatment group with the specified discipline CRCT scores in 2007 to establish that in aggregate, both female groups did not have significant differences entering into the study. With the five selected research questions, there were no significant differences between the two female groups within the disciplines.

The next step to answer research questions eleven through fifteen was to run an ANCOVA to assess if there were any significant differences between the control and treatment female groups within disciplines of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade year, 6<sup>th</sup> to 7<sup>th</sup> grade year, and 5<sup>th</sup> to 7<sup>th</sup> grades. The results in the ANCOVA in table 4.11, indicated that there were significant differences between the control and treatment group with regards to their achievement in mathematics on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade ( $p=.003$ ).



Table 4.11

*ANCOVA Results of Female Mathematics Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	1749	1	1749.00	9.20	0.003
Adjusted Error	22234	117	190.00		
Adjusted Total	23982	118			

The results in the ANCOVA in table 4.12, indicated there was a significant difference between the control and treatment group with regards to their achievement in reading on the CRCT from 5<sup>th</sup> to 7<sup>th</sup> grade (p=.043).

Table 4.12

*ANCOVA Results of Female Reading Scores 5<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	1492	1	1492.00	4.19	0.043
Adjusted Error	41682	117	356.30		
Adjusted Total	43174	118			

The results in the ANCOVA in table 4.13, indicated that there were significant differences between the control and treatment group with regards to their achievement in science on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade ( $p < .0001$ ). The results in the ANCOVA in table 4.14, indicated there were significant differences between the control and treatment group with regards to their achievement in science on the CRCT from 6<sup>th</sup> to 7<sup>th</sup> grade ( $p < .0001$ ).

Table 4.13

*ANCOVA Results of Female Science Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	10701	1	10701.00	47.89	<.0001
Adjusted Error	26142	117	223.40		
Adjusted Total	36843	118			

Table 4.14

*ANCOVA Results of Female Science Scores 6<sup>th</sup>-7<sup>th</sup> Grade*

Source	SS	df	MS	F	P
Adjusted Means	19424	1	19424.00	45.96	<.0001
Adjusted Error	49449	117	422.60		
Adjusted Total	68873	118			

An ANCOVA was conducted to assess if there were any significant differences between the control and treatment group in the social studies portion of the CRCT from their 5<sup>th</sup> to 6<sup>th</sup> grade year. The social studies portion of the CRCT was not scored for the 7<sup>th</sup> grade year. The results in the ANCOVA in table 4.15, indicated that there were significant differences between the control and treatment group with regards to their achievement in social studies on the CRCT from 5<sup>th</sup> to 6<sup>th</sup> grade ( $p < .0001$ ).

Table 4.15

*ANCOVA Results of Female Social Studies Scores 5<sup>th</sup>-6<sup>th</sup> Grade*

Source	SS	Df	MS	F	P
Adjusted Means	11402	1	11402.00	36	<.0001
Adjusted Error	37054	117	316.70		
Adjusted Total	48457	118			

The last step in answering the third research question was to run a test for homogeneity of regressions. For mathematics, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.69), 6<sup>th</sup> to 7<sup>th</sup> were (p=.077), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.699). For reading, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.921), 6<sup>th</sup> to 7<sup>th</sup> were (p=.523), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.477). For language arts, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.823), 6<sup>th</sup> to 7<sup>th</sup> were (p=.111), and 5<sup>th</sup> to 7<sup>th</sup> were (p=.202). For science, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.347), 6<sup>th</sup> to 7<sup>th</sup> were (p=.534) and 5<sup>th</sup> to 7<sup>th</sup> were (p=.452). For social studies, the test results for 5<sup>th</sup> to 6<sup>th</sup> were (p=.056).

For research question eleven, the study rejects the following hypothesis: there will be no significant difference in the mean scores of the math portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences between the female control and treatment group in mathematics with 5<sup>th</sup> to 6<sup>th</sup> (p=.003).

For research question twelve, the study rejects the following hypothesis: there will be no significant difference in the mean scores of the reading portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences in reading with 5<sup>th</sup> to 7<sup>th</sup> ( $p=.043$ ).

For research question thirteen, the study fails to reject the following hypothesis: there will be no significant difference in the mean scores of the language arts portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting.

For research question fourteen, the study rejects the following null hypothesis: there will be no significant difference in the mean scores of the science portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences in 5<sup>th</sup> to 6<sup>th</sup> ( $p<0.0001$ ) and 6<sup>th</sup> to 7<sup>th</sup> ( $p<0.0001$ ).

For research question fifteen, the study rejects the following null hypothesis: there will be no significant difference in the mean scores of the social studies portion of the Criterion-Reference Competency Test for the 6<sup>th</sup> and 7<sup>th</sup> grade years between the female

group of middle school students receiving instruction in a coeducation setting and the female group of middle school students receiving instruction in a single gender setting. Results showed there were significant differences in social studies in 5<sup>th</sup> to 6<sup>th</sup> ( $p < 0.0001$ ).

In the final chapter, five, there will be a summary of this study as well as a more detailed discussion of the findings and results. It will also include implications and limitations of the study with applications and recommendations for possible future research.

## **CHAPTER FIVE: DISCUSSION**

This chapter will summarize the results of the study. The first section of this chapter will include an overview of the study along with the purpose as well as the methodology. The second section of this chapter will discuss and summarize the results of the study. The final section of this chapter will include the implications, limitations, and applications of this study along with recommendations for future research.

### **Overview**

Margaret Spellings, the United States Secretary of Education, documented that the achievement gaps among genders and ethnicity is widening causing multiple issues for our society, the economy, and families in the United States (Spellings, 2009). The gap between the sexes has many people questioning possible gender separation in instructional environments (Tyre, 2006) even in coeducational setting, which have increased in popularity (Jackson & Smith, 2000). The popular idea of gender separation has grown faster than ever (Morse, 1998), specifically due to the fact that boys are different from girls in multiple facets including areas such as biology, developmental, and psychological (Tyre, 2006).

With the increased demand on schools to perform higher on the Georgia Criterion-Referenced Competency Test (CRCT), school administrators are looking for ways to increase productivity and encourage friendly learning environments. Among several schools that have piloted this program, one school in North Georgia has practiced gender separation for academic classes in a coeducational public school. The school has practiced this for several years, including 2007, 2008, and 2009.

## **Purpose**

The purpose of this study was to determine if the gender makeup of a class directly impacts the performance the students' exhibit on the CRCT. There were two groups of students in the study: one group at the first site school received academic instruction with same gender peers and the second group at the second site school received academic instruction in a coeducational setting. The students were followed for two years.

## **Review of Methodology**

This was a quantitative causal-comparative study examining two groups of students with regard to their achievement on the Georgia State assessment, CRCT; one group in a single-sex classroom and the other in a coeducational classroom. Each group was followed for two academic years, using three sets of CRCT scores. The fifth grade CRCT scores from the Spring 2007 were used as a pretest, the sixth grade CRCT scores from Spring 2008 were used as the first year posttest and the second year pretest, and the seventh grade CRCT scores from Spring 2009 were used as the second year posttest.

## **Participants**

The treatment school, located in northwest Georgia has approximately 600 students enrolled during the time of the study, 115 of which were in the study. The school was at this time considered a Title I school consisting of 71% on free and reduced lunch. The demographics of the treatment school were 92% White-Non Hispanic, 4% Black, and 2% Multiracial. The control site, also located in northwest Georgia just nine miles from the treatment school, consisted of approximately 750 students, 150 of which were in the study. This school had a significant amount of students on free and reduced



lunch, 61%, with demographics ranging from 90% White Non-Hispanic, 4% Black, 2% Hispanic, 2% Asian, and 2% Multiracial.

### **Procedure**

Students and demographic information were extracted by using a data base the state provides. The information was then charted, CRCT scores were obtained for years 2007, 2008, and 2009 and were consolidated on the chart as well. In order to count student achievement scores, the participants had to attend the school for three years and had to take all of the CRCT subtests for all three years; summer school retakes were not considered in this study. Once these eliminations were taken care of, the scores were charted and then broken down into subgroups according to the demographics. To ensure confidentiality for all participants, a numerical code was assigned to each student allowing for anonymity throughout the study.

### **Summary of Findings**

For the first five research questions, *t*-tests were run to show that in fact, the groups were the same in all areas. As a whole, in subareas, there were no significant differences: reading ( $p=.79$ ); language arts ( $p=.98$ ); math ( $p=.66$ ); science ( $p=.44$ ); and social studies ( $p=.73$ ). Once this was established, Vassar Stats was used to conduct an analysis of covariance (ANCOVA) to determine the variances in the pretest and the posttest scores due to the effects of a single-sex instructional setting as oppose to the coeducational instructional setting. The results of the ANCOVA found that in some academic areas, as a whole group there were significant differences between students that received instruction in a single-sex setting as opposed to students in a coeducational setting. In the areas of reading, from 5<sup>th</sup> to 6<sup>th</sup> ( $p=.015$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.021$ ), science

from 5<sup>th</sup> to 6<sup>th</sup> ( $p < .0001$ ), 6<sup>th</sup> and 7<sup>th</sup> ( $p < .0001$ ), and 5<sup>th</sup> to 7<sup>th</sup> ( $p = .021$ ), and social studies from 5<sup>th</sup> to 6<sup>th</sup> ( $p < .001$ ). There were no significant differences in the following areas: math from 5<sup>th</sup> to 6<sup>th</sup> ( $p = .188$ ), 6<sup>th</sup> to 7<sup>th</sup> ( $p = .133$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p = 1$ ); reading from 6<sup>th</sup> to 7<sup>th</sup> ( $p = .451$ ); language arts from 5<sup>th</sup> to 6<sup>th</sup> ( $p = .888$ ), 6<sup>th</sup> to 7<sup>th</sup> ( $p = .639$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p = .729$ ); social studies was not grade for 6<sup>th</sup> and 7<sup>th</sup> grade year.

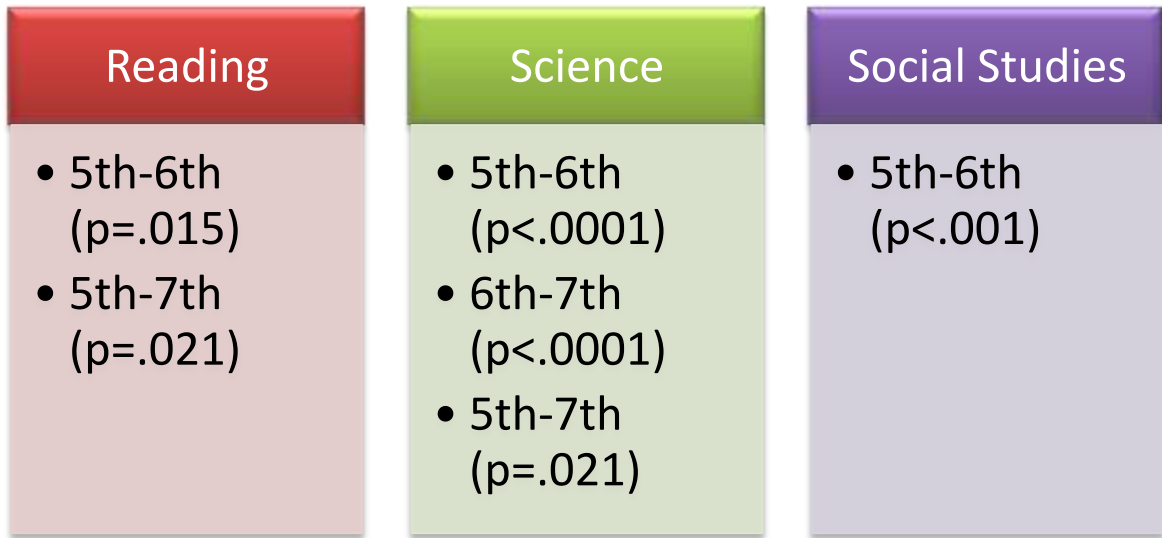


Figure 5.1. Single-Sex versus Coeducation Whole Group Significant Differences

For research questions six through ten, *t*-tests were conducted on the pretest scores for the males to ensure that, in aggregate, the male groups were the same. The results showed that in fact, the male groups were the same in all areas. In the subareas, there were no significant differences: math (p=.44); reading (p=.72); language arts (p=.89); science (p=.24); and social studies (p=.47). Next, using Vassar Stats, an ANCOVA was conducted to determine the variances with the pretest and posttest scores due to the effects of single-sex instructional setting rather than a coeducational instructional setting. The results of the ANCOVA found that in some academic areas, the male group had significant differences. In reading, for 5<sup>th</sup> to 6<sup>th</sup> (p=.013), there were significant differences; however the homogeneity of regressions score was (p=.023) for the 6<sup>th</sup> to 7<sup>th</sup> grade test was considered invalid and thrown out. In science, for 5<sup>th</sup> to 6<sup>th</sup> (p=.016) and 5<sup>th</sup> to 7<sup>th</sup> (p=.002), there were significant differences. Finally, in social studies for 5<sup>th</sup> to 6<sup>th</sup> (p=.024), there were significant differences. There were no

significant differences in the following areas: math for 5<sup>th</sup> to 6<sup>th</sup> ( $p=.26$ ), 6<sup>th</sup> to 7<sup>th</sup> ( $p=.339$ ), and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.807$ ); reading for 6<sup>th</sup> to 7<sup>th</sup> ( $p=.591$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.204$ ); science for 6<sup>th</sup> to 7<sup>th</sup> ( $p=.108$ ); and language arts for 5<sup>th</sup> to 6<sup>th</sup> ( $p=.672$ ), 6<sup>th</sup> to 7<sup>th</sup> ( $p=.863$ ), and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.591$ ). For the 5<sup>th</sup> to 7<sup>th</sup> language arts results, the homogeneity of regressions value was ( $p=.038$ ) and violated assumption resulting in the question being thrown out.

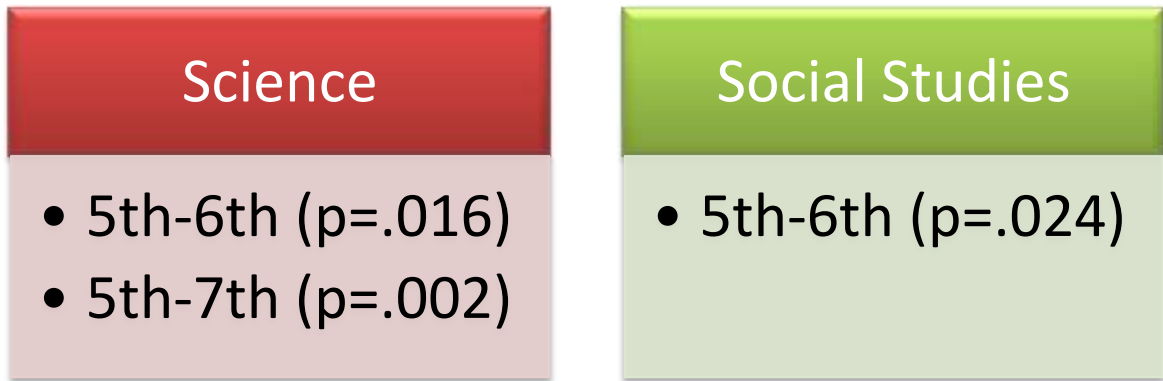


Figure 5.2. Single-Sex versus Coeducation – Males Significant Differences

For research questions eleven through fifteen, *t*-tests were conducted using Microsoft Excel for the pretest for the females to ensure that in aggregate they were the same. The results showed that the females exhibited no significant differences: math ( $p=.19$ ); reading ( $p=.98$ ); language arts ( $p=.95$ ); science ( $p=.77$ ); and social studies ( $p=.73$ ). After the *t*-test, an ANCOVA was used using the same program, Vassar Stats, to determine the variances with the pretest and posttest scores due to the effects of single-sex instructional setting as opposed to a coeducational instructional setting. The results of the ANCOVA rendered that in some academic areas females did have significant differences. In mathematics, there were significant differences of the female students from grade 5<sup>th</sup> to 6<sup>th</sup> ( $p=.003$ ). Also, there were significant differences in reading from 5<sup>th</sup> to 7<sup>th</sup> ( $p=.043$ ). In science, from 5<sup>th</sup> to 6<sup>th</sup> ( $p<.0001$ ) and 6<sup>th</sup> to 7<sup>th</sup> ( $p<.0001$ ) females showed significant differences. Finally, in social studies from 5<sup>th</sup> to 6<sup>th</sup> ( $p<.0001$ ) females showed significant differences. Females did not have significant differences in the following areas: mathematics for 6<sup>th</sup> to 7<sup>th</sup> ( $p=.21$ ) and 5<sup>th</sup> to 7<sup>th</sup> ( $p=.18$ ); reading for

5<sup>th</sup> to 6<sup>th</sup> (p=.31) and 6<sup>th</sup> to 7<sup>th</sup> (p=.136); language arts for 5<sup>th</sup> to 6<sup>th</sup> (p=.481), 6<sup>th</sup> to 7<sup>th</sup> (p=.125), and 5<sup>th</sup> to 7<sup>th</sup> (p=.464); and science for 5<sup>th</sup> to 7<sup>th</sup> (p=.108).



Figure 5.3. Single-Sex versus Coeducation – Females Significant Differences

## Discussion

Studies discussed in chapter two had mixed results when comparing coed classes to same gender classes. In the study using the Mississippi Curriculum Test reported by Laster, results supported that boys performed better in reading when separated by gender whereas females showed no difference (Laster, 2004). When comparing the basic performance to proficient performance, Laster noted the male single gender group out scored the coed group in language arts (2004). In other content areas, there were very little differences among the two groups in content areas (Laster, 2004). In a study in England, Younger and Warrington concluded the findings in their study supported single-gender education, specifically one that targets the growth and high achievement of girls and boys (Younger & Warrington, 2002). The U.S. Department of Education did a review of studies and compiled the results and found in the area of all content achievement that 67% of the studies supported single-gender education and only 11% supported coeducation, and 22% rendered null results (U.S. DOE, 2005). Within these findings, female and male achievements were the strongest in single gender education (U.S. DOE, 2005).

The results of the study found that there were significant differences between the group of students that received instruction in a single gender environment and the group of students that received instruction in a coed environment. The differences included students in reading, science, and social studies. The results also found that there were significant differences between the male group of students that received instruction in a single gender environment and the male group of students that received instruction in a coed environment. The differences included male students in science and social studies. The results found that there were significant differences between the female group of students that received instruction in a single gender environment and the female group of students that received instruction in a coed environment. The differences included female students in math, reading, science, and social studies. The results implied that the environment has an impact on the students performances, especially in specific content areas.

The implication of the study is that it may force a reexamination of how public education views desegregation with regards to gender. The majority of public school systems include classroom settings where male and female students work alongside each other; however, the study does reveal that there are performance differences when males and females are segregated in a classroom setting. Whereas the current model of public education states that diversity in gender is a necessary aspect of the classroom setting, whether this necessity is perpetuated by financial restrictions, law, or other means, the study does reveal that students will perform differently if segregated from the opposite sex.



## **Limitations**

There were several factors that might have influenced the results of the study. One of the biggest factors would be the classroom teachers. They were very important to the study because they were delivering the standards to the students. Depending on their teaching strategies, whether they differentiated instruction and application to appeal to the demographics of the classroom makeup might have had an influence on the performance of the students. The teachers' resources used within the parameters of the school and outside could have been a factor. Professional development and research based strategies geared toward growth of the knowledge of how students learn and expressing their knowledge through different methods could have been a beneficial factor to the success of the students. Classroom management and teacher's attitude is another limitation to the study. The experience that the teachers had could have been a factor in the study.

Administration, school leaders and guidance, along with teachers, are factors to consider in the study. The environment of the school, the attitude of the administrators, the involvement and support that the administration offers to the teachers and students are big factors to consider in the study. The school atmosphere, whether pleasant, organized, structured, or chaotic could have been a limitation in the study. The parental involvement in the school, with the staff and teachers, along with the support of the students are factors in the study.

The students participation and attitude are limitations in the study. The study was conducted with students at the 6<sup>th</sup> and 7<sup>th</sup> grade levels, meaning that this was their first and second years in middle school. The first year, being in a new school, new teachers

and administration, and possibly many new students could have been factors in the study. The demographics and socio economic status of the two selected schools in another limitation to the study. Both schools were Title I schools and had a very small amount of minorities. A general statement would not accurately represent diverse cultures. Another limitation to consider is that the students that attended the middle school conducting single gender classes who had previously only experienced coed classes in the elementary school.

The number of sample schools used in the study is another limitation. Although the student variables for each school sample were significant in size, it would have been better to have multiple site schools to use in order to establish a more consistent trend. Other limitations to the study were the location and the limited geographical area. The study was only conducted in two middle schools. The fact that it only targets a very specific age could be a limitation in the study and generalizations about single gender versus coeducation could not be accurately represented. Also, the two schools were located in two north Georgia rural counties causing the study to only be localized and possibly nontransferable to other counties in the United States.

The instrument used for the study, the CRCT, could be another limitation to the study. Although valid and reliable, the CRCT test given to assess the general knowledge of the GPS standards set forth by the state of Georgia is only tested annually. The pressure of the test can cause anxiety with students and could possibly be unreliable to produce an accurate picture of the success of the students.

## **Implications**

Several steps could be taken to enhance the learning environment in the classroom. As the study has shown, in several academic content areas, students have exhibited significant differences when separated by sex during instruction. Public school administrators, if given the liberty to do so, should be able to pilot possible programs in school allowing same gender classes.

In a higher level, the state should further investigate the possibilities of allowing and enabling public schools to pilot such programs as gender separation for academic classes. Also, the state should provide training to staff in the program on differentiated instruction geared towards certain genders.

## **Recommendations for Future Research**

One of the first recommendations for the future is to conduct a study for a longer period of time. Two years worth of data gives just enough evidence to show that there are some differences, however, it would be necessary to have years of data to support and strengthen the study and corroborates statistical differences over time.

Another recommendation for future research is to utilize many schools in the study. Having a greater pool of data from multiple schools will reinforce and confirm the differences developed and discovered in the study. This would also be better if the study looked at multiple age groups rather than just focusing on middle school ages. It may find that students do better when separated by gender in one age group but perform more poorly in another age group.

## **Conclusion**

Before the 1990s, single-sex education was predominately offered in private or religious sector (Anfara & Mertens, 2008). The interest has been renewed recently especially since 2003 when new regulations by the Department of Education renewed interest in single-sex education environments (Anfara & Mertens, 2008). There is mixed evidence on the success of one instructional setting over the other. The research provided that in most cases, there were very little differences in the performance of students in single-sex classes versus students in the coeducational classes. There were, however, some significant differences in students' performances in certain academic classes and during certain grade levels. There needs to be more extensive research on each type of instruction in a longitudinal study. Additional studies on diverse groups in different regions need to be followed to validate the possible findings of the research. The academic areas that presented significant differences need to be studied more intensely to support the findings of this study.

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## APPENDIX

### Appendix A: t-Test for Whole Group

#### Math

t-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	345.9304348	342.24
Variance	5773.977574	3300.626577
Observations	115	150
Hypothesized Mean Difference	0	
Df	206	
t Stat	0.434280981	
P(T<=t) one-tail	0.332269468	
t Critical one-tail	1.652284145	
P(T<=t) two-tail	0.664538936	
t Critical two-tail	1.971546622	

#### Reading

t-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	827.2434783	828
Variance	571.6770404	465.1543624
Observations	115	150
Hypothesized Mean Difference	0	
Df	232	
t Stat	0.266273065	
P(T<=t) one-tail	0.395132706	
t Critical one-tail	1.651448063	
P(T<=t) two-tail	0.790265412	
t Critical two-tail	1.970241883	



*Language Arts*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	828.773913	828.7066667
Variance	549.0186117	486.436868
Observations	115	150
Hypothesized Mean Difference	0	
Df	238	
t Stat	0.023749982	
P(T<=t) one-tail	0.490535969	
t Critical one-tail	1.651281164	
P(T<=t) two-tail	0.981071937	
t Critical two-tail	1.969981476	

*Science*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	822.8695652	819.5533
Variance	1353.360031	1095.578
Observations	115	150
Hypothesized Mean Difference	0	
Df	231	
t Stat	0.759354381	
P(T<=t) one-tail	0.224207393	
t Critical one-tail	1.651476726	
P(T<=t) two-tail	0.448414786	
t Critical two-tail	1.970286607	



*Social Studies*

*t*-Test: Two-Sample Assuming Unequal Variances

---

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	330.9478261	330.0066667
Variance	513.4709382	511.4831767
Observations	115	150
Hypothesized Mean Difference	0	
Df	245	
t Stat	0.335383721	
P(T<=t) one-tail	0.368811323	
t Critical one-tail	1.651096821	
P(T<=t) two-tail	0.737622645	
t Critical two-tail	1.969693865	

---

**Appendix B: ANCOVA Results for Whole Group, fails to reject**

*Math*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

Source	SS	Df	MS	F	P
Adjusted Means	1130	1	1130.00	1.74	0.188
Adjusted Error	2E+05	262	649.70		
Adjusted Total	2E+05	263			

Test for Homogeneity of Regressions

Source	SS	Df	MS	F	P
Between Regressions	93.85	1	93.85	0.14	0.709
Remainder	2E+05	261	651.80		
Adjusted Error	2E+05	262			

*Math*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	Df	MS	F	P
Adjusted Means	627.10	1	627.10	2.27	0.133
Adjusted Error	72361	262	276.20		
Adjusted Total	72988	263			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	17.81	1	17.81	0.06	0.807
Remainder	72343	261	277.20		
Adjusted Error	72361	262			

*Math*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	Df	MS	F	P
Adjusted Means	1.77	1	1.77	0	1
Adjusted Error	2E+05	262	688.80		
Adjusted Total	2E+05	263			

Test for Homogeneity of Regressions

Source	SS	Df	MS	F	P
Between Regressions	1317	1	1317.00	1.92	0.167
Remainder	2E+05	261	686.40		
Adjusted Error	2E+05	262			

*Reading*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	156.30	1	156.30	0.57	0.451
Adjusted Error	71499	262	272.90		
Adjusted Total	71655	263			

---

Test for Homogeneity of Regressions

---

Source	SS	df	MS	F	P
Between Regressions	426.70	1	426.70	1.57	0.211
Remainder	71072	261	272.30		
Adjusted Error	71499	262			

---

*Language Arts*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	4.41	1	4.41	0.02	0.888
Adjusted Error	72318	262	276.00		
Adjusted Total	72322	263			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	159.80	1	159.80	0.58	0.447
Remainder	72158	261	276.50		
Adjusted Error	72318	262			

*Language Arts*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	56.91	1	56.91	0.22	0.639
Adjusted Error	67215	262	256.60		
Adjusted Total	67272	263			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	343.10	1	343.10	1.34	0.248
Remainder	66872	261	256.20		
Adjusted Error	67215	262			

*Language Art*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	35.20	1	35.20	0.12	0.729
Adjusted Error	77496	262	295.80		
Adjusted Total	77531	263			

Test for homogeneity of regressions

Source	SS	df	MS	F	P
Between Regressions	173.10	1	173.10	0.58	0.447
Remainder	77322	261	296.30		
Adjusted Error	77496	262			

### Appendix C: *t*-Test Results for Males

#### *Math*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	357.96875	346.654321
Variance	9521.014881	5640.504012
Observations	64	81
Hypothesized Mean Difference	0	
Df	116	
t Stat	0.765604761	
P(T<=t) one-tail	0.222733248	
t Critical one-tail	1.658095745	
P(T<=t) two-tail	0.445466496	
t Critical two-tail	1.980625937	

#### *Reading*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	827.1875	828.6296296
Variance	636.281746	591.4111111
Observations	64	81
Hypothesized Mean Difference	0	
Df	133	
t Stat	-0.347291725	
P(T<=t) one-tail	0.36446056	
t Critical one-tail	1.656391245	
P(T<=t) two-tail	0.728921119	
t Critical two-tail	1.977961236	

*Language Arts*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	826.015625	825.4938272
Variance	588.968006	480.8780864
Observations	64	81
Hypothesized Mean Difference	0	
Df	128	
t Stat	0.134105956	
P(T<=t) one-tail	0.44676471	
t Critical one-tail	1.656845227	
P(T<=t) two-tail	0.89352942	
t Critical two-tail	1.978670823	

*Science*

*t*-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	826.125	818.7654321
Variance	1564.778	1167.35679
Observations	64	81
Hypothesized Mean Difference	0	
Df	125	
t Stat	1.180573	
P(T<=t) one-tail	0.120007	
t Critical one-tail	1.657135	
P(T<=t) two-tail	0.240014	
t Critical two-tail	1.979124	



*Social Studies*

t-Test: Two-Sample Assuming Unequal Variances

---

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	332.375	329.5802469
Variance	557.2539683	550.0466049
Observations	64	81
Hypothesized Mean Difference	0	
Df	135	
t Stat	0.709918558	
P(T<=t) one-tail	0.239489545	
t Critical one-tail	1.656219133	
P(T<=t) two-tail	0.47897909	
t Critical two-tail	1.977692248	

---

**Appendix D: ANCOVA Results for Males, fails to reject**

*Math*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

Source	SS	Df	MS	F	P
Adjusted Means	991.90	1	991.90	1.28	0.26
Adjusted Error	1E+05	142	776.90		
Adjusted Total	1E+05	143			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	27.67	1	27.67	0.04	0.842
Remainder	1E+05	141	782.20		
Adjusted Error	1E+05	142			

*Math*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	279.20	1	279.20	0.92	0.339
Adjusted Error	42911	142	302.20		
Adjusted Total	43190	143			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	655.50	1	655.50	2.19	0.141
Remainder	42255	141	299.70		
Adjusted Error	42911	142			

*Math*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	46.04	1	46.04	0.06	0.807
Adjusted Error	1E+05	142	788.40		
Adjusted Total	1E+05	143			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	1153	1	1153	1.47	0.227
Remainder	1E+05	141	785.80		
Adjusted Error	1E+05	142			

*Reading*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	1881	1	1881	6.38	0.013
Adjusted Error	41892	142	295		
Adjusted Total	43773	143			

---

Test for Homogeneity of Regressions

---

Source	SS	df	MS	F	P
Between Regressions	8.24	1	8.24	0.03	0.863
Remainder	41883	141	297.10		
Adjusted Error	41892	142			

---

*Reading*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	64.20	1	64.20	0.29	0.591
Adjusted Error	31632	142	222.80		
Adjusted Total	31696	143			

---

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	1151	1	1151	5.32	0.023
Remainder	30481	141	216.20		
Adjusted Error	31632	142			

*Reading*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	437.50	1	437.50	1.63	0.204
Adjusted Error	38065	142	268.10		
Adjusted Total	38502	143			

Test for homogeneity of regressions

Source	SS	df	MS	F	P
Between Regressions	404.50	1	404.50	1.51	0.221
Remainder	37660	141	267.10		
Adjusted Error	38065	142			

*Language Arts*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	56.15	1	56.15	0.18	0.672
Adjusted Error	44035	142	310.10		
Adjusted Total	44091	143			

Test for homogeneity of regressions

Source	SS	df	MS	F	P
Between Regressions	219.90	1	219.90	0.71	0.401
Remainder	43815	141	310.70		
Adjusted Error	44035	142			

*Language Arts*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	8.43	1	8.43	0.03	0.863
Adjusted Error	46316	142	326.20		
Adjusted Total	46324	143			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	0.70	1	0.70	0	1
Remainder	46315	141	328.50		
Adjusted Error	46316	142			

Language Arts

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	87.86	1	87.86	0.29	0.591
Adjusted Error	42991	142	302.80		
Adjusted Total	43079	143			

Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	1297	1	1297.00	4.39	0.038
Remainder	41694	141	295.70		
Adjusted Error	42991	142			

*Science*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	1389	1	1389.00	2.61	0.108
Adjusted Error	75501	142	531.70		
Adjusted Total	76890	143			

---

Test for Homogeneity of Regressions

---

Source	SS	df	MS	F	P
Between Regressions	104.70	1	104.70	0.20	0.655
Remainder	75397	141	534.70		
Adjusted Error	75501	142			

---



## Appendix E: *t*-test Results for Females

### *Math*

t-Test: Two-Sample Assuming Unequal

Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	330.8235294	337.057971
Variance	749.9082353	545.9083546
Observations	51	69
Hypothesized Mean Difference	0	
Df	98	
t Stat	-1.310966518	
P(T<=t) one-tail	0.096466361	
t Critical one-tail	1.660551218	
P(T<=t) two-tail	0.192932723	
t Critical two-tail	1.984467404	

### *Reading*

t-Test: Two-Sample Assuming Unequal Variances

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	827.3137255	827.2608696
Variance	501.6996078	322.4309463
Observations	51	69
Hypothesized Mean Difference	0	
Df	93	
t Stat	0.013875786	
P(T<=t) one-tail	0.494479402	
t Critical one-tail	1.661403674	
P(T<=t) two-tail	0.988958804	
t Critical two-tail	1.985801768	

*Language Arts*

t-Test: Two-Sample Assuming Unequal

Variances

---

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	832.2352941	832.4782609
Variance	487.7035294	473.4002558
Observations	51	69
Hypothesized Mean Difference	0	
Df	107	
t Stat	-0.059953082	
P(T<=t) one-tail	0.476152418	
t Critical one-tail	1.659219312	
P(T<=t) two-tail	0.952304836	
t Critical two-tail	1.982383312	

---

*Science*

t-Test: Two-Sample Assuming Unequal

Variances

---

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	818.7843137	820.4782609
Variance	1083.452549	1025.63555
Observations	51	69
Hypothesized Mean Difference	0	
Df	106	
t Stat	-0.281900227	
P(T<=t) one-tail	0.389284824	
t Critical one-tail	1.659356034	
P(T<=t) two-tail	0.778569649	
t Critical two-tail	1.982597204	

---

*Social Studies*

t-Test: Two-Sample Assuming Unequal

Variances

---

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	329.1568627	330.5072464
Variance	462.694902	473.1653879
Observations	51	69
Hypothesized Mean Difference	0	
Df	109	
t Stat	-0.338337697	
P(T<=t) one-tail	0.367879773	
t Critical one-tail	1.658953459	
P(T<=t) two-tail	0.735759545	
t Critical two-tail	1.98196743	

---

**Appendix F: ANCOVA Results for Females, fails to reject**

*Math*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	380.60	1	380.60	1.59	0.21
Adjusted Error	28064	117	239.90		
Adjusted Total	28444	118			

Test for Homogeneity of Regressions

Source	SS	Df	MS	F	P
Between Regressions	749.80	1	749.80	3.18	0.077
Remainder	27314	116	235.50		
Adjusted Error	28064	117			

*Math*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	446.20	1	446.20	1.82	0.18
Adjusted Error	28665	117	245.00		
Adjusted Total	29112	118			

### Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	37.51	1	37.51	0.15	0.699
Remainder	28628	116	246.80		
Adjusted Error	28665	117			

*Reading*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	331.20	1	331.20	1.04	0.31
Adjusted Error	37151	117	317.50		
Adjusted Total	37482	118			

---

Test for homogeneity of regressions

---

Source	SS	df	MS	F	P
Between Regressions	2.90	1	2.90	0.01	0.921
Remainder	37148	116	320.20		
Adjusted Error	37151	117			

---

*Reading*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	754.20	1	754.20	2.25	0.136
Adjusted Error	39169	117	334.80		
Adjusted Total	39923	118			

---

### Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	136.90	1	136.90	0.41	0.523
Remainder	39032	116	336.50		
Adjusted Error	39169	117			

*Language Arts*

5<sup>th</sup> to 6<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	115.80	1	115.80	0.50	0.481
Adjusted Error	27127	117	231.90		
Adjusted Total	27243	118			

---

Test for Homogeneity of Regressions

---

Source	SS	df	MS	F	P
Between regressions	12.47	1	12.47	0.05	0.823
Remainder	27114	116	233.70		
Adjusted Error	27127	117			

---

*Language Arts*

6<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	442.90	1	442.90	2.39	0.125
Adjusted Error	21704	117	185.50		
Adjusted Total	22147	118			

---



Test for Homogeneity of Regressions

Source	SS	df	MS	F	P
Between Regressions	471.60	1	471.60	2.58	0.111
Remainder	21232	116	183.00		
Adjusted Error	21704	117			

*Language Arts*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

Source	SS	df	MS	F	P
Adjusted Means	137.00	1	137.00	0.54	0.464
Adjusted Error	29927	117	255.80		
Adjusted Total	30064	118			

Test for Homogeneity of Regressions

Source	SS	Df	MS	F	P
Between Regressions	418.60	1	418.60	1.65	0.202
Remainder	29508	116	254.40		
Adjusted Error	29927	117			

*Science*

5<sup>th</sup> to 7<sup>th</sup>

ANCOVA Summary

---

Source	SS	df	MS	F	P
Adjusted Means	1368.00	1	1368.00	2.62	0.108
Adjusted Error	61087	117	522.10		
Adjusted Total	62455	118			

---

Test for Homogeneity of Regressions

---

Source	SS	df	MS	F	P
Between Regressions	296.40	1	296.40	0.57	0.452
Remainder	60790	116	524.10		
Adjusted Error	61087	117			

---