COMPARISON OF PASS ASSESSMENT SCORES IN SINGLE-GENDER AND HETEROGENEOUS MIDDLE SCHOOLS IN SOUTH CAROLINA

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the EDUC 990 Course

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ABSTRACT

In response to the mandates of No Child Left Behind, (NCLB), educators across the country struggle to close the gaps between males and females. Some of the physiological differences existing between the male and female brain suggest support for single-gender instruction, which is on the rise within this country as well as other parts of the world. Using the theoretical framework based on brain research, the purpose of this quantitative study was to compare the effect of single-gender instruction on assessment results in Palmetto Assessments of State Standards (PASS) math and reading scores of public middle single-gender schools to mixed-gender schools in South Carolina. This was a causal-comparative research study because the data used came from the South Carolina's educational website with the focus on individual school report cards of the 78 middle schools which were used in this study. Mean scores from the Palmetto Assessments of State Standards (PASS) performance statistics spreadsheet in math and reading were used in determining achievement levels of single-gender and heterogeneous instruction.

Descriptors: Academic achievement, Annual yearly progress (AYP), No Child Left Behind (NCLB), Palmetto Achievement Challenge Tests (PACT), Palmetto Assessments of State Standards (PASS), Single-gender education

DEDICATION

This dissertation is dedicated to the people who have impacted my life in so many ways. To my sons Stephen and Donovan who have been my inspiration and motivation since coming into my life. To my husband Randy who supported my decision to pursue my doctorate and who continues to make unselfish sacrifices for the sake of our family. You have been my number one cheerleader since I began this portion of my journey. Thank you for being my best friend. Likewise, I am thankful for the continuous encouragement from various family members and dear friends.

Lastly, this dissertation is dedicated to the memory of loved ones who left this world all too soon: my parents, my deceased husband Steve, my brothers Paul and Wilson, and my sister in spirit Johnette. Thank each of you for the life's lessons you taught me. I am especially thankful to my mother for giving me life and for the example she was to me in my early years. Although limited in her educational achievement, she always stood behind me and supported me in my educational interests and endeavors. She was and forever will be my role-model. I still feel her love and guidance in my various journeys. How I wish you all were here to celebrate this achievement with me even though I believe you are here in spirit.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

On January 8, 2002, Public Law (P.L.) 107-110, a set of federal directives specifying that all students should be able to function academically at the basic performance level by 2014 the United States, was passed under the direction of George W. Bush. The primary focus of P.L. 107-110 Section 5131(a) (23) and Section 5131(c) became known as The No Child Left Behind (NCLB) Act of 2001 (US Department of Education, 2008). Presently, student performance on standardized tests is the primary measure used by the national government in determining an individual state's annual yearly progress (AYP). Although the federal government designed P.L. 107-110, it has been left up to each state to determine how AYP should be met. In order to receive AYP, each of the 37 objectives must be met by the state of South Carolina. The 2010-2011 No Child Left Behind Annual Yearly Progress report showed that the state only met 35/37 objectives (SCDE, 2011). To make matters worse, the achievement gap between males and females in reading, mathematics, and science has continued to grow (Vrooman, 2009). The National Assessment of Educational Progress shows that boys are lagging by one and one-half years behind girls in reading and writing. Currently, boys are marginally ahead of girls in math and science, subjects in which boys in the past performed much better than girls while the gap in reading achievement is increasing (Finley, 2011).

To address these concerns, the amendment to Title IX in 2006 provided the opportunity for single-gender education to become a public school choice. For educators looking for innovative ways to help students meet the mandates of NCLB, same-sex instruction became an option in academic subjects (U.S. Department of Education, 2008).

Prior to that time, single-gender instruction in this country had been primarily found in the private sector. With the revision of Title IX, the number of schools offering single-gender instruction began to rise.

In the United States, Belcher, Frey, and Yankeelov (2006) studied the outcome of same sex classes on classroom environment, confidence, and standardized test scores of sixth grade students at a middle school in Kentucky. The study's conclusion was that single-sex instruction offered some encouraging outcomes, but the verdict was still out on how it affected academic achievement.

Under the direction of Jim Rex, former State Superintendent of Education, South Carolina made the single-gender initiative a reality. By 2008, more than 200 single-gender programs were available in the state (Chadwell, 2008). The option of single-gender instruction is considered to be a good option because it can be put into practice within a relatively short period of time with minimum costs. Within one calendar year of being implemented, performance data can be examined to determine the needs of the students (Rex, Chadwell, Sneed, & Hefner, 2009). Early results in South Carolina schools reported an increase in student performance and an decrease in student referrals. Taylors Elementary School in Greenville, SC discipline referrals dropped from 0.36 per student in 2007-2008 to 0.06 referrals per student in 2008-2009. Seventh grade students at Whittemore Park Middle School in Conway, SC began to offer single-gender instruction in 2008-2009 and had only 4 F's compared to 50 F's from the previous year students (Rex, Chadwell, Sneed, & Hefner, 2009).

In 2009, Roberta Bondar Public School and Cheyne Middle School created a few gender classes for grade 7 in an effort to close the gap in academic performance between

the boys and girls. At Roberta Bondar, there were two classes for single-gender. At Cheyne, there was one 7 grade class of boys and two classes of girls participating in the initiative. Within one school year, the principals and instructors reported improvements in students' conduct, mind-set, and scholastic performance. The classroom teachers stated that the single-gender setting allowed them to meet the individual needs of their student which helped them concentrate and do extremely well academically. Although the initiative is not perfect, the officials there felt that it was a practical alternative in addressing the needs of some of their students because the school systems were not meeting the needs of most boys and a hefty faction of girls (Belgrave, 2010).

In South Carolina, as in numerous states, performance gaps still exist between the sexes. This is most evident in the proportion of boys and girls in grades 3 through 8 who have scored below basic competency in English language arts and mathematics on the state's annual assessment over the last four years. Examining gaps between males and females is prompting educator to look at options such as single-gender instruction. (Rex, Chadwell, Sneed, & Hefner, 2009). The goal of this dissertation was to determine if Palmetto Assessment of State Standards (PASS) results in single-gender schools differed from those in mixed-gender schools by comparing data for both types of instruction for sixth to eighth grade students attending public middle schools.

Background

The theoretical framework of this study was based on brain research in gender differences. Leading cognitive theorists such as Leonard Sax (2005) and Michael Gurian (2005) asserted differences in the brain account for the disparity that is currently seen in classroom achievement. Sax's educational learning theory focuses on the innate gender

differences in cognitive, social, and emotional development. His research centered on the development of the brain and its distinct differences in brain chemistry and performance between boys and girls. Sax's research provides the foundation for teaching methods that accommodates these differences in the classroom (Sax, 2005).

Gurian's research focused on brain research gender differences. His nature based theory states that the learning differences between the sexes exist due to how the brain is wired. His theory incorporates neuro-biology which is the biological study of the human brain and body (Gurian & Stevens, 2005).

With the evidence of disparities existing between male and female brains, it seems feasible that the following statistics may be linked to gender differences: Boys earn less than half of the A's earned in the classroom; two-thirds of learning disability diagnoses are given to males; 90% of discipline issues involve boys; males make up 80% of the dropout rate, and make up less than 40% of the college population (Gurian & Stevens, 2008).

Most contemporary literature addressing brain diversity, use of speech, development and maturation distinguish between the male and female brains and the differences in their functions. With this information, some educators presume that males and females would benefit from individualized instruction based on the differences in their learning styles and cognitive development (Finley, 2011). However, educational institutions continue to teach boys and girls jointly in the classroom and educate them as if they all learn in the same manner. These facts coupled with what is currently known about brain differences have changed the type of instruction for educational programs implementing single-gender instruction.

Problem Statement

Results from local, state, and national sources show male students' performance in the area of reading achievement has been lower than female students (McTaggart, 2009). Although researchers have considered the value of single-gender instruction in parochial and private areas, quality research centering on public single-gender education is limited (Bradley, 2009). Little existing research focuses on state assessment scores for school districts in South Carolina participating in single-gender instruction (D. Chadwell, personal communication June 24, 2010).

Research-based evidence taken from the public school community is needed to decide if single-gender education is an effective approach to increasing academic performance for middle school students (Bradley, 2009).

Purpose Statement

The single-gender initiative in South Carolina currently has 156 schools involved in this type of instruction. Although the initiative is not without drawbacks, the state's single-gender coordinator seems to exert a concerted effort to update the state's website regularly for the initiative's participants and to provide information for any educators who may be considering this as a public school option (Chadwell, 2010).

Education leaders in their efforts to enhance student performance need to make sure there are specific program goals addressed in single-sex programs before implementation efforts begin (Salomone, 2006). The aim of the research was to find out whether sixth to eighth grade performance on the state assessment PASS differed for single-sex instruction and heterogeneous instruction schools located throughout South

Carolina. The study evaluated the PASS results in math and reading, the dependent variables, and compared based on the type of instruction and student gender, the independent variables.

A causal-comparative study was conducted using archival state assessment data from 2010 which was retrieved from the South Carolina Department of Education's website. The information came from 78 middle schools' report cards and the PASS performance statistics spreadsheet in South Carolina representing single-gender and heterogeneous instruction. The question addressed in this study was: Does single-gender instruction impact the academic achievement for sixth to eighth grade middle school students on state level tests in math and reading for students receiving single-gender instruction when compared to students receiving mixed-gender instruction?

Significance of the Study

As mandated by NCLB, enhancing student performance in public schools is strongly encouraged. Identifying methods of instruction that will address students' needs is essential to the nation's educational goals of schools. In the past single-gender education existed primarily in the private school sector (Salomone, 2003). However, brain research using imaging tools confirmed that genetic brain functions based on gender play roles in differences seen in classroom achievement (Sax, 2005). Looking at gender equity through research can inform changes in current educational practices (Bradley, 2009).

In addition, there were a number of assumptions held in order for this study to be considered significant. It was assumed that careful planning was done before the program's implementation by an administrator considering a single-gender plan. There

was the rationale that each single-gender program satisfied the guidelines outlined in the 2006 version of the federal regulations, and principals were engaged in an intensive study before such an implementation (Portheroe, 2009). It was also essential that one year before the program began, parents were contacted and given the option of having their children enrolled in single-gender classrooms or remain the heterogeneous setting(Chadwell, 2010).

Education leaders should have taken special care that a single-gender agenda possessed a clearly articulated rationale and specific program goals were decided before implementation efforts began (Salomone, 2006). Single-gender classrooms should have provided an educational environment that addressed specific needs of the students. This should have been executed by educators who were able to facilitate learning among the students by understanding the biological and developmental difference among the genders (Gurian (2009); and Levine (2002)).

In the quest to give all students improved instructional experiences, recognizing distinctions in how both genders obtain information within the classroom may be prudent. Gender equity does not mean that both sexes should be provided with exactly the same things. It means that educators should provide both sexes with what they need to succeed academically (Salomone, 2006). Becoming familiar with gender research currently available may prove to be instrumental in deciding if the single-gender initiative in South Carolina is a practical means in meeting the needs of many of the state's students. If the findings support these assumptions, this study will add to the collective research and aid educators in their decision to consider the possibility that single-gender schools or classrooms may have a positive impact on the learning environment.

Research Questions

The following questions were examined in this study:

1. Is there a significant difference in sixth to eighth grade students' math achievement based on instructional group?

2. Is there a significant difference in sixth to eighth grade students' reading achievement based on instructional group?

3. Is the instructional group difference in sixth to eighth grade students' math achievement the same for males and females?

4. Is the instructional group difference in sixth to eighth grade students' reading achievement the same for males and females?

Alternative and Null Hypotheses

H1. There will be a significant difference in sixth to eighth grade students' math achievement based on instructional group.

H_0.There will be no significant difference in sixth to eighth grade students' math achievement on PASS math assessment scores based on instructional group (i.e. single-gender, versus mixed-gender instruction).

H_2. There will be a significant difference in sixth to eighth grade students' reading achievement based on instructional group.

H_0. There will be no significant difference in sixth to eighth grade students' reading achievement on PASS reading assessment scores based on instructional group (i.e. single-gender, versus mixed-gender instruction).

H_3. There will a significant instructional group difference in sixth to eighth grade students' math achievement the same for males and females.

$H_{0.}$There will be no significant instructional group difference in sixth to eighth grade students' achievement on the PASS math assessment scores based on gender (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender).

H_4. There will be a significant instructional group difference in sixth to eighth grade students' reading achievement the same for males and females.

$H_{0.}$There will be no significant instructional group differences in sixth to eighth grade students' reading achievement on PASS reading assessment scores based on gender (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender).

Identification of Variables

Single-gender instruction is defined as the provision of classroom instruction for males and females within different classrooms with the same high standards (Chadwell, 2008). The current study involved determining if instructional type and gender, the independent variables, showed a significant difference in PASS results. The two independent variables combined to create four levels, which were examined and compared in this study. They were: Male single-gender, male mixed-gender, female single-gender, and female mixed-gender instruction. The South Carolina Palmetto Assessment of State Standards (PASS) test scores, measure the students' academic performance in the content areas of writing, English language arts (ELA), mathematics, science, and social studies (Creighton, 2008b). Math and ELA (reading) scores were the dependent variables. The results from this study may help determine whether or not

performance in PASS math and PASS reading scores for students in single-gender settings differ from those in heterogeneous settings.

Definitions

The following definitions will provide an understanding of the terms and concepts used in this study.

Academic achievement: The specific measurement of educational accomplishment for each school used in this study is the percentage of students meeting the state's minimum score on the PASS test (Creighton, 2008 b).

Adequate yearly progress (AYP): Sufficient gains to meet proficient and advanced levels of performance, which each local school agency in the United States show as mandate by NO Child Left Behind (20 U.S.C. code 6322(b) 2(B) (1).

Coeducational education: The traditional, heterogeneous mixture of males and females within the same classroom and school (Bracey, 2006).

No Child Left Behind (NCLB): The Act requires states to develop assessment in basic skills to be given to all students in specified grades for states to receive federal funding for education (U.S. Department of Education, 2008).

Palmetto Achievement Challenge Tests (PACT): An accountability test used in South Carolina used to measure student performance in math, social science, English, and history from 2001-2008 (South Carolina Department of Education, 2010).

Palmetto Assessments of State Standards (PASS): An accountability test used in South Carolina used to measure student performance in English language arts (reading and research), writing, mathematics, science, and social studies from 2008 to the present (South Carolina Department of Education, 2010).

Single-gender education: Education in which males and females attend class with members of their own sex (U.S. Department of Education, 2008).

CHAPTER 2: LITERATURE REVIEW

Introduction

The focus of the NCLB reform is reading and mathematics (NCLB, 2001). Accountability for student achievement has created the need for educators at all levels to look at a variety of educational strategies to increase student learning. Many of the arguments for single-gender education are to address the apparent imbalance in subject achievements between genders (Vrooman, 2009). The differences between the sexes have ignited a lot of debate over the years. Granted, many cognitive similarities exist between male and female. Studies on the measure of intelligence support that the sexes are equal in ability. However, a number of distinctions exist between the male and female brains (Weimann, 1999). Investigations conclude that although children are unique, gender uniqueness of the brain are genuine.

Gurian and Henley (2001) speculate that the level of development is the biggest gap between the genders that students experience. Their studies led them to believe that females receive additional sensory information than males. Females on average have keener hearing and display more control over impulsive behavior than their male counterparts (Sax, 2010). Gurian and Henley (2001) suggested that males possess higher levels of spatial ability with respect to measuring, mechanical design, geography, and map reading than females do. However, females often respond more verbally than males do because they possess stronger verbal skills and rely on these abilities in communication (Bradley, 2009).

Supporters of single-gender education argue that physiological differences carry over into the classroom. Gurian and Stevens (2005) report approximately 70% of D's

and F's are received by boys. Eighty-percent of the discipline problems occur in males; 70% of diagnosed learning disabilities are males. Males lag behind by one-and-a-half years in writing and reading (females are slightly behind in math and science but to a lesser degree). Males make up 80% of the high school dropout population and 44% of college enrollees. Sax (2007) asserted that most schools have environment that are detrimental to males in the classroom. He argued the current classroom settings contribute to boys being turned off to learning and are responsible for boys not being prepared for the responsibilities of adulthood, due to such things as lack of: positive male leadership, promotion of self-discipline, and responsibility. Special education referrals and discipline referrals for males have grown disproportionately in numbers (Gurian, 2003). Studies demonstrate that boys are not as motivated about school as girls, and their attitudes are not as encouraging as females (Francis, 2000; Van Houtte, 2004).

> The crisis in male education is not unique to the United States. An international study created from a three-year study on knowledge and skills…called the Program for International Assessment (PISA)…measured reading, mathematics, and scientific literacy. In the United States, England, Canada, Australia, Germany, France, and Japan-indeed in thirty-five developed countries-girls outperformed boys in overall educational markers, the male tests results skewing the overall statistics most dramatically in the basic areas of reading and writing (Gurian & Stevens, 2005, pp22-23).

However, the gender gap is more noticeable in some subjects for females. In high school, females make up the majority of Advanced Placement (AP) examinees. However, according to the College Entrance Examination board, the number of females

taking the AP exam in computer science has remained lower than male test takers. In 2011, females counted for 20% of the AP exam computer science test takers (College Entrance Exam Board, 2011). To battle the gender imbalance in math and science, educationalists in Dallas, Texas produced a curriculum to increase female participation and performance in AP science and computer technology. As part of this endeavor, educators participated in a seminar addressing the critical needs areas. Data were examined and teachers discussed the reasons for the imbalance in their science and technology classes (Nelson& Sanders, 2004). Those participating in the seminar listed factors that may have prevented females from enrolling in their classes. These included issues such as ineffective recruiting and females being hesitant to participate actively in class. These apparent disadvantages at the expense of females caused many researchers to form the hypothesis that mixed-gender classrooms in science, math, and technology do not favor girls. The National Center for Education Research found that females were more likely to select classes and professions in math and science if their awareness was developed throughout their school experience (Padilla, 2007).

Teachers constantly make decisions that affect the learning process through their theoretical, behavioral, and subject area knowledge (Cooper, 2007). Jensen (2005) and Gurian and Henley (2001) claimed that the students' development also affect their ability to process and organize information when mastering a skill or finishing a task. Gender differences are the focus of single-gender classroom instruction in assisting students to attain success. In the same gender classrooms, teachers are encouraged to look for ways to enhance the learning environment for their students by working both sides of the brain

(Bradley, 2009). In most cases, teachers may need to adapt their teaching strategies in their classroom in an attempt to achieve this goal.

Yet, dogma still exists that the sexes learn in the same manner and can be taught in a way that guarantees equal results for both boys and girls (Gurian & Steven, 2005). Gurian and Steven (2005) assert that, "This aspect of human development is ignored, and young teachers, like young parents, are taught that being a "boy" or a "girl" is culturally insignificant in education, that basically all kids learn the same way and can be educated in a way that ensures gender-exclusive, predictable results" (p. 91).

Theoretical Framework

Brain research in gender differences supports the physiological distinctions addressed in this paper. Sax's (2005) educational learning theory focuses on innate gender differences in cognitive, social, and emotional development. His research focuses on the development of the brain and its distinct differences in brain chemistry and performance between boys and girls. He supports teaching strategies that accommodate these diversities in the classroom. Sax expressed that failure to acknowledge the diversities that exist between the male and female brain is responsible for the current educational crisis.

Michael Gurian is another researcher who has conducted brain research based on gender differences. Gurian (2009) stated that the learning differences between the sexes exist due to how the brain is wired. His theory incorporates neurobiology, which is the biological study of the human brain and body. Like Sax, his research incorporates gender differences of the brain, and the argument is given that the androgynous

classroom does not take the learning styles of boys into consideration, which has a negative impact on their academic performance (Gurian, 2009).

Simon Baron-Cohen (2003) focused on the theory that males and females have different brain types. This theory is called empathizing-systemizing (E-S) theory. Simon Baron-Cohen ascertained that the basic difference between male and female brains is the wiring. The female brain is basically wired for empathy and the male brain is primarily wired for understanding and building systems. He states that three common types of brains exist. The first type is for individuals who possess a lot of empathy, known as the female brain or the type E brain. The second brain type is the male brain, or the type S brain; it describes the ability to create systems. The third brain type refers to individuals who are equally strong in their ability to empathize and systemize; people who possess this quality have type B brains. However, the only way to determine the brain type is through testing (Baron-Cohen, 2003).

The theory of neurodevelopment by Levine (2002) suggested that neurodysfunctions in cognitive development are responsible for differences in the learning process among males and females. Levine argued that boys and girls have differences that can be seen outwardly. He expressed that each male and female is born with a mixture of strengths and weaknesses, aptitudes and problems. He urged schools to consider making adjustments for the range of intelligences they encounter between the genders instead of forcing students to adapt to classroom instruction. The typical classroom should not consist of memorization or speedy recall. He believed students should be allowed a variety of options for evaluation instead of the traditional tests that

are currently in place, and he urged educators to begin to recognize that treating students fairly does not mean all should be treated the same way.

These theories presented in support of gender differences in the brain are the basis for current research. Their impacts have begun to influence educators throughout the world. Although scientific data to support their propositions, many still argue that focusing on gender differences reinforces stereotypical views that are held about males and females. The androgynous classroom and ultimately society is still perceived to be the ideal for many, even with the surmounting evidence that gender differences should not continue to be ignored.

Genetic Differences of the Brain

The differences in how the different genders receive information continue to present new perspectives into single-gender instruction. Granted many cognitive similarities between males and females exist. Studies on the measure of intelligence support that the sexes are equal in ability. However, a number of distinctions exist between the male and female brains (Weimann, 1999). According to Jensen (2005), male and female brains develop in diverging ways because of prenatal differences. They organize information differently from the early stages of life through the formative years, which leads to the different learning preferences exhibited in the classroom environment (Sax, 2005).

According to James (2005), past research has shown that the male brain is larger than the female brain; one explanation is that the male brain contains more brain cells. Males and females have different genetic makeup. Their hormones can have an effect in the brain's rhythm, which can change how a student learns in the classroom (Jensen,

2005). Jensen argued that male and female students differ in performance on skill-based tasks, such as fine motor skills, verbal communication, and the ability to rotate shapes mentally. Cutting and Clements (2006) completed a study with 30 adult participants who were engaged. They used functional magnetic resonance imaging. For language, females showed an increase in two-sided activation in the inferior frontal gyrus when speaking. The imaging for the males showed that activation was more prominent in the left part of the brain. When the visuospatial task was conducted, the reverse pattern of lateralization also showed more activity in the left side of the male brains. Males showed more bilateral activity in the parietal lobe when they were engaged in visuospatial activities; the females showed an activation in the right lateral part of the brain when engaged in this type of task.

The study also showed that the males and females performed equally on tasks with respect to precision and timing; the biggest difference was the distinct parts of the male and female brains used in completing the tasks. Males tend to be mislabeled in the classroom with bad behavior (being impolite or insensitive) when their spatial intelligence is exhibited in the class if they take up too much work space to complete assignments. This type of behavior is often seen as disruptive and noncompliant in the typical heterogeneous classrooms (Gurian & Henley, 2001).

Researchers in gender differences have discovered that hormones impact learning. Maki, Rich, and Rosebaum (2002) suggest that elevated levels of estrogen in females negatively affect their memory. On the other hand, Neave, Meneged, and Weightman, (1999) claimed the testosterone cycle can impact boys' performance if a low level of testosterone is present. They asserted that lower testosterone levels assist males in

completing spatial tasks, but a high level of testosterone may increase the likelihood of a negative result on task completion.

Sax (2007) stated that the left hemisphere of the brain controls the hearing and touching senses in females. Hearing and touching senses develop more quickly in females than spatial vision, which develops more quickly in males. In studies of the auditory system, research shows that girls' hearing is two to four times more acute than boys' hearing. One reason is that the cochlea in males is longer, which causes the response time to take longer (Don, Ponton, Eggermont, & Masuda, 1993; James, 2007). This characteristic is believed to be responsible for females possessing a heightened sense of hearing, particularly with respect to the higher frequencies that are needed in developing speech discrimination.

Sax (2005) asserted that girls have more sensitive hearing than boys, and this difference increases with age. For instance, an adult male may speak to a female in what he thinks is a normal voice; however, her keen sense of hearing may cause her to perceive it as yelling. On the other hand, males who seem to be distracted in class may in fact just be sitting too far away to hear instruction-especially if the teacher is female. These differences will continue to increase as children grow older (Sax, 2006). Ironically, in many classrooms male students are found sitting in the back of the room where sound delivery is at a distance (Vrooman, 2009).

Blood flow to the brain. The amount of blood flow that goes to the brain in males and females is also different. Due to less blood flow, boys' brains go into what is referred to as a rest state many times each day. The more words are used, the more likely it is that they will enter into this state. Based on observational research, some boys

appear to avoid these rest states by participating in such activities as drumming their pencils or striking a peer with a paper spitball. These actions are responses by the male brain to struggle to stay awake in a classroom that may not be conducive to his style of learning. When the male becomes uninterested, some of his brain functions may shut down. This drift into the brain state may cancel out learning and academic performance. This process may explain why males seem better equipped to work with symbols, abstract ideas, diagrams, pictures, and objects moving through space. (King & Gurian, 2006)

On the other hand, females receive 15% more blood flow to the brain than do males. Single photon emission computed tomography (SPECT) scans have helped educators understand the rest states of male and female brains (Gurian & Stevens, 2005). Amen (2005) found that in positron emission tomography (PET) scans, the female brain showed more blood flow and activity in a resting state than the male brain did in the active state. This process gave researchers the opportunity to observe what parts of the brain were associated with various types of learning. Therefore, when bored, the female is able to stay more active than the male is. She is more likely to maintain the ability to take notes, write vocabulary down, and listen carefully because of the increase in blood flow she receives to the brain (Gurian & Stevens, 2005).

Cognitive processing differences. Another difference between the male and female brain deals with decision making and controlling feelings which is measured using the orbitofrontal to amygdale ratio (OAR). The Orbitofrontal is the area of the brain that is responsible for cognitive actions such as decision-making. The name of this region is derived from the location within the frontal lobes which rests above the orbits of

the eyes. The amygdala is the almond shaped region of the brain adjacent to the hippocampus, which links the cortex. It is responsible for an individual's conscious. Investigators have found that females possess a significantly larger orbitofrontal-to-amygdala ratio (OAR) than males do. These findings indicate that women may be more capable of controlling their emotional reactions than their male counterparts (Danivas et al, 2009).

Furthermore, students experiencing constant apprehension often experience difficulty in using higher order thinking skills and lose their ability to categorize, stockpile, and recover information (Jensen, 2005). Jensen further asserts "high levels of distress can cause the death of brain cells in the hippocampus -an area critical to specific memory formation. And chronic stress impairs students' ability to sort out what is important and what is not" (p. 45). A study by Yurgelun-Todd, Killgore, and Cintron (2003) found that the increases in the amygdala had connections to strengths in the areas of vocabulary, basic arithmetic and reading single words. As educators plan lessons for classroom instruction, thought can be given to the emotional effect that a lesson might have on its pupils.

Inferior parietal lobules differences. The inferior parietal lobule (IPL) is an area in the brain that is larger in males than females. This area is two-sided and is located just above the level of the ears in the parietal cortex; the left side IPL is larger in males than the right side. In females, this irregularity is reversed, although the difference between left and right sides is not as large as in men. Evidence suggests that IPL's size is linked to strong mental numerical abilities. Studies have linked the right IPL with the memory involved in understanding and influencing spatial relationships and the ability to sense

relationships between body parts. It is also related to the ability to be aware of one's feelings. The left IPL is involved with perception of time and speed, and the ability to mentally rotate three dimensional figures (Danivas et al, 2009). The right IPL in the brain processes information from senses and aid in selective attention and perception. The right IPL has also been linked with memory used in understanding and influencing spatial relationships and the ability to sense relationships between body parts (Kennedy Krieger Institute, 2006).

The hypothalamus. Equally important, the hypothalamus is another region of the brain that displays differences between the sexes. This structure is found at the base of the brain and is responsible for the body's regulating food intake and controlling sex drive (Sanderson, 2008). The preoptic area is responsible for mating behavior. It is 2.2 times larger in males than females; it also contains twice as many cells as the female counterpart. This difference becomes apparent after the age of 4. At this age, the numbers of cells in the hypothalamus for girls begin to decrease (Cahill, 2005).

Likewise, the suprachiasmatic nucleus is the second part of the hypothalamus that shows a difference between the genders. This is the area of the hypothalamus that is responsible for circadian rhythms that regulate changes in mental and physical characteristics that occur in the course of a day. The hypothalamus also controls the reproductive cycle for both genders. The only difference between the sexes is that the nucleus of the male is shaped like a sphere, and it is more elongated in females. It is theorized that the shape of suprachiasmatic nucleus is responsible for the connections made with other areas of the hypothalamus (Cahill, 2005).

Language abilities. Research has shown differences exist between the hemispheres of the brain for males and females. The left hemisphere is thicker in the female indicating that language skills are more proficient in girls. This thickness is believed to allow communication between both hemispheres of the female brain. Therefore, females have the ability to do multiple tasks while engaged in conversation because they have more synapses between their hemispheres than males. Boys tend to have to focus on one single task at a time. They deliberate best when they pursue an activity in chronological sequence. They also take more time than girls in shifting between jobs which might be perceived by teachers as being uncooperative (King & Gurian, 2006).

Moreover, high neuron activity for the male is concentrated in the left side of the brain's hemisphere. The right hemisphere is thicker in the male. The corpus callosum is thinner, and this may be why men use one side of the brain when they communicate. Males rarely express feelings in the way that females do. Males compartmentalize language in the left hemisphere and emotions in the right. This may help explain why boys and men seem to have more difficulty in expressing their feelings (King &Gurian).

Ding and Harscamp (2006) noted a difference in how males and females share ideas during problem solving in physics class. The male students expressed their opinions directly, and the female students avoided in depth conversation. Although the female students were more likely to initiate conversation by asking questions, the males usually offered clarification in their portion of discussion.

Females tend to be left-hemisphere learners who have the ability to express themselves more clearly than males. Males tend to be right-hemisphere learners who use

more visual skills then verbal skills. However, the female is able to become more competent in language proficiency because she is able to use emotions and feelings while she is retrieving vocabulary (Sanderson, 2008). This process may also account for language acquisition at an earlier age for females and longer attention spans during conversation. Females surpass males in memory tasks, associational fluency, and color naming, or listing objects that begin with a designated letter (Kimura, 1992).

The limbic system. On average, the females' deep limbic system is larger than that of their male counterparts. The limbic system is responsible for numerous functions including feelings, demeanor, long term memory, and the sense of smell. Due to the larger deep limbic brain, females have a tendency to be in touch with their feelings; they are usually better at expressing their emotions than males. Females also have an increased capacity to bond and are able to relate to others better than are males. What's more, they have a more discriminating sense of smell than their male counterparts (King & Gurian, 2006). Dalton (2002) presented research indicating that under certain situations, a female's sense of smell may be up to 100,000 times more heightened than a male's. Unfortunately, having a larger deep limbic system leaves a female somewhat more predisposed to depression, especially at times of significant hormonal changes: The onset of puberty, before menses, after having a baby, and during menopause (King & Gurian 2006).

P cells and M cells differences. Vision is another area in the sensory system which displays more gender differences. Present research confirms that the male retina is thicker than the female retina. This difference is because the male retina is made up of the larger, thicker M cells. The female retina is primarily comprised of the thinner

ganglion P cells (Salyer & Lephart, 2001). The male visual system (visual and neural) relies more heavily on type M ganglion cells, which perceive movement. Females generally have more type P ganglion cells, which are responsive to color variety and other fine sensory activity.

Since the retina is thicker in males than it is in females, males tend to have better vision than do females (James, 2007). As a result, boys tend to rely more on pictures and moving objects when they write, whereas girls tend to excel in using words describing color and other fine sensory information (Sax, 2005). In general, male students display a preference for half as much light as female students. By adjusting the lighting in the classroom, teachers may be able to determine the best type of lighting that can be utilized in an effort to improve education in single-gender settings.

Serotonin and oxytocin levels differences. The prefrontal cortex in females develops earlier than males. This development, along with their lower serotonin levels, causes females to be less aggressive than males. Because females produce the chemical at a lower level than males, they have a tendency to develop mood disorders, particularly depression (Moore, 2007). Males not only have less serotonin levels in their blood, they also produce less oxytocin which is the main human bonding chemical (King & Gurian, 2006).

As a result, boys have the tendency to be more impulsive than females. In addition, boys are naturally more aggressive and competitive than girls are (Gurian, 1996). Girls are not likely to participate in competitive learning and relationships that are characterized by what is called aggression nurturance-the hitting and playful rough

housing that boys continually engage in to support one another. The bonding chemical oxytocin greatly affects this male/female difference (Taylor, 2002).

At an early age, girls use vocabulary when playing with dolls. Because of the higher levels of this chemical in their systems, girls have the ability to form bonds with such objects; on the other hand , due to the decrease level of oxytocin in their systems, boys merely use dolls as a tool (Gurian & Stevens, 2005). As a result, oxytocin is believed to play a role in girls being perceived as pleasers in the classroom setting and boys being perceived as unwilling to comply in the same atmosphere (King & Gurian, 2006).

Spatial-visual abilities. Studies show boys' brains generally have more cortical areas dedicated to spatial-mechanical functioning than girls' brains do. This cortical ability for spatial-mechanical functioning is responsible for causing many boys to move objects through space, such as throwing balls, model airplanes, or moving their arms and legs. This ability enables them to aim more accurately at targets whether they are in motion or immobile (Gurian & Stevens, 2004). Most males are also better at navigating than are females. They tend to rely on direction, distance, and geometric shapes during navigation. Females, on the other hand, often use landmarks as guides (Weiman, 1999). They perform better on disembedding, which is the ability to find simple shapes that are hidden in a multifaceted figure (Blum, 1997).

Males do well on tests that involve rotating an object mentally (Gurian and Stevens, 2004). Psychologists at Pitzer College and University of California, Los Angeles have learned that the ability to rotate objects mentally is found in boys as young as 5 months of age. Moore (2008), an expert in the development of perception and cognition in infants, stated that he and his collaborators had not anticipated finding any

difference in infants this young; yet, the results showed that 5-month-old girls did not display the same ability as males did. Testosterone levels are believed to be a factor in spatial abilities; therefore, females with high levels of testosterone perform better on spatial tasks than those who have lower levels (Kumira, 1992).

Play and empathy differences. The idea that children are asexual at birth has been recently disputed by a professor at Concordia University. Serbin (2001) and fellow coworkers studied 77 1.5-year-old boys and girls. They discovered that the toddlers were unable to identify their gender; they were also unable to correctly recognize the gender of other children. Yet, the study revealed that toy preferences are established by this time, particularly for males. When the boys were offered a truck or a doll, they tended to choose the truck; they chose trucks over dolls more consistently than girls favored dolls over trucks. By the time they are 18-months-old ,girls are able to identify their sex by this age as well as the gender of other children. If the androgynous theories proved accurate, the females at this age ought to display a preference for "gender-typical toys" because they have a better understanding of sexual category (Sax, 2005, p. 27).

Baron-Cohen (2001) completed a study on youngsters engaged in play. The results showed that boys displayed less compassion and more egocentric behavior than the girls did. When playing in the same area, a study involving a movie player with only one eye-piece showed that boys received more than a reasonable amount of time in peering through the eye piece. The boys simply pushed the girls out of the way with their shoulder when they wanted to view the movie player. Another activity involved the use of big plastic vehicles that children ride on. The young boys often smashed into each other deliberately charging the plastic cars into the other children. On the other hand, the

girls rode more carefully and avoided crashing into others, suggesting that they are more conscientious of other riders.

The previous sections provided studies showing the differences in the six senses between the sexes. Information in brain activity, verbal skills, and overall developmental differences were addressed. Table 1 offers a summary of the sensory perception differences, verbal skills, and brain activity differences found between males and females (James, 2007).

Table 1

Sensory Perception Differences

Sensory	Females	Males
Auditory	• Ability to hear 2-4 times better than males • Able to perceive softer sounds and higher pitches • Hearing is more sensitive	• Frequently sit at the back of class • Put up with noise better • Ability to locate sound better • Often lose hearing earlier
Visual	• Favor bright lights	• Has better vision and like darker environments • Higher incidents of color blindness
Touch	• Frequently linked with feelings	• Larger tolerance for pain • Able to tolerate hot and cold better
Taste and /Smell	• Taste and smell often more sensitive • Ability to identify smells and tastes better	•
Brain Activity	• Brain at rest is more active than male's optimal level	After 10 minutes of lecture brain goes into rest mode
Verbal Skills	• Speak earlier; speech is clearer sooner • Better spellers • Neural connectivity stronger	• Neural connectivity more direct • Experience dyslexia more often

Spatial	• Spatial visualization equal to males • Perceptual speed is better	• Able to complete mental rotation of objects more efficiently • Spatial perception slightly better • Ability to better complete spatiotemporal tasks
Special Education	• 23%	• 77%
Developmental Differences	• Speaks earlier • Fine motor skills develop earlier • Develop hippocampus at younger age • Problem solving skills develop earlier • Use social support when under stress	• Gross motor skills develop earlier • Use flight or fight response due to an increase in testosterone • Recall facts better • When stressed, will stand and defend

Gender learning characteristics

No set of teaching strategies for teaching males or females is guaranteed to work in every situation. However, the evidence does support that learning differences are based in part on gender. Some researchers' findings indicate that females have a tendency to set higher standards for their classroom performance than males do (Ferrara, 2005). Consequently, they self-evaluate their performance more critically than do males. Ironically, with high standards, females often have lower self-esteems, and they are extremely critical when evaluating academic performance (Pomerantz, Alterman, & Saxon, 2002). Males, on the other hand, tend to be unrealistic in estimates of their academic performance. However, they are more concerned than females about the perception of their peers, and females tend to develop relationships that are close and personal (Francis, 2000; Gurian, 2003; Sax, 2005; Van Houtte, 2004; Warrington, Younger & Williams, 2000). Tinklin, Croxford, Ducklin and Frame (2000) found that

gender-specific study cultures had effects on academic achievement. Warrington et al (2000) concluded:

> In general, it is recorded that girls spend more time doing homework, display less disturbing behavior in the classroom and play truant less often. Girls have higher expectations of them and are more enthusiastic about continuing their studies. Boys take it easier, work less hard and are distracted more quickly. (p. 397)

The learning characteristics of both genders listed in Table 2 provide a summary of the traits females and males are more apt to display while engaged in learning. Although these traits are more evident in single-gender classrooms, they may prove to be helpful for those involved in mixed-gender instruction (Ferrara & Ferrara, 2005).

Table 2

Single-Gender Learning Characteristics

Females	Males
Comfortable with cooperative learning activities	Enjoys competition and challenges. Likes "Loud and Moving"
Enjoy open ended assignments	Enjoy quick pace assignments
Tend to report more verbally and Participate in class discussions	Enjoy quick paced assignments that can be completed quickly
Use the arts to express feelings and concepts	Use analogies based on sports or action figures when expressing concepts
Express self more through poetry and fiction	Express self more through non-fiction
Enjoy role playing or skits to summarize key concepts or previous learning	Enjoy activities that are fact-oriented and objective when summarizing a concept
Talks about activities done with parents and friends	Tendency to provide limited details about activities with parents and friends

Prefer reading assignments	Prefer math or science assignments
Prefer independent research projects	Prefer short reports
Comfortable with short answer, extended responses or verbal reasoning test formats	Comfortable with multiple test formats or true/false questions
Take academic failure personally	Identify academic failure as failure of subject
Love learning about background before concept or skill is taught	Often not interested in the story behind the concept or skill to be taught; just the facts
Enjoy informal learning arrangements	Works more effectively in formal setting
Write more when prompted to write "I feel..."	Write more when asked to write prompts with "I would like to be..."
Does better with embedded word problems	Solves word problems using spatial strategies

Research demonstrates that although children are unique, gender differences of the brain are real. Nevertheless, ideology exists that all children learn in the same manner and can be taught in a way that guarantees equal results for both sexes (Gurian & Steven, 2005). To affect student learning measurably, educators are looking at current research on the human brain and the ways in which it works and learns to determine how to implement learning strategies for academic achievement (Vrooman, 2009).

Best practices for teaching males and females are topics that have received a lot of attention in the educational arena recently. Educators are currently faced with how to use their comprehension of physiological gender differences to create gender-specific instructional strategies that may reach all learners (Houston, 2011). Sax (2006) recommended the following to classroom teachers:

1. Tap into visual spatial strengths. For math, use Legos, blocks, and Lincoln Logs into the lessons. In language arts, students can map their own filmstrip to make predictions of the book's ending.

2. Allow time for movement. Build physical movements into lessons when possible. Active students, especially boys, may need breaks built into the day. Activities such as standing up, stretching, and walking around may prove beneficial. For example, when teaching an English lesson on punctuation, the class can stand up and act out a period, a question mark, exclamation points, or a semicolon.

3. Use hands-on materials. Students need to be given the opportunity to show how they learn in a variety of ways. Instead of writing the letters of the alphabet, students can use modeling clay to make them.

4. Incorporate technology. The use of computer-based education can be used to get boys involved in learning at all grade levels. Computer learning games, internet research time, and cyber hunts are some examples of utilizing technology in the classroom effectively.

5. Provide male role models. To balance the female influence, fathers can be invited into the classroom and male guest speakers from the community can be used regularly. High school boys could be a good source of tutoring for the younger boys who are struggling academically.

6. Allow opportunities for competition. Some students flourish from the energy of academic competition. Studying contests, spelling bees, geography bees, math competitions, and brainteasers can be great ways to spark learning.

7. Choose books that appeal to boys. Nonfiction reading is a great way to capture a boy's interest. Boys tend to like books filled with interesting facts and information. Remembering their interests when planning lessons is especially important. For example, if the topic of earthquakes sparks an interest, move onto tidal waves.

8. Above all, create a supportive classroom environment**.** Teachers should create classes that are safety zone for students. The classroom can be a place where students do not have to put false fronts. Teachers can establish an environment of respect that encourages boys to let their feelings show, to feel safe to make mistakes, and girls to speak out and show confidence and take risks (p. 195).

Related Literature

This section presents studies conducted internationally and within the United States examining single-gender instruction, the studies have provided varied results. Some studies support same-sex instruction while other studies present evidence that single-gender instruction has no positive impact. Still other studies do not produce evidence to support or refute the impact of single-gender education.

Warrington and Younger (2001) assessed the value of single gender instruction on improving the academic accomplishments of boys and girls. The study took place in England where the instruction was only done for core subject areas. The researchers examined attitudes through staff and student interviews and parent questionnaires. The results indicated that parents and student believed that same sex classes offered the students several advantages, and the school should continue to offer single gender

instruction. The expressed felt that single-sex classes had apparent advantages for girls, but the view was not the same for boys.

The results showed that most of the participants in the survey believed single-gender instruction created surroundings that decreased harassment and humiliation, shielded them from distractions of the opposite sex, boosted confidence levels, and promoted student engagement. Conversely, the investigation showed that teachers did not adjust their teaching based on gender needs. Based on these findings, Warrington and Younger (2001) suggested that single-sex education can only increase academic accomplishment when educators recognize the difference in learning styles of girls and boys.

The Moten Elementary School in Washington, D.C. began offering single-gender instruction in 2001. Moten, which is located in one of Washington, D.C.'s poorest residential areas, ranked near the bottom of the school district's achievement list prior to the implementation of single-gender education. The results of the Stanford 9 mathematics test showed that the passage rate increased from 49% the previous year to 88 % during the first year of implementation. The reading scores passage rate increased from 59% to over 92%. Discipline referrals were dramatically reduced. At the end of the study, Moten ranked with some of the top public and private schools in the district with respect to achievement and discipline (Gillis, 2005; Single-Gender Education, 2003).

In 2002, Benjamin Wright the principal at Thurgood Marshall Elementary, a low performing school, divided genders due to discipline issues and low performing male students. Before the students were separated 30 students, 80% male, were sent daily to the office for discipline reasons. Once the students were separated by gender, the results

were impressive. The discipline referrals dropped from 30 a day to only one or two. Moreover, achievement on state assessments went from being 30% to 73% (Davis, 2002).

The studies on Moten Elementary and Thurgood Marshall did not involve identifying particular strategies used in the classrooms other than separating the students by gender. The literature fails to provide insight into the specific ways educators addressed the single-gender classroom. The literature summarized in these studies supporting single-gender education addresses other factors that effect student performance that warrant consideration, including attitude, motivation, teacher gender, student socio-economic status and student ethnicity (Vrooman, 2009).

Crombie and other researchers (2002) conducted research that focused on 250 students in 11th grade computer classes. The results revealed that females in single-gender classrooms had higher levels of interest in occupational aspirations and to further their education pass high school than their male counterparts. This research concluded that the single-gender design might also add to female performance in computer science. The study's findings indicated that females in the single-gender classes reported higher levels of teacher support, assurance and plans to pursue higher education than did the females in .the mixed-gender environments.

In another research effort, Wong, Lam and Ho (2002) discovered that even after controlling for previous achievement, females benefited academically from single-gender instruction in English, the sciences, and the arts. Similar findings were evident for males in the single-gender classes. The researchers found that males benefited in all subject areas tested when placed in a single-gender setting. However, it was noted that the original sample was significantly reduced when students who had previously repeated a

grade in secondary school or who had taken the graduating examinations were eliminated from the study (Wong et al., 2002).

In 2002-2003, a single-gender instruction pilot program was implemented in Paducah, Kentucky at Paducah Middle School for all sixth and seventh grade. At the end of the 9 weeks, data showed 64% of the boys increased their academic performance in math and science, while 94% of the girls improved their grades in science and 78% showed gains in math. Also, prior to the pilot program, 48 discipline referrals were issued every day. During the 9 week period, referrals had decreased to two per day (Kenning, 2002).

Shapka and Keating (2003) published their research findings from a comparative study of 85 students in single-gender females classes at the 9th and 10th grade level with 701 mixed-gender students (319 females and 382 males) at the same level. Math and science performance was the focus of the study. The results indicated that females in the single-gender classrooms showed a significant difference ($p<.05$) in their performance in math and science when compared to males and females in the heterogeneous classrooms.

Van De Gaer, Pustjens, Van Damme, and De Munter (2004) compared single-gender and mixed-gender instruction of 4,000 students, 50 classroom teachers, and 180 schools in Australia. Their results indicated that males' language achievement improved in the coeducational classroom, but their math scores did not. On the other hand, females' mathematics scores improved in the coeducational environment, but their language scores did not. Their research provides some support for coeducational instruction.

However, another Australian study that spanned 20 years provided more encouraging results in favor of single-gender education. The study, conducted by Rowe (2004), involved 270,000 students who transitioned from mixed-gender to single-gender instruction. The investigation revealed that even after controlling for student ability and other background factors, academic performance improved in the single-gender classroom. Both male and female students benefited from the single-gender environment. Specifically, Rowe found that females and males scored between 15 and 22 percentage points higher on achievement tests while participating in a single-gender program.

Herr and Arms (2004) examined the effects of single-gender classrooms on instruction at a single-sex private school at an urban middle school in California. During its implementation, the school struggled to balance the matter of high accountability with single-sex performance with its population of 1,100 students, who were primarily ethnic minority students from low socioeconomic backgrounds. Interviews with teachers and classroom observations showed that a lack of specialized training in gender-specific strategies weakened instruction. Furthermore, pressures to increase standardized test scores discouraged teachers from providing the optimal setting in gender reform. These outcomes suggested the importance of and need for teacher training in single-gender strategies.

In a pilot study by Gillis (2005), fifth grade students in an elementary school were divided by gender in mathematics class. The purpose of this investigation was to analyze student achievement after applying gender-based instruction in a suburban public elementary school. The measurements integrated performance in academic

accomplishment, attendance, and discipline. Gillis (2005) believed the results from the study would allow school and district administrators to review the study's findings on the success of single-gender classrooms and determine the future of the program.

A mixed method's design was used in the investigation. A qualitative case study was used to examine the opinions of the stakeholders participating in the single-gender classroom experience. Interviews and observations were collected throughout the school year to obtain the perceptions and thoughts of educators, parents, and students for the case study. A quantitative analysis was used to determine the effect of single-gender classrooms on the academic performance of the fifth grade mathematics' students. A pretest-posttest design was used for the outcomes from the control group (fourth grade coeducational class) and treatment group (fifth grade single-gender mathematics' class). A paired samples *t* test was used to analyze statistical significance of the difference, if any, between fourth and fifth grade scores as well as male/female discipline referrals (Gillis, 2005).

The findings of this study indicated that students maintained a daily average attendance rate of 96.7% during the fifth grade, with the district's average being 95.6%. The most noteworthy findings in the study came from the discipline section of the research. Based on the data, the students in the single-gender program were better behaved than were the students in the fourth-grade mixed-gender classrooms. The behavior did not differ from the fifth-grade single-gender classes. Although the study showed there was no significant difference in the academic performance, the other areas of study did provide sufficient data. Thus administrators decided to continue with the program for the next school year (Gillis, 2005).

Mael, Smith, Alonso, Rogers, and Gibson (2005) reviewed single-gender research studies conducted by the United States Department of Education. The meta-analysis consisted of 40 quantitative and four qualitative studies that examined academic achievement in the single-gender environment compared to the coeducational environment. Nine of the studies in this meta-analysis focused on high school programs that used achievement tests to assess single-gender education's effect on educational achievement. Four of the nine studies provided support for single-gender education for females while results from three studies showed an increase in academic success for males. One study reported null findings (Mael et al. 2005).

In the same meta-analysis, Mael and fellow researchers (2005) found that two out of nine studies that used subject assessments to evaluate academic achievement supported mixed-gender education. For the 14 studies designed to examine results in math achievement, eight provided null results, and two studies supported teaching math in the mixed-gender environment (Mael, et al. 2005). Lastly, in the 10 studies for which science was used as the measure for academic achievement, five showed no significant differences between the single-gender and mixed-gender setting (Mael et al., 2005).

The American Institutes for Research for the U.S. Department of Education (2005) reviewed over 2000 quantitative research studies on single-gender instruction. The researchers narrowed the studies down to 33 studies with reliable information. The American Institutes for Research found some support for the argument that single-gender education is beneficial; limited findings existed to indicate that single-gender education could be harmful or that coeducation classrooms are more beneficial. Ultimately, the

American Institutes for Research concluded that not enough evidence of benefit or harm existed.

Belcher, Frey, and Yankeelov (2006) studied the consequence of same sex classes on classroom environment, confidence, and standardized test scores of sixth grade students at a middle school in Kentucky. The researchers found that students felt that single-sex classrooms were more orderly and more conducive to learning. They also stated that participants were more attentive and self-esteem increased in the single-gender setting. However, the data showed no considerable differences in academic achievement, as measured by the state's standards. The study's conclusion was that single-gender instruction offers some encouraging outcomes, but the verdict is still out on how it impacts academic achievement.

Thorn (2006) conducted a dissertation study in which she compared the level of academic achievement in single-sex classes and coeducational classes at a middle school. Based on the study data, Thorn asserted that single-sex education facilitated academic achievement in reading/language arts and math for both males and for females in regular education classes. However, there were no significant differences in achievement for males and females enrolled in special education.

Kniveton (2006) conducted research involving 68 students (33 males and 35 females) voluntary participants. The study investigated sex and achievement as they related to students working alone or in pairs. All of the participants were from coeducational schools. Student success was compared in several combinations: Paired coeducation, paired single-gender, male working independently, and female working

independently. The results showed no significant differences between mixed-gender or single-gender pairing on language arts.

Bracey (2006) focused on a study at the San Francisco 49ers Academy. The academy was initially created to help improve male students' academic performance in an effort to decrease the crime rate in a San Francisco district. Any positive effect to the school on behavior might provide cause to continue with the initial charter. However, the single-gender academy did not produce high academic results (Bracey, 2006). For reading on the California Standards Test, only five percent of the males scored at or better than the proficient level, and only three percent of the females scored at or better than the proficient level. This trend was consistent when the students took the California Achievement Test; only six percent of the students reached the 50th percentile in language arts and 18% reached the same level in math **(**Bracey, 2006).

Daly and Defty (2006) conducted a study on the effect of single-gender instruction in English, mathematics, science, social studies, and writing in British high schools. After analyzing the performance data, the results showed no significant gains for middle and upper class students. However, the results for African and Hispanic students from low income and working-class homes were positive and showed significant gains on all performance tests. The findings were true for both male and female, with the results being almost one year higher than students with similar demographics in the coeducational programs.

The National Association for Single-Sex Public Education (NASSPE, 2007) collected data on single-gender programs throughout the United States to determine the effectiveness of single-gender instruction on academic performance. At Andersen Junior

High School in Arizona, achievement test scores suggested that the single-gender format does help increase student achievement. Students in the all-females class scored about 11% higher than the females taught in the heterogeneous classroom during the first year of the program's implementation. The fact that all classes in the study shared the same instructors and resources added credibility to the findings. Even though all students were not grouped randomly, most assignments to class were random (A small percentage of the students were group based upon teacher or parent input). Similar evidence was found for the males in the all-male class. Students in the all-males class scored an average of 5% higher than males in the heterogeneous classroom during the first year of implementation (NASSPE, 2007).

Studies conducted at Black Mountain Middle School in California and Clarksville Middle School in Indiana provides additional support for single-gender instruction (NASSPE, 2007). Based on grade point averages, there was academic improvement for students receiving science single-gender instruction. The science grade point average (GPA) of males receiving single-gender instruction was 3.22 compared to the 2.44 GPA for males in mixed-gender classrooms. The science average for females in single-gender classroom had a GPA of 3.67 compared to 3.05 for females receiving heterogeneous instruction. In addition, Clarksville Middle School showed improvement in academic achievement after just one year of single-gender instruction. Before implementing single-gender instruction, only 35% of the males and 54% of the females passed the state's standardized test. One year after single-gender implementation, the passage rates increased to 53% for males and 69% for females (NASSPE, 2007).

Wills (2007) evaluated the possible benefits of single-gender instruction, focusing on males. In a qualitative study based primarily on observations, students in the fifth and sixth grade were observed in single-gender and mixed-gender environments. The findings led to a grounded theory which states that students in a coeducational educational setting have an inclination to gather into groups in the classroom where one dominates the other (Wills, 2007).

This grouping often leads to rivalry and aggression between the groups which are made worse by the instructors' efforts when they try to dissuade the negative behaviors. This division of the group hinders learning. On the other hand, in a single-gender setting, learners do not feel inclined to compete for attention and acknowledgment. Instead, they develop a sense of dependence on each other and a unified atmosphere is cultivated. Nonetheless, actions that promote contests are encouraged within the learning atmosphere and may be able to facilitate instruction (Wills, 2007).

A longitudinal study performed by Gibb, Fergusson, and Horwood (2008) involved 940 people born in Christchurch, New Zealand in 1977. The study looked at the effects of single-gender and heterogeneous education from birth to age 25 on the gap in educational achievement based on gender. The cohort followed from birth, four months, one year, and yearly intervals after that to age 16, and again at ages 18, 21, and 25. The data gathered used various methods: Semi-structured interviews with participants and their parents; teacher assessments; and standardized testing. The schools included a mix of public and private schools. The schools were either single-gender or heterogeneous settings. When the participants reached 14, 15, and, 16, the type of high school they attended was documented. Those who attended both single-gender and coeducational

programs were not included in the study. The participants were grouped into two categories according to the type of education received during the three-year period.

After the variables such as IQ and socioeconomic status were controlled Gibb, et al., and (2008) discovered significant differences between single-gender and heterogeneous schools in the gender gap with respects to achievement. At heterogeneous programs, there was a statistically significant gap favoring females, while there was a no significant difference favoring females for those who received single-gender programs. The results of this study showed that single-gender instruction may be instrumental in decreasing male disadvantages in educational accomplishment.

Under the direction of Jim Rex, State Superintendent of Education, the South Carolina Department of Education (2010) made the single-gender initiative a reality. By 2008, more than 200 single-gender programs would be available in the state. The pressure was on for single-gender programs to show that academically they have more benefits than their co-educational counterparts (Salomone, 2003). To ensure this initiative would work, Rex appointed David Chadwell to be the state's single-gender coordinator for South Carolina. Mr. Chadwell became the first coordinator of this type in the nation. To address the needs of students in single-gender programs, the state's Office of Public School Choice: Single-Gender Education began to offer assistance to schools and districts in producing, executing, and assessing the single-gender public school choice. Under Chadwell's direction, the Office of Public School Choice began to provide administrative planning, staff training, presentations, classroom observations, teacher meetings, and parent presentations. The state's website created a single-gender link

which offered workshops, newsletters, and online workshops for educators statewide (D. Chadwell, personal communication June 24, 2010).

Additionally, the state started to gather data in the form of surveys from the program's participants beginning in the spring of 2008. The South Carolina Department of Education (2010) single-gender survey showed encouraging results of the attitudes of students, teachers, and parents on their perceptions towards single-gender education. A qualitative study was conducted in May of 2010 to investigate the attitude and opinions regarding qualities that contribute to success in school as they are addressed in single-gender classes. Surveys were provided for grades Kindergarten through ninth grade for all single-gender classrooms. All of the survey forms for students, parents, and teachers asked them to specify their opinions regarding the way students think, behave, and feel regarding themselves and their performance in their classes.

The parents responded favorably and gave the highest percentage of positive levels among the three groups. Female students, parents of females, and teachers of females, gave positive responses at a higher percentage level than male students, parents of males, and teachers of males. African American students (both males and females) and their parents gave positive responses at higher percentage levels than European American students and their parents (SC Department of Education, 2010).

Hilliard and Liben (2010) completed a two week study in the Southwest on how low and high gender salience effects gender bias in preschool settings. The participants were 57 children ranging in age from 3to 5 years. The children were from two preschools, each program had approximately the same number of boys and girls. Most of the participants were European American from middle-class families. The children who

were immersed in high salience gender vocabulary for two weeks displayed more gender biased than the children who were in the low salience groups. Although the study provided this negative finding, the results of the study showed that there was no significant difference in how the children rated same-sex peers.

Houston (2011) completed an ex post facto research study of 15 middle schools in South Carolina addressing the impact of single-gender instruction in the state. The study compared student performance for students in grades sixth to eighth. Data from heterogeneous programs (2006-2007) and single gender education environments (2007-2008) were analyzed to determine differences in the areas previously mentioned. More than 50% of the students received subsidized meals in 13 of the 15 middle schools in this study. The school size varied among the 15 schools. One middle school contained fewer than 300 students, eight middle schools had from 300–500 pupils, two middle schools had from 501-700 students, one middle school had from 701-900 students, and three middle schools had more than 900 students.

An alpha level of .05 was set as the measure for the level of significance. The paired samples *t*-test for grades 6, 7, and 8 showed no significant differences, indicating that student performance on the state's Palmetto Achievement Challenge Test in English and Language Arts and math for the heterogeneous school year (2007) was not statistically different from student performance on Palmetto Achievement Challenge Test ELA and math for the single gender education year (2008). Thus, academic performance for males and females showed no considerable difference between the learning environments. However, the outcomes from this study represent only one year of performance.

Summary

Gurian (2007) suggests that it is important to notice differences and understand the internal development of each child. It includes understanding how boys and girls innately problem solve whether they are at home, in the community or at school (Vrooman, 2009). Physiological differences of the brain play key roles in cognitive abilities, speech development, and behavior in males and females. With research continuing to support these noted differences, educators need to reevaluate teaching methods that are currently used in classroom instruction grows (Sax, 2005).

As children grow older, gender differences continue to be noticed both inside and outside of the classroom. Sax asserted, "Girls and boys play differently. They learn differently. They fight differently. They see the world differently. They hear differently" (Sax, 2005, p.28). These findings have stirred a renewed interest in single gender education within the current school system. According to Sax (2005), ignoring differences between the genders has created problems within the classroom. Physiological differences of the brain play key roles in cognitive abilities, speech development, and behavior in how males and females perform in the classroom.

The various studies presented in the literature review show marked differences. Some studies have shown that there are no significant differences in the ways boys and girls learn (Datnow**,** 2005). When specific skills are identified, important differences can be established. Spatial skills are the strongest male advantage, whereas language use is the strongest female advantage (James, 2007).

Cuizon (2008) argued that heterogeneous instruction offers the same learning experience to both male and female students. Critics of single-gender programs refer to

gender stereotypes and disparity of the teaching profession as reasons why single-gender schools should not exist in the United States public school system. Cuizon also asserted that disapproval of single-gender instruction may be responsible for negative preconception against those in such educational settings. However, McNeil (2008) asserted that the movement in separating genders was the result of the need to improve research data in addressing educational needs of students. By separating males and females, students of both sexes may be able to improve academically because they will be taught according to their different learning styles (McNeil, 2008).

Although current studies offer conflicting results, the fact remains that not all girls are alike and all boys are not the same ; enough data support the need for educators to look at instruction with a different approach. Although gains have been made for girls, there is overwhelming evidence that shows it is not working for the majority of our boys. With research continuing to support these noted differences, a need for instructors to reevaluate teaching methods that are currently used in classroom instruction grows. Revaluating teaching methods may lead to more educators taking a look at these differences and possibly implementing constructive classroom changes that may have the potential to improve and promote learning for all students. In examining results from standardized tests from selected middle schools, this study was an attempt to determine the effectiveness of the single gender initiative that is currently in South Carolina.

CHAPTER 3: METHODOLOGY

Introduction

With the passage of P.L. 107-110 Section 5131(a) (23) and Section 5131(c), better known as The No Child Left Behind (NCLB) Act in 2001 (US Department of Education, 2008), reauthorizations and emphasis on accountability have impacted state performance across the country. Success in student test scores has become not only a measure of what students can do, but it has become a measure of teacher performance as well. Furthermore, school administrators are now held responsible if the academic success of the total student body does not meet the standards outlined by NCLB (U.S. Department of Education, 2008).

Although single-gender education is not a new idea, it exists today in a new format based on mandates from NCLB which included a stipulation to relax the restrictions of Title IX regarding same sex education. Those opposed to same- sex instruction have responded by arguing that a lack of convincing research supporting single-gender instruction is lacking, and the proposed revisions are based on the aspiration to make available to public education the same instructional flexibility exercised by private schools. However, supporters of same sex education have asserted that separating the sexes, during middle grades will reduce classroom disruptions permitting an increase in time on assignments. Supporters also assert that teachers will employ instructional strategies that address the diversity in learning styles between males and females when engaged in single gender instruction (James, 2009).

In an effort to achieve the directives dictated by NCLB, the former State Superintendent of Education for South Carolina Jim Rex implemented the single gender

program in 2007. South Carolina has 156 schools participating in single gender instruction which is currently more than any other state; there are 56 middle schools with single-gender programs. Because interest within South Carolina to incorporate single gender instruction is growing, the purpose of the inquiry was to determine if single gender education is a viable option for public school choice. PASS math and reading assessment scores in 2010 compared public middle school single-gender programs academic performance with heterogeneous public middle school programs. This chapter serves to describe the design, questions and hypotheses, participants, setting, instrumentation, procedures, and data analysis involved in this study.

Research Design

Causal-comparative research was chosen for this study. The causal-comparative design was appropriate because the focus of the study was the effects of a preexisting on learning (Gall, Gall, & Borg, 2007). Retrieving information from the state's archival records located on the South Carolina educational website was used to determine whether utilizing gender-inclusive and heterogeneous classroom instruction showed major differences in sixth to eighth grade student performance on the state's standardized tests in PASS math and PASS reading. The causal-comparative design best fit the needs of this investigation because the research involved the use of archival data in comparing groups that received different treatments-single-gender and heterogeneous instruction (Trochim, 2005).

The graphing unit of analysis for this study is schools. As a consequence, no individual data is included in the analyses. The outcome variables are school-level means on PASS tests in math and reading. Each school has separate means for male and

female students. Thus, student gender is school-level within-subjects variable. Each school is classified as either mixed-gender or single-gender. The instructional type is a school-level between-subject.

The study evaluated the Palmetto Assessment of State Standards' assessment (PASS) results in math and reading, the dependent variables, and compared them with the type of instruction and gender, the independent variables. The PASS is the state's current assessment used for grades 3to 8 in South Carolina which includes tests in five subject areas: Writing, English language arts (reading and research), mathematics, science, and social studies. These test results have been used for state and federal (No Child Left Behind) accountability purposes. The results from the 2010 data were used to assess the academic performance for math and reading of sixth-eighth grade students participating in the single gender initiative and their mixed-gender counterparts.

The Analysis of Variance (ANOVA) was chosen to conduct the main analyses because ANOVA has the capacity to compare more than two treatments or populations (Field, 2009). The within between ANOVA used in this study showed the effect a four level independent (type of instruction and gender) had on the dependent variable (assessments). The data were examined using the PASW (formerly SPSS) computer program. The analyses examined differences in the sixth to eighth grade PASS reading and math scores between single-gender and mixed-gender schools located throughout the state.

Questions and Hypotheses

This study posed the following research questions:

1. Is there a significant difference in sixth to eighth grade students' math achievement based on instructional group?

2. Is there a significant difference in sixth to eighth grade students' reading achievement based on instructional group?

3. Is the instructional group difference in 6th to 8th grade students' math achievement the same for males and females?

4. Is the instructional group difference in sixth to eighth grade students' reading achievement the same for males and females?

Alternative and Null Hypotheses

This study posed the following alternative and null hypotheses:

H1. There will be a significant difference in sixth to eighth grade students' math achievement based on instructional group.

H_0.There will be no significant difference in sixth to eighth grade students' math achievement on PASS math assessment scores based on instructional group (i.e. single-gender, versus mixed-gender instruction).

H_2. There will be a significant difference in sixth to eighth grade students' reading achievement based on instructional group.

$H_{0.}$ There will be no significant difference in sixth to eighth grade students' reading achievement on PASS reading assessment scores based on instructional group (i.e. single-gender, versus mixed-gender instruction).

H_3. There will a significant instructional group difference in sixth to eighth grade students' math achievement the same for males and females.

$H_{0.}$ There will be no significant instructional group difference in sixth to eighth grade

students' achievement on the PASS math assessment scores based on gender (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender).

H_4. There will be a significant instructional group difference in sixth to eighth grade students' reading achievement the same for males and females.

H_0. There will be no significant instructional group differences in sixth to eighth grade students' reading achievement on PASS reading assessment scores based on gender (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender).

Participants

The use of the archival data on the state's PASS assessments in math and reading was beneficial in obtaining the appropriate sampling population. Following the federal guidelines, the enrollment for the single-gender programs was voluntary and each school had to make heterogeneous instruction available for parents who did not want their children participating in the initiative. The sampling population came from the 56 middle schools that incorporated the single-gender initiative in their classrooms since 2007 and middle schools that continue to offer mixed-gender instruction, totaling 78 schools.

A random number generator was conducted using a TI-84 graphing calculator. To ensure a confidence level of 95%, the confidence interval of 8.6% was established for the simple random sample using the online sample size calculator from Creative Research Systems (2011). Based on the simple random sample, 39 schools were used as the

sample size for each instructional type in order for the study to be representative of the entire state.

Once the single-gender schools were randomly selected, heterogeneous schools with similar demographics within the same school district, county, or neighboring county were matched according to their overall population, gender population, ethnicity, free/reduced meals, and AYP status. They were selected using the same process described above for the single-gender programs.

The single-gender programs engaged in single-gender teaching strategies ranged in population from 128 to1270, totaling 25,222. The female population totaled 12,145 and the male population totaled 13,077 for the single-gender schools used in this study. The ethnic populations for the single-gender schools were: European American 12,566, African American 11,139, Hispanic 1037, and Other 466. The free and reduced meal population for the single-gender population ranged from 0 to 694 (South Carolina Education Bug, 2009).

The mixed-gender school populations ranged from 149 to 1,159, totaling 24,301. The female overall population was 11,752 and the male population was12,549 for the mixed-gender schools used in this study. The ethnic population s for the single-gender schools were as follows: European American 14,824, African American 7843, Hispanic 1,134, and Other 535. The free and reduced meal population for the mixed-gender population ranged from 88 to 503 (South Carolina Education Bug, 2009).

Table 3 contains female demographic data for mixed-gender schools used in this study.

Table 3

Female Data for Mixed Gender Schools

Mixed Gender School	Total Enrollment	Free/ Reduced Meals	Female Enrollment Grades sixth to eighth	% Females Passed Math	% Exemplary Math	% Females Passed Reading	% Exemplary Reading	AYP
1	222	214	106	30.5	5.7	37.1	12.4	3
2	508	147	239	42.7	39.7	32.8	52.2	4
3	527	351	247	44.8	10.8	46.2	22.4	4
4	402	252	215	42	34.3	36.2	43.5	3
5	921	342	397	46.9	35.5	36.5	45.3	5
6	906	430	441	43.1	26.3	36.4	39	3
7	654	409	291	40.7	26.7	31.5	32.6	3
8	458	355	214	42.5	26.5	34	32.5	3
9	328	247	154	38.5	11.5	32.4	24.3	3
10	992	134	486	33.6	57.7	23	65.1	5
11	904	380	446	42.7	42.2	34.6	44.9	4
12	1,159	298	569	36	49.8	25.8	61.1	5
13	885	400	447	40.6	39.7	31.1	51.3	4
14	184	161	94	56.2	5.6	41.6	15.7	3
15	1,001	373	506	30.6	41.4	25.7	51.6	4
16	814	411	393	39.2	38.4	35.4	43.7	3
17	296	171	139	50.4	27.5	38.9	38.2	3
18	567	437	291	44.6	8.2	39.6	23.2	3
19	1,043	572	502	37.9	44	29.1	53.1	4
20	405	297	206	43.9	20.9	38.8	29.1	3
21	149	88	77	40.8	26.3	31.6	30.3	3
22	1,047	163	490	43.8	42.1	30.9	59.6	5
23	581	308	244	42.6	23.8	34.1	39	4
24	261	119	128	49.6	32	36	40	5
25	354	326	174	34	6.3	34	13.2	1
26	382	317	176	43	13.3	38.2	20.6	3
27	781	286	365	33.1	43.7	27	56	5
28	587	387	294	39	24.2	24.5	44	3
29	664	437	307	46.2	18.8	40.4	32.1	3
30	632	503	303	38.4	11.1	31.8	23.9	3
31	393	195	196	38.6	26.1	31	41.3	3
32	612	285	303	48.3	24.5	33.6	42.7	3
33	741	321	346	42.9	45.3	35.6	48.3	5
34	810	376	424	47.6	20.2	35.8	40	3
35	553	201	276	36.9	46.5	31	52.8	4
36	992	134	486	33.6	57.7	23	65.1	5
37	708	328	350	44.7	24.5	33.5	42.3	3
38	685	456	345	44.7	22.2	39.6	32.7	3
39	261	119	128	49.6	32	36	40	5

Table 4 contains female demographic data for single-gender schools used in this study.

Table 4

Female Data for Single Gender Schools

Single Gender School	Total Enrollment	Free/ Reduced Meals	Female Enrollment Grades sixth to eighth	% Females Passed Math	% Exemplary Math	% Females Passed Reading	% Exemplary Reading	AYP
1	300	279	139	24.8	3.6	26.3	8.8	1
2	514	325	237	45.2	24.1	40.4	30.3	3
3	594	238	302	38.3	38.3	32.4	47.4	4
4	386	346	182	31.5	7.9	32.7	8.5	1
5	1,051	656	504	42.8	16.5	39	32.2	3
6	1,064	328	521	40.7	42.9	33.9	49.6	5
7	680	415	383	31.8	32	29.8	39.8	3
8	339	279	150	42.4	22.2	35.4	26.4	3
9	142	126	63	56.9	17.2	50	25.9	3
10	961	351	483	37.5	49	33.2	51.2	5
11	998	782	486	43.6	18	39.3	25.8	3
12	1,238	684	665	36.2	37.5	29.3	45.3	4
13	1,052	292	522	40.2	47.1	29.1	58.4	5
14	272	134	124	43.8	17.4	39.7	32.2	3
15	1,138	466	554	38.9	31.9	31.9	44.6	3
16	1,279	576	639	40	30.4	35.5	42.7	4
17	363	233	175	39.8	16.8	42.9	23.6	3
18	853	432	430	38.5	33.1	31.1	46.7	4
19	1,113	694	556	41.1	24.2	34.5	32.1	3
20	458	314	239	38	30.1	34.5	31	3
21	180	120	97	53.9	13.5	38.2	22.5	3
22	1,083	403	506	48.6	26.7	35.6	46.3	4
23	540	511	249	35.8	10.6	33.9	16.5	3
24	303	0	159	38.6	51	23.5	69.3	5
25	367	265	195	47.9	26.3	37.9	24.7	3
26	378	204	174	60.8	20.5	45.8	39.83	3
27	703	371	323	47.9	18.8	40.9	39.6	3
28	548	371	378	46.8	23.8	34.9	37.9	3
29	534	346	248	49.8	34.3	41.4	44.4	4
30	604	288	306	45.2	33.3	35.5	41.3	3
31	492	466	219	39.6	7	32.6	11.8	1
32	574	430	284	43.2	12.9	40.4	21.3	3
33	712	370	342	50.5	20.7	37.5	36.8	3
34	763	447	435	46.7	15.8	37.6	30	3
35	500	289	249	39.8	30.9	5.6	31.9	3
36	906	430	441	43.1	26.3	36.4	39	3
37	799	371	411	43.8	35.6	37.7	45.5	4
38	524	135	256	37.7	26.8	36.8	30.7	3
39	236	164	102	40	29.5	32.6	34.7	3

Table 5contains male demographic data for mixed-gender schools used in this study.

Table 5

Male Data for Mixed Gender Schools

Mixed Gender School	Total Enrollment	Free/ Reduced Meals	Male Enrollment Grades sixth to eighth	% Males Passed Math	% Exemplary Math	% Males Passed Reading	% Exemplary Reading	AYP
1	222	214	116	31.5	1.8	18.9	3.6	3
2	508	147	269	38.4	36.8	31.4	46.1	4
3	527	351	280	41.6	13	35.7	25.9	3
4	402	252	187	39.4	30.9	32	35.4	3
5	921	342	524	41.5	36.2	37.2	35.8	5
6	906	430	465	35.1	31.6	33.3	37.4	3
7	654	409	363	36.5	31.5	32	31.5	3
8	458	355	244	41	20.9	31.2	25.6	3
9	328	247	174	34.1	13.2	28.1	21	3
10	992	134	506	31.1	58.6	29.3	53.5	5
11	904	380	458	39.9	43.2	34	42	4
12	1,159	298	590	35.7	47.4	27.5	54.5	5
13	885	400	438	33.3	41.9	26.2	43.6	4
14	184	161	90	37	6.2	35.8	8.6	3
15	1,001	373	495	29.4	40.1	29.3	43.3	4
16	814	411	421	40.9	32.8	36.2	34.2	3
17	296	171	157	32.4	32.4	27.7	31.8	3
18	567	437	276	38.5	10.4	34.6	17.7	3
19	1,043	572	541	37.5	38.9	32.3	36.9	4
20	405	297	199	37.9	27.4	35	30.1	3
21	149	88	72	40	38.5	40	32.3	3
22	1,047	163	557	35.5	47.4	30.1	53.3	5
23	581	308	337	37.3	30.5	30.2	34.4	4
24	261	119	133	31.8	47.3	29.5	40.3	5
25	354	326	180	27.3	3.2	31.9	10.5	1
26	382	317	206	34.9	11.1	35.4	20.1	3
27	781	286	416	32.7	46.2	28.4	50	5
28	587	387	292	30.9	30.5	25.1	40.2	3
29	664	437	367	35.8	21.5	37.1	27.1	3
30	632	503	329	34.3	13.1	31.7	20.2	3
31	393	195	197	39.4	21.8	31.4	37.8	3
32	612	285	309	41.8	27.9	35.7	36.7	3
33	741	321	395	34.2	50.8	34.5	33.8	5
34	810	376	385	44.4	21.8	30.4	41	3
35	553	201	277	33.3	47	31.5	46.3	4
36	992	134	506	31.1	58.6	29.3	53.5	5
37	708	328	358	43.7	25.4	34.1	32.7	3
38	685	456	340	37.2	23.1	29.2	26	3
39	261	179	110	34.3	1	29.2	8.8	1

Table 6 contains male demographic data for single-gender schools used in this study.

Table 6

Male Data for Single Gender Schools

Single Gender School	Total Enrollment	Free/ Reduced Meals	Male Enrollment Grades sixth to eighth	% Males Passed Math	% Exemplary Math	% Males Passed Reading	% Exemplary Reading	AYP
1	300	279	161	22.7	4	19.2	6	1
2	514	325	277	35.8	25.2	36.6	22.8	3
3	594	238	292	43.6	30.9	29.1	43.6	4
4	386	346	204	26.5	7.6	28.1	10.8	1
5	1,051	656	547	36.7	16.5	31.3	26.4	3
6	1,064	328	543	36.8	39	33.5	40	5
7	680	415	297	34	22.3	33.3	5.9	3
8	339	279	189	39.1	17.3	26.8	21.8	3
9	142	126	79	33.8	16.9	23.9	18.3	3
10	961	351	478	29.2	52.1	30	47.2	5
11	998	782	512	39.8	17.9	34.2	22.6	3
12	1,238	684	573	33.1	30.1	30.6	31.9	4
13	1,052	292	530	32.3	49.4	29.4	49.6	5
14	272	134	148	41.2	19.1	35.3	28.7	3
15	1,138	466	584	30.6	32.8	30.5	37.6	3
16	1,279	576	640	36	27.3	30	33.8	4
17	363	233	188	32.7	24	22.8	28.7	3
18	853	432	423	32.7	40.1	25.5	46.4	4
19	1,113	694	557	37.9	29.5	32.1	30.3	3
20	458	314	219	40.4	19.2	27.4	23.6	3
21	180	120	83	43.6	14.1	29.5	19.2	3
22	1,083	403	577	38	28.1	36	36.6	4
23	540	511	291	37.1	8.3	36.4	11.4	3
24	303	0	144	38.9	52.1	36.1	56.3	5
25	367	265	172	42.8	25.3	35.5	23.5	3
26	378	204	204	44.2	27.4	34.5	32.5	3
27	703	371	380	39.6	23	32.2	32.5	3
28	548	371	270	38.3	22.3	33.7	26.9	3
29	534	346	286	41.3	40.9	36.4	41.6	4
30	604	288	298	36.7	30.8	33.6	27.7	3
31	492	466	273	21.7	4.7	17.4	6.4	1
32	574	430	290	30.8	13.6	27.6	20.8	3
33	712	370	370	43.1	24.9	36.1	29.8	3
34	763	447	416	40.9	21	30.9	29.3	3
35	500	289	251	48.7	32.2	39.6	31.3	3
36	906	430	465	35.1	31.6	33.3	37.4	3
37	799	371	388	41.6	29.5	35.9	32.6	4
38	524	135	268	31.7	30.6	31	23.4	3
39	236	164	134	33.3	31	37.3	20.6	3

Table 7 contains the PASS means for males and females for the mixed-gender and single-gender schools used in this study.

Table 7

Males and Females in Mixed-Gender and Single-Gender PASS Means

School Name	ELA Female Average	ELA Male Average	Math Female Average	Math Male Average	Instructional Type
1	641.14	625.32	627.66	622.38	Mixed Gender
2	634.46	630.83	636.15	641.01	Single Gender
3	583.30	571.78	586.73	580.14	Single Gender
4	630.44	615.06	633.13	630.22	Mixed Gender
5	601.07	585.30	592.81	587.78	Mixed Gender
6	623.14	611.67	631.80	625.52	Single Gender
7	619.79	607.07	611.03	618.16	Single Gender
8	619.59	614.37	608.22	608.80	Mixed Gender
9	643.03	633.12	638.98	632.68	Single Gender
10	625.42	610.20	613.59	608.80	Single Gender
11	646.17	634.16	653.37	653.05	Mixed Gender
12	640.99	627.22	639.89	638.88	Mixed Gender
13	625.99	614.56	616.97	614.49	Mixed Gender
14	639.70	635.96	639.91	644.42	Single Gender
15	629.88	621.36	624.02	626.05	Single Gender
16	647.52	639.58	655.73	651.35	Mixed Gender
17	631.39	625.43	623.35	619.11	Mixed Gender
18	596.88	570.96	597.33	583.97	Single Gender
19	634.46	630.32	611.70	624.15	Mixed Gender
20	621.43	601.38	628.71	613.93	Single Gender
21	619.81	612.52	620.06	622.49	Mixed Gender
22	630.71	613.96	625.68	617.34	Single Gender
23	610.79	600.63	608.41	601.66	Single Gender
24	640.76	624.91	637.47	632.23	Mixed Gender
25	607.33	590.48	605.27	598.90	Mixed Gender
26	626.43	616.85	619.04	613.83	Single Gender
27	622.86	618.21	623.15	628.15	Single Gender
28	620.32	608.23	616.59	611.98	Single Gender
29	616.59	610.22	628.28	626.51	Single Gender
30	611.78	603.50	605.76	603.35	Mixed Gender
31	619.77	596.28	620.13	603.40	Single Gender
32	631.85	625.18	621.94	623.82	Mixed Gender
33	619.79	611.23	614.84	616.27	Single Gender
34	633.34	624.47	622.76	620.85	Mixed Gender
35	624.47	608.69	626.67	616.24	Mixed Gender

36	614.59	605.39	620.86	615.97	Single Gender
37	631.07	618.46	621.17	620.02	Mixed Gender
38	598.70	593.40	599.51	599.21	Single Gender
39	632.44	618.11	626.08	625.69	Mixed Gender
40	671.83	657.88	657.26	661.69	Single Gender
41	632.71	612.94	627.26	619.21	Single Gender
42	623.08	622.37	626.58	631.75	Mixed Gender
43	596.58	577.65	595.04	585.82	Mixed Gender
44	618.87	605.57	625.19	623.85	Single Gender
45	623.46	608.73	622.63	615.77	Mixed Gender
46	646.56	624.69	647.51	639.89	Mixed Gender
47	638.73	634.80	646.28	648.42	Mixed Gender
48	632.61	629.17	624.73	626.82	Mixed Gender
49	625.16	607.73	628.68	623.34	Single Gender
50	648.25	637.51	643.81	637.98	Mixed Gender
51	640.48	624.18	630.92	628.11	Single Gender
52	628.82	612.46	619.43	614.56	Mixed Gender
53	611.36	606.01	610.48	602.70	Mixed Gender
54	659.26	646.82	657.15	655.58	Mixed Gender
55	641.53	622.41	638.93	631.14	Single Gender
56	637.37	621.99	626.96	625.25	Mixed Gender
57	659.59	649.48	649.88	653.03	Mixed Gender
58	647.00	627.93	645.05	640.50	Mixed Gender
59	663.21	650.93	665.97	665.59	Mixed Gender
60	654.49	641.73	655.81	656.24	Single Gender
61	593.41	586.08	596.08	589.88	Single Gender
62	635.48	615.85	638.08	628.76	Single Gender
63	609.96	603.27	604.37	604.46	Mixed Gender
64	651.50	644.88	649.11	658.25	Mixed Gender
65	637.10	621.00	630.93	625.92	Single Gender
66	640.35	625.18	640.61	633.20	Mixed Gender
67	633.86	623.42	619.59	620.17	Single Gender
68	616.19	598.48	623.27	607.97	Single Gender
69	597.27	585.19	593.23	586.08	Mixed Gender
70	646.50	634.75	638.94	636.81	Mixed Gender
71	644.14	636.08	635.75	640.19	Single Gender
72	615.92	599.46	604.88	601.51	Mixed Gender
73	638.94	622.19	640.82	631.07	Single Gender
74	632.94	620.79	627.51	623.92	Single Gender
75	628.57	621.60	622.35	625.21	Single Gender
76	647.83	633.18	651.26	642.69	Single Gender
77	644.12	631.11	632.01	628.79	Single Gender
78	614.51	600.63	612.41	614.09	Single Gender

Setting

The setting for the study is the state of South Carolina. The data used contained school report card information for PASS assessments in reading and math of sixth to eighth grade male and female students, comparing results of single-gender and mixed-gender instruction. The PASS performance statistic spreadsheet was used to obtain the mean scale scores in math and reading. There are 46 counties in the state with a total of 1,177 schools currently serving 699,198 students. There are 626 elementary schools, 255 middle schools, and 252 high schools.

Forty counties presently are involved with the state's single-gender initiative with 64 of the 102 school districts providing single-gender education. Of the 255 middle schools, 56 offered single-gender instruction, either for all classes within their schools or the school within a school option, and 199 continued to offer mixed-gender instruction. Instruction for reading and math were based on standards that were adopted by the state. Standards are statements on the most important expectations for students learning in a specific discipline. With the standards are specific statements of the cognitive processes and the content knowledge and skills that must be displayed for students to meet the standards, which are called indicators. A reading and mathematics curriculum was also provided for public school teachers with 41 subject indicators (South Carolina Department of Education, (2008).

In addition to the curriculum, schools offering single-gender instruction included strategies specific to gender (Chadwell, 2008). The single-gender classrooms included specific gender strategies that were to be presented to the students. The heterogeneous

classrooms covered the same standards, indicators, and followed the curriculum without specific strategies implemented (Chadwell, 2008).

Before the implementation of the single-gender initiative commenced, it was essential that one year before the program began, parents were contacted and given the option of having their children enrolled in single-gender classrooms or remain the heterogeneous setting(Chadwell, 2010). The educational leaders' primary role was to ensure the single-gender agenda possessed a clear rationale and specific program goals were determined before implementation efforts began (Salomone, 2006). Careful planning was done before the program's implementation by an administrator considering a single-gender plan. There was the rationale that each single-gender program satisfied the guidelines outlined in the 2006 version of the federal regulations, and principals were engaged in an intensive study before such an implementation (Portheroe, 2009).

By understanding the biological and developmental difference among the genders (Gurian (2009); and Levine (2002), the single-gender classrooms should have provided a learning environment that addressed specific needs of its students. This should have been executed by educators who were able to assist learning for their students. There was no specific instruction or implementation provided for teachers who taught in the heterogeneous settings.

Instrumentation

The State of South Carolina uses a standards-based curriculum that is implemented in all public schools. In 1998, the state adopted academic standards for reading, writing, mathematics, and science. The State used standardized tests evaluate students' abilities in relation to these standards. These tests were the Palmetto

Achievement Challenge Tests (PACT) for grades three to eight, the End of Course (EOC) for grades nine to eleven, and the HSAP (High School Assessment Program) for grade ten. In 2001, these assessments were incorporated in the school's accountability report, which identifies low and high performing schools within the state (Creighton, 2008a).

These assessments are a part of the statewide testing program that is a part of South Carolina's overall accountability measurement under NCLB to enhance student performance. All students in grades three through eleven, including students with disabilities and limited English proficiency, are required to participate in the testing process. This testing is based on the levels outlined in Bloom's taxonomy and requires students to analyze, synthesize, and evaluate information while applying strategies to determine the correct answers for the test (Huynh, Meyer, and Barton, 2000). These measurements require students to recall previously learned information and facts that expand their level of cognition and comprehension of content. The results provide teachers, administrators, and education officials' feedback on curriculum and instructional strategies used within the classroom in an effort to meet the mandates of the No Child Left Behind Act (NCLB).

The PACT, an accountability system and a statewide test, was mandated by the South Carolina Education Accountability Act of 1998 and the federal No Child Left Behind Act of 2001 (NCLB), is a standards-based accountability measurement of student achievement used in the state from 1998 to2008 (Creighton, 2008a). Under the directive in Chapter 18, Title 59 of the 1976 Code, the South Carolina Education Accountability Act was modified in May, 2008 to provide for the development of a new statewide assessment program. Therefore, the Palmetto Assessments of State Standards (PASS)

replaced the PACT in 2009 because many educators complained the PACT took too long for results to be returned, and its report did not offer an explanation of student performance. PASS was first administered in the spring of 2009. It is currently given to South Carolina public and charter school students in grades three through eight (Creighton, 2008b). The results have been used for school, district, and federal NCLB accountability purposes.

The assessment questions used in PASS have been designed and selected by the test developers (Data Recognition Corporation, 2009) and reviewed by the South Carolina Department of Education (Creighton, 2008b). Each passage used within the PASS has been published prior to use in the test in order to substantiate its reliability. South Carolina educators and citizens are invited to join in the review process of the content administered within the state assessment by residing on a grade-level committee.

One hundred and forty-five South Carolina educators acted as expert judges who evaluated the content that students would assess. The educators also examined the levels of thinking demanded by the test items. Differential item functioning analysis was performed on test items. The results showed little or no difference in difficulty in 95% of the multiple choice items, supporting test validity. The data indicated that the PASS assessments for mathematics and writing showed very little differential item functioning for gender or ethnicity. (Creighton, 2008b)

Once the committee, the Department of Education, and test developers have reviewed the content, creation of the test begins each year (Creighton, 2008a). The study used the data results from the 2010 PASS examinations in math and reading to compare the academic performance of students in the state's single gender initiative with the

students still engaged in heterogeneous instruction. By using the data results from the state assessments, reliability and validity in this single-gender study were maintained. Objectivity was maintained because the assessments for the state consist of multiple-choice questions with closed-form responses (Gall et al, 2007). The scale scores range from 300 to 900.

The PASS comprises tests in five subject areas: English language arts (reading and research), writing, mathematics, science, and social studies. Students' performances from these assessments are based on the state standards. The subtests evaluated in this study were 2010 results for PASS math and PASS reading. The state established three performance levels to reflect the knowledge and skills exhibited by eighth grade students on the PASS:

Exemplary-The student demonstrated exemplary performance in meeting the grade level standard. On the scale score of 300 to900, a student needs to earn a score between 649-900 for reading and 657 to 900 for mathematics.

Met-The student met the grade-level standard. On the scale score of 300 to900, a student needs to earn a score between 600 to 648 for reading and 600-656 in mathematics.

Not met-The student did not meet the grade-level standard. On a scale score of 300-900, a student earns a score between 300 to 599 for reading and mathematics (Creighton, 2008b).

For the PASS 2010 results, the preceding levels were accessible in the state's archival data and were used in the study in comparing the assessment data for reading and math of students in grades 6 to8. The South Carolina Department of Education

website provided the data results from the 2010 PASS report cards in math and reading to compare the academic performance of students in the state's gender initiative with the students engaged in heterogeneous instruction. The mean scale scores used were found in the PASS performance statistics spreadsheet found on the website.

If used ineffectively, the instrumentation used could have limited the outcome. However, since the PASS is a state wide assessment for South Carolina, a standard set of written and oral instructions was provided each time the test was administered. Teachers and other test administrators also received training each year the test was administered to eliminate inconsistencies in scores promoting reliability and validity of this assessment (Creighton, 2008b).

Procedures

Once approval was received from the chair, committee, and research consultant, the appropriate forms were submitted to the Institutional Review Board before data collection began (see Appendix). Archival assessment data from 2010 were used in comparing the type of instruction. Data collection began by going to the single-gender link located on the South Carolina Department of education website which provided a list of middle schools currently offering single-gender instruction. Based on a simple random sample, 39 of the 56 state's middle schools were used as the sample size for each instructional type in order for the study to be representative of the entire state. After the random selection for single-gender middle schools was completed, mixed-gender schools with similar demographics within the same school district or county were matched with the single-gender middle school. The assessment data were retrieved from the selected middle school state report cards and the PASS performance statistics spreadsheet for

2010 using the South Carolina Department of Education website. The data were compiled into one document using the Microsoft Office Excel software program showing the mean math and reading PASS scores of sixth to eighth grade students for each middle school.

Data Analysis

The simple random sample determined that data from 39 of the state's 56 single-gender middle schools was to be used for the sample size. The data collected was obtained from 39 single-gender and 39 mixed-gender schools located throughout the state of South Carolina. Using PASW statistic software (formerly called SPSS), preliminary analyses were completed to establish if the variances were equal for both groups, and to examine both instruction type demographic differences and the normality of dependent variables. ANOVA (Analysis of Variance) was the main statistical analysis used in this study in analyzing the results in comparing single-gender education to mixed-gender instruction. The analysis involved examining differences in PASS reading and math scores between single-gender and mixed-gender schools and whether any differences were the same for males and females The analysis conducted involved within between ANOVAs in determining if a difference existed in PASS reading and math assessment scores for single-gender and heterogeneous schools. None of the schools used in the study sample were identified through their PASS results. Findings were considered significant if the p value < 0.05.

In addition to looking at the significance level of the study's alpha level, the effect size was determined in this archival investigation. Effect size is a value that shows how much the independent variable effects the dependent variable in an experimental study.

An effect size was determined after conducting an appropriate statistical test for significance (Eddy, 2010). Eta squared (η^2) was used to determine the effect size on the type of instruction of sixth to eighth grade PASS reading and math scores in single-gender and mixed-gender schools in South Carolina.

CHAPTER 4: RESULTS

The purpose of this study was to determine if single-gender middle schools demonstrated a significant difference in assessment scores on the South Carolina Palmetto Assessment of State Standards (PASS) compared to students who attended mixed-gender schools. This chapter presents information on the data collected from 39 single-gender and 39 mixed-gender schools located throughout the state. Preliminary analyses were completed (a) to determine whether assumptions of ANOVA were met by examining if the variances are equal for both instruction types as well as the normality of dependent variables and (b) to examine demographic differences between the two groups. ANOVA results examined the effectiveness of instruction and gender on student performance addressing the following research questions:

1. Is there a significant difference in sixth to eighth grade students' math achievement based on instructional group?
2. Is there a significant difference in sixth to eighth grade students' reading achievement based on instructional group?
3. Is the instructional group difference in sixth to eighth grade students' math achievement the same for males and females?
4. Is the instructional group difference in sixth to eighth grade students' reading achievement the same for males and females?

Descriptive Data

The study included 78 middle schools. This study involved comparing the PASS math and reading results for the 2009-2010 year of single-gender and mixed-gender middle school programs. The PASS mean scale scores for schools used in the

sample were obtained from the South Carolina Department of Education website. The research involved determining whether differences occurred based on student gender and type of instruction. Using South Carolina State Report Card data, Table 8 provides a statistical description of the middle school used in the sample. The schools ranged in population from 142 to 1279. The data show a broad range of ethnic groups represented in this sample. The percentage of free and reduced meals ranged from 0.0 to 96, and there was a 31 to 41% passing rate for schools that administered the PASS.

Table 8

Statistics of Middle Schools Enrollment, Ethnicity, Free Meals, and PASS Passage Rates

Variable	*M*	*SD*
Total enrollment	640.12	295.89
African American	40.50	25.02
Hispanic	4.43	4.40
European American	52.90	24.70
Other ethnic group	1.73	1.50
Free reduced meals	57.60	20.95
Females passed math	41.70	6.24
Females passed reading	34.84	5.36
Males passed math	36.43	5.15
Males passed reading	31.59	4.50

Instruction Type Differences in Descriptive Characteristics

Before the analyses were completed on the PASS math and reading results, preliminary analyses were conducted to compare the descriptive characteristics of the single-gender and mixed-gender school populations. Independent *t*-tests were conducted to identify demographic differences between the single-gender and mixed-gender

schools. Eight separate analyses were conducted in which instruction type was the independent variable and total enrollment, ethnic group enrolled, percent of each gender, and percent free or reduced meals were dependent variables. Each group contained 39 single-gender and 39 mixed-gender schools. Table 9 shows the means, standard deviations, and sizes for each demographic variable.

Table 9

Differences in Instruction Type

		Mixed Gender		Single Gender	
Variable	*n*	*M*	*SD*	*M*	*SD*
Total enrollment	39	621.97	276.60	658.26	316.58
Females Enrolled	39	48.18	2.47	48.82	2.90
Males enrolled	39	51.83	2.48	52.36	8.33
African American	39	36.23	28.11	44	21
European American	39	57	27.21	45	21.50
Hispanic	39	4.72	3.98	4.13	4.77
Other Ethnic Group	39	1.85	1.43	1.61	1.50
Free reduced meals	39	55.63	21.68	59.55	20.28

Table 10 contains the results for a *t*-test of the Equality for Means which examines whether the groups differ on demographic variables. The scores from the dependent variables indicate the groups did not differ on any of the basic demographic variables.

Table 10

T-Test for Equality of Means of Independent Variables

Variable	*t*(78)	Significance (2-tailed)	Mean Difference
Total enrollment	-.54	.60	-36
Female enrolled	-1.1	.30	-.64
Male enrolled	-.40	.70	-.54
Hispanic	.60	.56	.59
African American	-1.5	.13	-9.0
White	1.44	.15	8.0
Other ethnic group	.70	.49	.23
Free reduced meals	-.82	.41	-4.0

A similar analysis was conducted to examine AYP status. Because AYP status is a categorical variable, a different analysis was used. A chi-square analysis was conducted to examine whether AYP status differed for the two types of instruction in this sample. The results of the cross-tabulation indicate the following for the single-gender group: 7.7% were in the at risk category. 17.9% of the schools received a good rating, and 4 10.3% of the schools in the single-gender sample were in the excellent category. However, the majority of the schools used in the single-gender sample (64.1%) received an average AYP status. The results for the mixed-gender schools were: 5.1% were in the at risk category; 17.9% of the schools received a good rating, and 20.5% of the schools in the mixed-gender sample were in the excellent category. Like the single-gender data, the majority of the schools used in the mixed-gender sample (56.4%) received an average

AYP status. The Chi-square p-value indicated that the instructional groups did not significantly differ in AYP status, χ^2 (3) = 1.725, p = .631.

Normality Analyses

Prior to the primary analyses, preliminary analyses to examine the assumptions of the statistical tests were conducted. Assumptions should be met in order for the statistical tests to be valid. One of the assumptions of ANOVA is that variables are normally distributed within the type of each group (type of instruction and gender). Normality can be viewed statistically and graphically and both approaches were used in presenting the findings of this study.

Shapiro-Wilk Test

The Shapiro-Wilk test is a test of normality used when sample sizes are less than 2000. The values range from 0 to 1, with higher numbers indicating more normal scores. Values are 1 when data are normally distributed and diminish as distributions diverge from normality. Table 11 shows the Shapiro-Wilk test findings of PASS math and reading results for each school gender type. The probability value (p-value) is considered significant if the values are less than .05. Normality in the variables is not assumed if the Shapiro-Wilk test is significant. For example, the percent of females who passed reading in mixed-gender classes did not appear to stray from normality, W (39) = .98, p = .57.

Table 11

Shapiro-Wilk Tests of Normality

School Gender Type	Variable	*W*	*df*	Significance
Mixed Gender Classes				
	Female Math Average	.98	39	.537
	Female Reading Average	.98	39	.563
	Male Math Average	.98	39	.708
	Males Reading Average	.97	39	.326
Single Gender Classes				
	Female Math Average	.98	39	.574
	Female Reading Average	.97	39	.488
	Male Math Average	.97	39	.427
	Males Reading Average	.98	39	.566

Skewness and Kurtosis

Table 12 provides skewness and kurtosis for each dependent variable on each type of instruction. Skewness is the extent to which the distribution lacks symmetry. A positive skew signifies that the tail is to the right with a large number of cases to the left. A negative skew means the tail is to the left with a large number of cases to the right (Howell, 2011). Kurtosis refers to the peakedeness of a distribution. Positive kurtosis indicates the distribution is peaked-long, thick tails, and negative kurtosis has a flat distribution of short, heavy tails (Howell, 2011). Normal distributions have kurtosis and skewness of 0, but values between -2 and +2 are considered normally dispersed. All skewness and kurtosis values fell in the standard range, suggesting that the variables used in this study were normally distributed.

Table 12

Skewness and Kurtosis Findings Based on School Gender Type

	Single-gender		Mixed-gender	
Variable	Skewness	Kurtosis	Skewness	Kurtosis
Females				
Math	-.26	.51	.02	-.71
Reading	-.20	1.06	-.29	.38
Males				
Math	-.19	.78	-.07	-.43
Reading	-.27	.91	-.49	.10

Histograms with Normal Curves

The frequency histograms with normal curves were viewed to examine the normality of the dependent variables for each instructional type. The histograms in Figures 1-8 display the frequency of assessment scores for the schools' mean in math and reading for the male and female middle school students within the single-gender and mixed-gender learning environments.

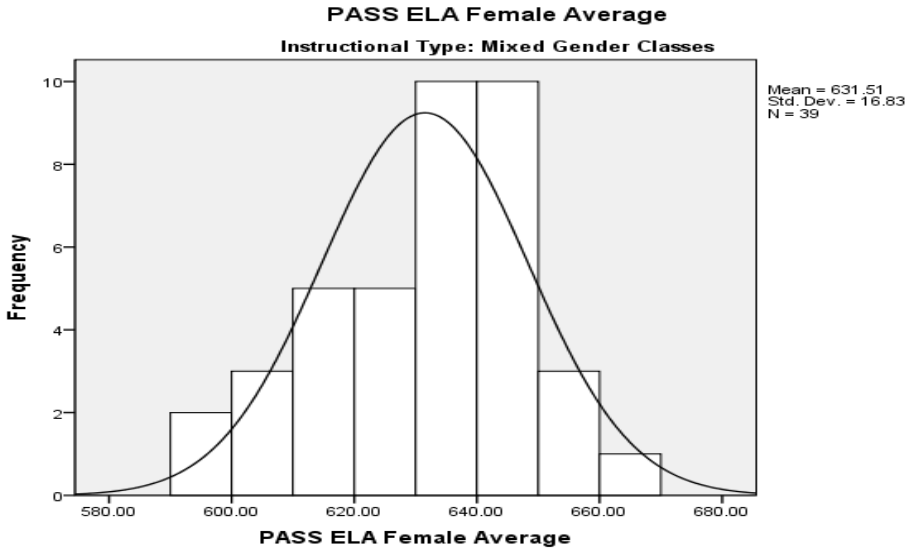

Figure 1

Palmetto Assessment of State Standards reading mean for females in mixed-gender classes.

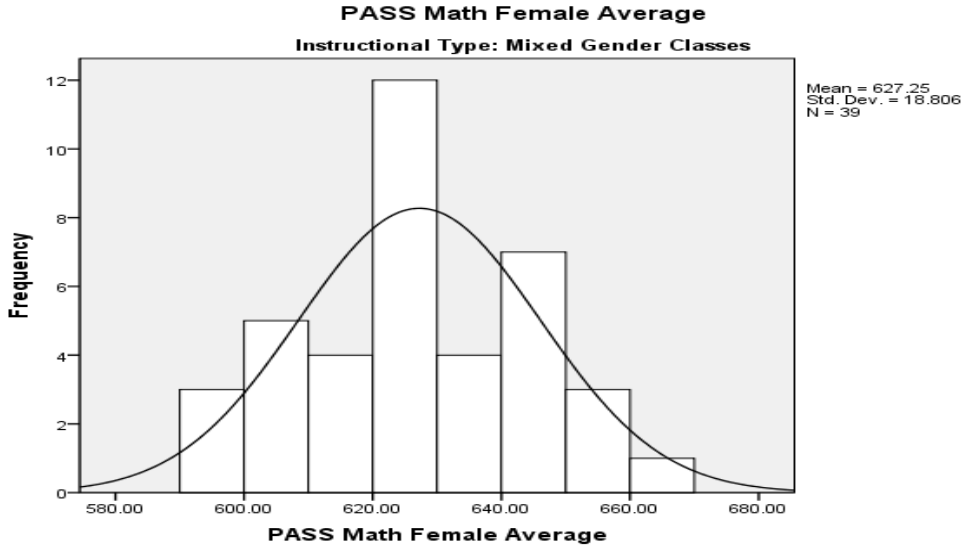

Figure 2

Palmetto Assessment of State Standards *math mean for females in mixed-gender classes*

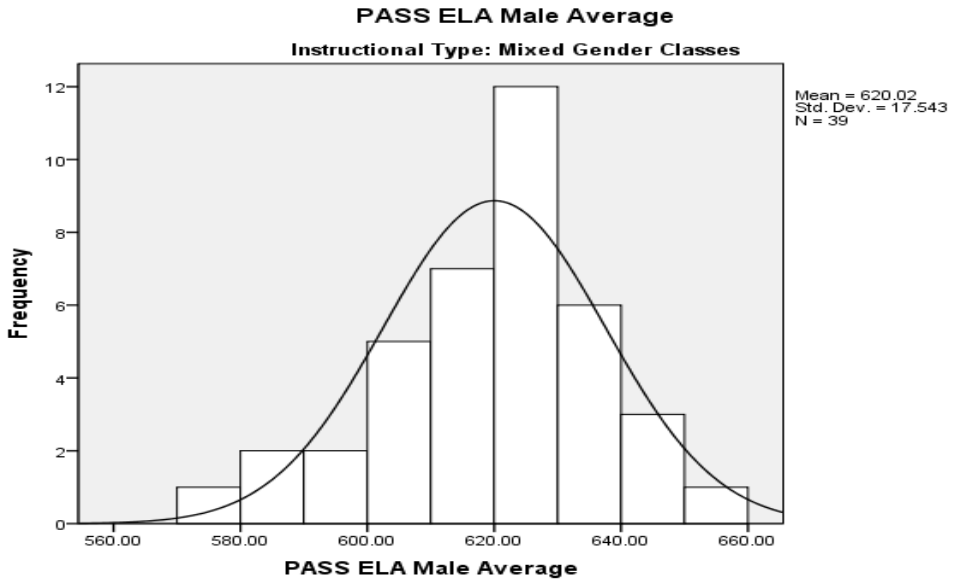

Figure 3

Assessment of State Standards reading mean for males in mixed-gender classes.

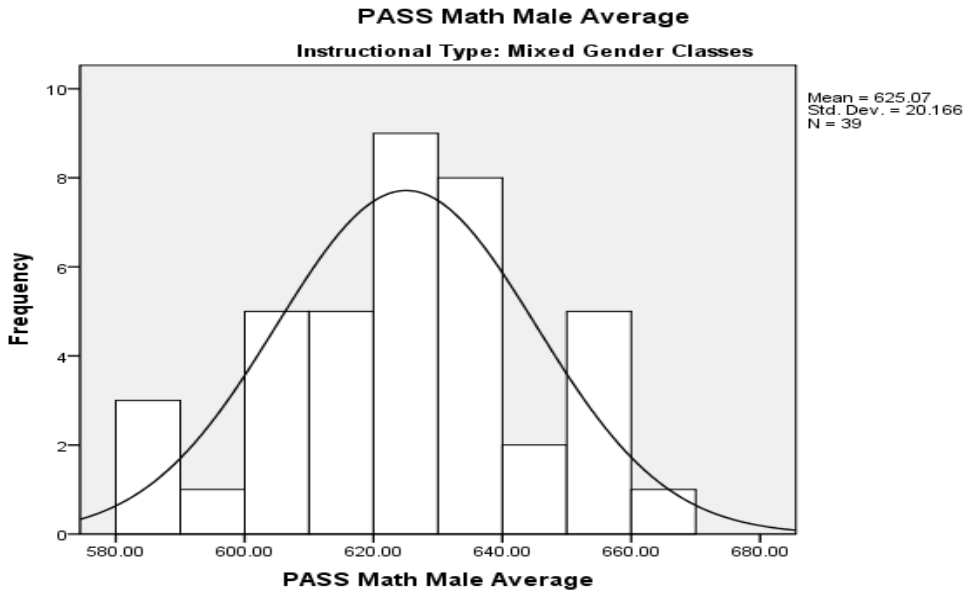

Figure 4

Palmetto Assessment of State Standards math mean for males in mixed-gender classes

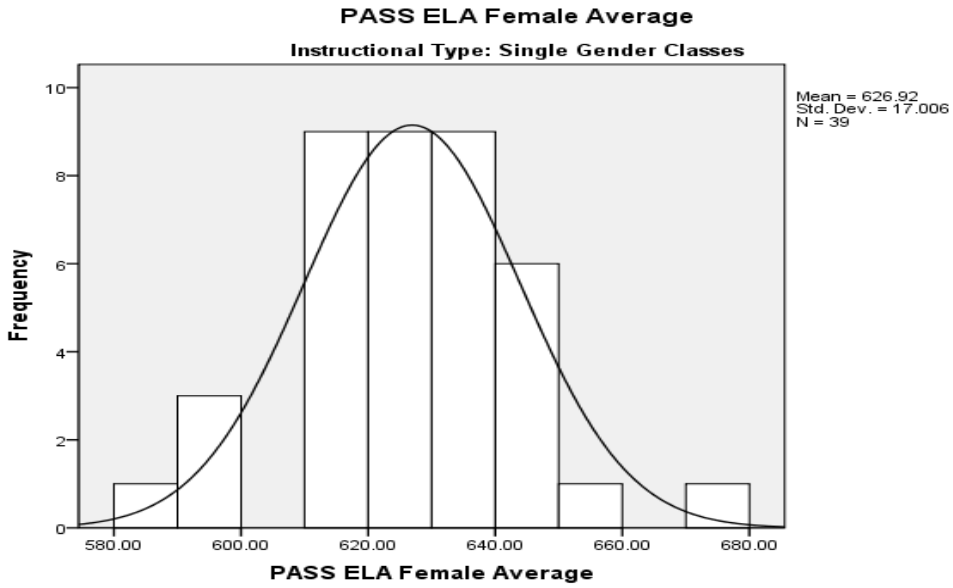

Figure 5

Palmetto Assessment of State Standards reading mean for females in single-gender classes

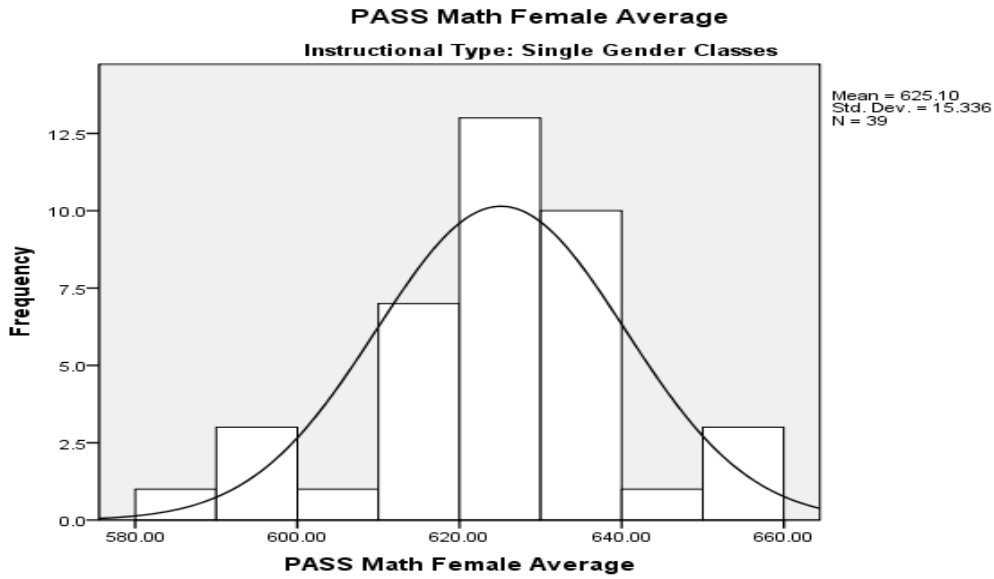

Figure 6

Palmetto Assessment of State Standards math mean for females in single-gender classes.

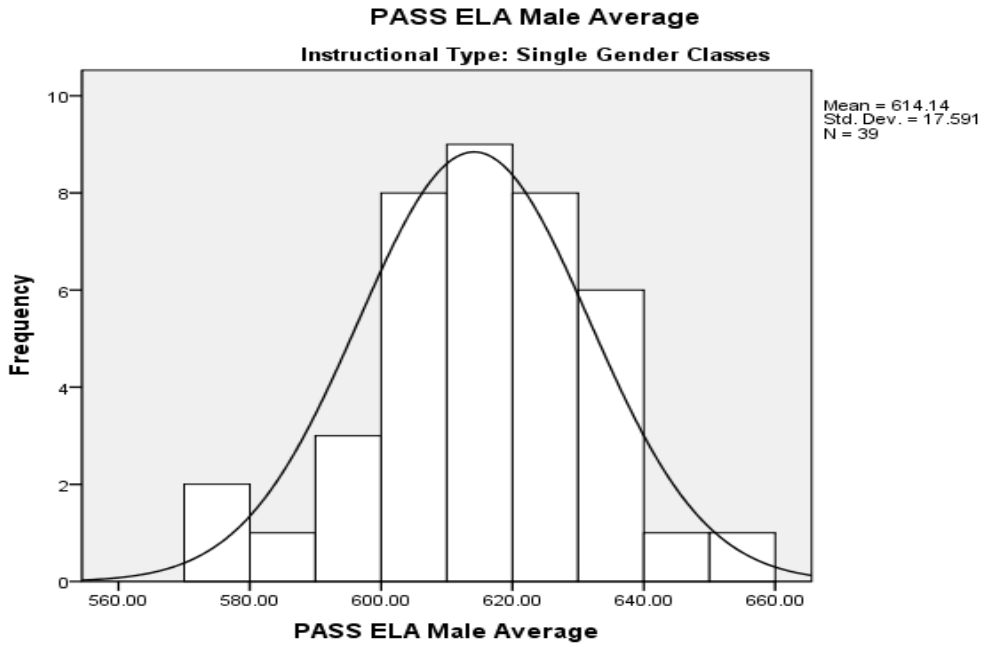

Figure 7

Palmetto Assessment of State Standards reading for males in single-gender classes.

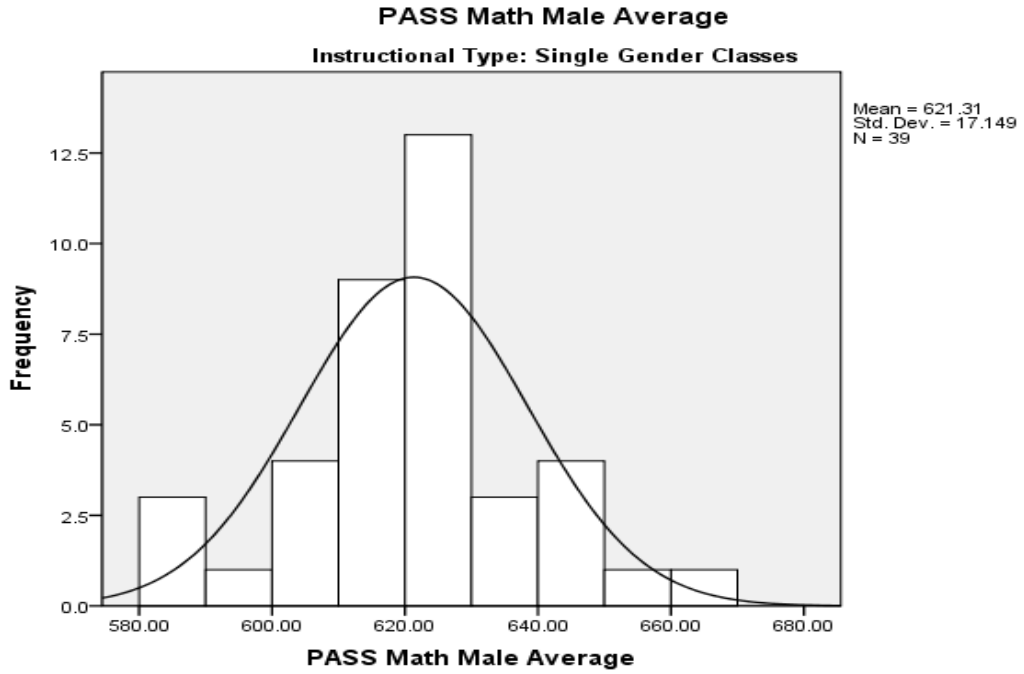

Figure 8

Palmetto Assessment of State Standards math mean for males in single-gender classes.

In the preceding histograms, the variables peaked in the middle with gradual reduction as they moved way form the center. This was consistent with the Shaprio-Wilk's findings. No gross violations of normality were apparent. The group sizes were checked to determine if they were pretty much equal, and the analyses showed that the group sizes were equivalent. ANOVA is prepared to handle violations of suppositions when group sizes are equal, and it is able to deal with small violations of normality when sample sizes are equivalent across groups. Consequently in light of this condition, the ANOVA analyses were used as the main analyses for this study.

ANOVA Outcomes

Analyses of variance were used to test the effects of instructional group and gender on the PASS math and reading outcomes. This analysis included 2 levels of the first independent variable (instructional type: mixed vs. single-gender) and 2 levels of the second independent variable (gender: male vs. female). The ANOVA has one within-subjects factor (gender); which means that the levels of the independent variable reflect different measures for the same schools. The ANOVA also has one between-subjects factor (instructional type), meaning that the levels of the independent variable reflect different groups of schools. This analysis is more accurately described as a within between ANOVA.

PASS Math Outcomes

The first mixed ANOVA focused on the PASS outcomes for math. The Box's test of equality of covariance matrices and Levene's test of equality of error variances were examined to evaluate assumptions of ANOVA. The effect of instructional type on

math results and the effect of the interaction between instructional type and gender on math results were used to evaluate the study hypotheses, as described below.

Box's test of equality of covariance matrices. Box's test of equality of covariance matrices tests the assumptions that the pattern of associations among males' and females' scores are the same for both types of instruction, and that the variances are the same for both groups. This assumption is identified as the homogeneity of covariance matrices. This test is susceptible to violations of normality, so $p < .001$ is usually used to determine significance. The test result for Box's Test Equality of Covariance Matrices was not significant, Box's M = 3.75, F (3, 1039680) = 1.22, $p = .30$. Therefore, the findings imply that the pattern of associations for the math mean PASS scores is similar across the groups and the assumption was met.

Levene's test of equality of error variances. Levene's test of equality of error variances is another test of assumption, the homogeneity of variance assumption. This test examined the extent to which variances were equivalent across the two groups for the dependent variable, the PASS math results. The test was not significant for female math mean PASS scores in 2010; F (1, 76) = 2.84, $p = .12$, or the male math mean PASS scores, F (1, 76) = 1.35, $p = .25$.

Effect of instructional type on math scores. Research question 1 inquires if a significant difference exists in sixth to eighth grade students' math achievement based on instructional group. To determine if the mean scale score for math differed based on instructional type, tests of between-subjects effects were examined. The ANOVA results indicated that mean scale average for math did not differ based on instructional type, F (1, 76) = 0.54, $p = .465$, $\eta^2 = .007$. The null hypothesis that no significant difference

existed in sixth to eighth grade students' PASS math assessment scores based on instructional group (i.e. single-gender and mixed- gender instruction) was supported in these findings.

Effect of instructional type by gender on math scores. Research question 3 inquires if the instructional group difference in sixth to eighth grade students' math achievement will be the same for males and females. The ANOVA results indicated that the instructional group effect on math scores was the same for females and males, Wilk's $\Lambda = .98$, $F\ (1, 76) = 1.78$, $p = .194$, $\eta^2 = .02$. The null hypothesis that the instructional type difference in sixth to eighth grade students' PASS math assessment scores would be the same for males and females is supported.

Additional analysis. The ANOVA results indicated that average math PASS score was higher for females than for males, Wilk's $\Lambda = .76$, $F\ (1, 76) = 23.6$, $p < .001$, $\eta^2 = .237$.

Table 13 presents the PASS average in math for the instructional types (single-gender and mixed-gender) of males and females presented in this study.

Table 13

Palmetto Assessment of State Standards Math Scores for Instructional Type

	Instructional Type	*M*	*SD*	*n*
Female				
	Mixed Gender Classes	627.25	18.81	39
	Single Gender Classes	625.10	15.34	39
	Total	626.17	17.08	78
Male				
	Mixed Gender Classes	625.07	20.170	39
	Single Gender Classes	621.31	17.15	39
	Total	623.19	18.69	78
Total				
	Mixed Gender Classes	626.16	19.49	78
	Single Gender Classes	623.21	16.25	78

PASS Reading Outcomes

The second ANOVA focused on the PASS outcomes for reading. The Box's test of equality of covariance matrices, and Levene's test of equality of error variances were examined to evaluate assumptions of ANOVA. The effect of instructional type on reading results and the effect the interaction between instructional type and of gender on reading results were used to evaluate the study hypotheses, as described below.

Box's test of equality of covariance matrices results. Box's test of equality of covariance matrices tests one of the assumptions of mixed ANOVA-the pattern of associations among males' and females' scores are the same for both types of instruction, and that the variances are the same for both group. The test was not significant, Box's M,

= .173, *F* (3, 1039680) = 0.056, *p* = .983. The findings imply that the variance-covariance matrices for the reading mean scale were similar across groups and the assumption was met.

Levene's test of equality of error variances. The homogeneity of variance assumption examined the extent to which variances are equivalent across the two groups for the dependent variable, the PASS reading results. The Levene's test was not significant for female mean reading scores, F (1, 76) = .025, *p* = .874 or male mean reading scores, *F*(1, 76) = .024, *p* = .877, indicating that the assumption was met.

Effect of instructional type on reading scores. Research question 2 inquires if a significant difference exists in sixth to eighth grade students' reading achievement based on instructional type. To determine if the average for reading differed based on instructional type, tests of between-subjects effects were examined. The mean scale score for reading did not differ based on instructional type, *F (1, 76) =1.842, p = .179*, η^2 =.015. The null hypothesis, which states no significant difference in sixth to eighth grade students' PASS reading assessment scores based will occur on instructional group (i.e. single-gender and mixed-gender instruction), has been retained based on these findings.

Effect of instructional type by gender on reading scores. Wilk's Λ =.99, *F* (1, 76) = 1.20, *p* = .278, η^2 = .02,. The p-value is not significant. The null hypothesis that the instructional type difference in sixth to eighth grade students' PASS reading assessment scores would be the same for males and females was supported.

Additional analysis. The ANOVA results indicated that average reading PASS score was higher for females than for males, Wilk's Λ =.152, *F* (1, 76) = 452.61, *p* < .001, η^2 = .85.

Table 14 contains the PASS reading results for 2010 presented for both school type and gender.

Table 14

Palmetto Assessment of State Standards Reading Scores for Instructional Type

	Instructional Type	*M*	*SD*	*n*
Female				
	Mixed Gender Classes	631.51	16.83	39
	Single Gender Classes	626.92	17.01	39
	Total	629.21	16.97	78
Male				
	Mixed Gender Classes	620.02	17.54	39
	Single Gender Classes	614.14	17.59	39
	Total	617.08	17.70	78
Total	Mixed Gender Classes	625.77	17.19	78
	Single Gender Classes	620.53	17.3	78

Summary of Results

2010 South Carolina Report Card archival data, statistical analyses associated with each research question were conducted comparing traditional mixed-gender and single-gender classroom environments on PASS math and reading results. A within between ANOVA was used for the independent variables, instruction type and gender, to answer the following research questions:

Research Question 1

Is there a significant difference in sixth to eighth grade students' math achievement based on instructional group?

$H_{1.}$ There will be a significant difference in sixth to eighth grade students' math achievement based on instructional group.

H_0. There will be no significant difference in sixth to eighth grade students' math achievement on PASS math assessment scores based on instructional group (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender instruction).

A within between ANOVA analysis was conducted on math achievement scores. The analysis involved comparing students from mixed-gender and single-gender learning environments to find out if a significant difference existed in South Carolina PASS math scores. The PASS math outcomes showed no major differences in between the groups; the null hypothesis was retained.

Research Question 2

Is there a significant difference in sixth to eighth grade students' reading achievement based on instructional group?

H_2. There will be a significant difference in sixth to eighth grade students' reading achievement based on instructional group.

H_0. There will be no significant difference in sixth to eighth grade students' reading achievement on PASS reading assessment scores based on instructional group (i.e. male single-gender, male mixed-gender instruction, female single-gender, and female mixed-gender instruction).

A within between ANOVA analysis was completed on reading achievement scores. The analysis involved comparing students from mixed-gender and single-gender learning environments to find out if a significant difference existed in South Carolina PASS reading scores based on instruction type. The PASS reading outcomes showed no major difference between the groups;, the null hypothesis was retained.

Research Question 3

Is the instructional group difference in sixth to eighth grade students' math achievement the same for males and females?

H_3. There a will be a significant difference in instructional group for male and female sixth to eighth grade math scores.

H_0. There will be no significant difference in instructional group math scores for male and female sixth to eighth grade students' PASS math assessment scores.

The ANOVA results indicated that that the instructional group effect on math scores was the same for females and males,. The null hypothesis was retained.

Research Question 4

Is the instructional group difference in sixth to eighth grade students' reading achievement the same for males and females?

H_4. There will be a significant difference in instructional group in reading achievement scores for males and females.

H_0. There will be no significant difference in instructional group reading achievement for males and females.

The ANOVA results indicated that the instructional group effect on reading scores was the same for females and males. The null hypothesis that the instructional

type difference in sixth to eighth grade students' PASS reading assessment scores would be the same for males and females was supported.

Statistical analyses showed no significant differences when comparing PASS scores for single-gender instruction and mixed-gender instruction in math and reading. However, evidence from the math scores provided evidence that females in both instructional groups scored higher than their male counterparts.

CHAPTER V: DISCUSSIONS

This chapter summarizes the study and methods in analyzing the data from this study. Additionally, a summary of the study's findings is provided along with its conclusions. Finally, a discussion of the implications and suggestions for additional research are offered.

Summary of the Findings

In 2008, The No Child Left Behind (NCLB) Act, a set of federal directives specifying that all students should be able to function academically at the basic performance level by 2014 (US Department of Education, 2008), became law under President George W. Bush. Although the federal government designed this law, it has been each state's responsibility to determine how AYP should be met. At the present, student performance and academic achievement in South Carolina have not met the expectation levels established by the NCLB legislation (Creighton, 2008b). To make matters worse, the achievement gap between males and females in reading, mathematics, and science has continued to grow (Vrooman, 2009). The National Assessment of Educational Progress shows that boys are lagging by one and one-half years behind girls in reading and writing. Currently, boys are marginally ahead of girls in math and science, subjects in which boys in the past performed much better than girls (Colin, 2003).

To address these concerns, the amendment to Title IX in 2006 provided the opportunity for single-gender education to become a public school choice. For educators looking for innovative ways to help students meet the mandates of NCLB, same sex instruction became an option in academic subjects (U.S. Department of Education, 2008).

With the revision of Title IX, the number of schools offering single-gender instruction began to rise.

The mandates of the NCLB have spurred educators across the United States to seek instructional policies that will have a positive impact on student accomplishment. As a result, single-gender education became an educational initiative that many schools across the country began to embrace. Single-gender instruction refers to school environments where males and females attend classes exclusively with members of the same sex. Although some sources in the literature review recommended ways to incorporate teaching strategies to maximize achievement in the single-gender classroom, research in the United States and other parts of the world have received varied results in regards to single-gender instruction improving overall student achievement (Belcher et al., 2006; Daly & Defty, 2004; Ferrara, 2005;
Mulholland et al., 2004; Spielhofer et al., 2004; Van de gaer et al., 2004; Wills et al., 2006; Younger & Warrington, 2002)

Under the direction of Jim Rex, former State Superintendent of Education, South Carolina made the single-gender initiative a reality. By 2008, more than 200 single-gender programs were available in the state (Chadwell, 2008). The South Carolina Department of Education (2010) single-gender survey showed encouraging results of the attitudes of students, teachers, and parents on their perceptions towards single-gender education. A qualitative study was conducted in May of 2010 to investigate the attitude and opinions regarding qualities that contribute to success in school as they are addressed in single-gender classes. Surveys were provided to grades Kindergarten through ninth grade for all single-gender classrooms. All of the survey forms for students, parents, and

teachers asked them to specify their opinions regarding the way students think, behave, and feel regarding themselves and their performance in their classes.

The parents responded favorably and gave the highest percentage of positive levels among the three groups. Female students, parents of females, and teachers of females, gave positive responses at a higher percentage level than male students, parents of males, and teachers of males. African American students (both males and females) and their parents gave positive responses at higher percentage levels than Caucasian students and their parents (SC Department of Education, 2010).

The aspiration of this quantitative study was to determine if single-gender instruction has a positive influence on middle school students' performance on the state assessment Palmetto Assessment of State Standards' (PASS) math and reading scores when compared to mixed-gender instruction in schools located throughout South Carolina. This study examined and evaluated the single-gender programs created and developed through the South Carolina Department of Education Single-Gender Initiative. The study evaluated the Palmetto Assessment of State Standards' results in math and reading, the dependent variables, and compared them with the type of instruction, the independent variables (single-gender and heterogeneous) and gender (male and female) which were retrieved from the South Carolina Department of Education's website.

The study focused on 78 individual middle schools' report cards in South Carolina which represented single-gender and mixed-gender schools throughout the state. There are 46 counties in the state with a total of 1,177 schools currently serving 699,198 students. There are 626 elementary schools, 255 middle schools, and 252 high schools. Forty counties presently are involved with the state's single-gender initiative with 64 of

the 102 school districts providing single-gender education. Of the 255 middle schools, 56 offer single-gender instruction.

The single-gender programs engaged in single-gender teaching strategies ranged in population from 128 to1270, totaling 25,222. The female population varied from 102 to 655 (12,145 total) and the male population ranged from 79to 640 (13,077 total) for the single-gender schools used in this study. The ethnic population ranges for the single-gender schools are as follows: European American-12,566, African American-11,139, Hispanic-1037, and Other-466. The free and reduced meal population for the single-gender population ranged from 0 to 694 (South Carolina Education Bug, 2009).

The mixed-gender school populations ranged from 149 to 1,159, totaling 24,301. The female population varied from 77 to 569 (11,752 total) and the male population ranged from 72 to 557 (12,549 total) for the mixed-gender schools used in this study. The ethnic population ranges for the single-gender schools are as follows: European American-14,824, African American-7843, Hispanic-1,134, and Other-535. The free and reduced meal population for the mixed-gender population ranged from 88 to 503 (South Carolina Education Bug, 2009).

Instruction for the single-gender classrooms included specific gender strategies that were to be presented to the students (Chadwell, 2008). The heterogeneous classrooms covered the same standards, indicators, and followed the curriculum without specific strategies implemented in the instruction (Chadwell, 2008).

Instrumentation. The State of South Carolina uses a standards-based curriculum that is to be executed in all public schools. In 2009, the PASS replaced as the PACT as the state's assessment for grades three to eight because many educators complained it

took too long for results to be returned, and its report did not offer an explanation of student performance. The PASS includes test of five subject areas: English language arts (reading and research), writing, mathematics, science, and social studies. Students' performances from these assessments are based on the state standards. The state established three performance levels to reflect the knowledge and skills exhibited students on the PASS:

Exemplary-The student demonstrated exemplary performance in meeting the grade level standard. On the scale score of 300 to 900, a student needs to earn a score between 649 to 900 for reading and 657-900 for mathematics.

Met-The student met the grade-level standard. On the scale score of 300 to 900, a student needs to earn a score between 600 to 648 for reading and 600-656 in mathematics.

Not met-The student did not meet the grade-level standard. On a scale score of 300-900, a student earns a score between 300 to 599 for reading and mathematics (Creighton, 2008b).

To establish if the single-gender environment benefitted schools participating in South Carolina's initiative, academic success in reading and mathematics were the factors examined in determining if there were any noteworthy differences between single-gender and mixed-gender settings. The 2010 PASS results were accessible in the state's archival data and were used in the study. Data collected from this site were used to determine if males or females performed better in the single-gender programs. To assess and measure performance, students in both type of instructional programs were administered the PASS in the spring of 2010. The tests were initially released in 2009

from the South Carolina Department of Education which had replaced the PACT, the former state assessment.

Analyzing the data. A quantitative study examined archival data acquired from the sixth to eighth grade middle schools in single-gender and mixed-gender programs. Before the analyses were completed on the PASS math and reading results, preliminary analyses were conducted to compare the descriptive characteristics of the single-gender and mixed-gender school populations. The *t*-test and the chi-square test were used to establish if there were any important differences in demographics and AYP status for schools used in this study. Independent *t*-tests were conducted to identify demographic differences between the single-gender and mixed-gender schools. Eight separate analyses were conducted in which instruction type was the independent variable; total enrollment, ethnic group enrolled, percent of each gender, and percent free or reduced meals were the dependent variables. Each group contained 39 single-gender and 39 mixed-gender schools.

A *t*-test was conducted on Instruction Type Differences. This test determined the means and standard deviations of the independent variables examined in this study. Table 9 showed the results for the dependent, and there were no significant deviations in the variables to report. Table 10 contained the results for the Equality of Means of Independent Variables. This *t*-test examined whether the groups differed on demographic variables. The scores from the dependent variables indicated that the groups were equivalent on basic demographic variables and there were no significant differences.

A similar analysis was conducted to examine AYP status. Because AYP stratus is a categorical variable, a different analysis was used. A chi-square analysis was conducted to examine whether AYP status differed for the two types of instruction in this

sample. The results of the cross-tabulation indicate the following for the single-gender group: 7.7% were in the at risk category. 17.9% of the schools received a good rating, and 4 10.3% of the schools in the single-gender sample were in the excellent category. However, the majority of the schools used in the single-gender sample (64.1%) received an average AYP status. The results for the mixed-gender schools were: 5.1% were in the at risk category; 17.9% of the schools received a good rating, and 20.5% of the schools in the mixed-gender sample were in the excellent category. Like the single-gender data, the majority of the schools used in the mixed-gender sample (56.4%) received an average AYP status. The Chi-square p-value indicated that the instructional groups did not significantly differ in AYP status, χ^2 (3) = 1.725, p = .631.

Before the main analysis was conducted, it needed to be determined that assumptions were met in order for the statistical tests to be valid. The Shapiro-Wilk Test was the test of normality conducted because the sample size of this study was less than 2000. The values range from 0 to1, with higher numbers indicating more normal scores. Values are 1 when data are typically dispersed and diminish as distributions deviate from normality. The probability value (p-value) is considered significant if the values are less than .05. Ultimately, the findings confirmed that homogeneity existed across the groups and that there were no major violations.

Once the preliminary analyses were completed, within between ANOVAs were used to test for statistical significance differences between PASS math and reading results for single-gender and mixed-gender schools. By using the mean scores, investigations of differences between males and females for single-gender and mixed-gender schools were performed.

Prior to conducting an ANOVA to test each hypothesis, an alpha level of .05 was determined. The independent variables type of instruction (single-gender instruction and mixed-gender instruction) and gender (i.e. male single-gender, male mixed-gender , female single-gender, and female mixed-gender). The dependent variables were the 2010 results for PASS math and PASS reading.

Results. Research questions addressed in this study were:

1. Is there a significant difference in sixth to eighth grade students' math achievement based on instructional group?
2. Is there a significant difference in sixth to eighth grade students' reading achievement based on instructional group?
3. Is the instructional group difference in sixth to eighth grade students' math achievement the same for males and females?
4. Is the instructional group difference in sixth to eighth grade students' reading achievement the same for males and females?

To answer research questions one and two, 2x 2 ANOVAs were conducted to determine if the passing percentage for math and reading based on instructional type, tests of between-subjects effects were examined. The ANOVA results indicated that mean scale average for math did not differ based on instructional type, F (1, 76) = 0.54, p = .465, η^2 = .007. The null hypothesis that there would be no significant difference in 6th-8th grade students' math achievement on the PASS math assessment scores based on instructional group was supported in these findings. The mean scale score for reading did not differ based on instructional type, $F\ (1, 76) = 1.842$, $p = .179$. The null hypothesis stated there would be no significant difference in 6th-8th grade students' reading

achievement on PASS reading assessment scores based on instructional group was retained based on these findings.

Questions three and four were answered through the ANOVA analyses on the effect on gender on math and reading results. The ANOVA results indicated that the instructional group effect on math scores was the same for females and males, Wilk's Λ =.98, F (1, 76) = 1.78, p = .194, η^2 = .02. The null hypothesis that the instructional type difference in sixth to eighth grade students' PASS math assessment scores would be the same for males and females was supported.

The ANOVA results indicated that the instructional group effect on reading scores was the same for females and males. Wilk's Λ =.99, F (1, 76) = 1.20, p = .278, η^2 = .02,. The p-value is not significant. The null hypothesis that the instructional type difference in sixth to eighth grade students' PASS reading assessment scores would be the same for males and females was supported.

Discussion of the Findings

Based on the findings of this study, the researcher concludes that middle schools offering single-gender instruction did not show significant gains in PASS reading and mathematics scores when compared to mixed-gender programs in South Carolina. This finding is supported by Baker (2002) and Van Houtte (2004). Their studies led them to the conclusion that single-gender male instructional settings had a negative impact on male achievement.

The results of this study are similar with the findings of some investigations which have examined the influence of single-gender education on academic achievement. Conversely, the results are incompatible with the findings of other investigations. The

findings of this study signify that the implementation of single-gender instruction in 39 South Carolina public middle schools for grades six through eight did not demonstrate statistically significant impact PASS scores in reading and math.

Thorn (2006) compared the level of academic achievement in single-gender classes with coeducational classes at a middle school and found no significant differences in student achievement. Another study that produced similar findings involved the American Institutes for Research (AIR) for the U.S. Department of Education (USDE, 2005). The study reviewed over 2000 quantitative research studies on single-gender instruction. Although the AIR found some support for the argument that single-gender education is beneficial, the study ultimately concluded that there was not enough evidence of benefit or harm for single-gender instruction over the coeducational setting.

Belcher, Frey, and Yankeelov (2006) produced similar results to this study's findings. The data they collected showed no considerable differences in academic achievement, as measured by the state's standards. Research involving Kniveton (2006) examined gender and achievement in 68 students (33 males and 35 females). The results showed there were no significant differences to support single-gender education. Additionally, Bracey (2006) conducted a study at the San Francisco 49ers Academy with similar results. Bracey found that the single-gender academy did not produce high academic results. Finally, Houston (2011) conducted a study of 15 middle schools in South Carolina which initiated single-gender instruction. The study's findings showed there were no considerable difference in academic performance for males and females in the single-gender and mixed-gender schools for PACT scores in 2007-2008 (Houston, 2011).

The findings of this study are supported in part by Daly and Defty (2006) who conducted a study of British high schools on the impact of single-gender instruction in English, mathematics, science, social studies, and writing. After evaluating the assessment data, the results showed there were no significant gains for middle and upper class students. However, the results for African and Hispanic pupils from low socioeconomic and working class families were encouraging and showed a noticeable increase on all assessment areas. The findings were similar for both male and female, with the results with an increase of one year higher than students with related demographics in the mixed-gender programs (Daly & Defty, 2006).

The findings of this study are not sustained by a study conducted at Andersen Junior High School in Arizona. Achievement test scores indicated that the single-gender format helped increase student test performance. Students in the single-gender female classes scored about 11% higher than the females taught in the heterogeneous classrooms during the first year of the program's implementation. The fact that all classes in the study shared the same instructors and resources added reliability to its findings (NASSPE, 2007).

Studies conducted at Black Mountain Middle School in California and Clarksville Middle School in Indiana provides additional support for single-gender instruction (NASSPE, 2007). Based on grade point averages, there was academic improvement for students receiving science single-gender instruction. The science grade point average (GPA) of males receiving single-gender instruction was 3.22 compared to the 2.44 GPA for males in mixed-gender classrooms. The science average for females in single-gender classroom had a GPA of 3.67 compared to 3.05 for females receiving heterogeneous

instruction. Clarksville Middle School showed improvement in academic achievement after just one year of single-gender instruction. Before implementing single-gender instruction, 35% of the males and 54% of the females passed the state's standardized test. One year after single-gender implementation, the passage rates increased to 53% for males and 69% for females (NASSPE, 2007).

A longitudinal study performed by Gibb, Fergusson, and Horwood (2008) involved 940 people born in Christchurch, New Zealand in 1977 does not support the findings from this study. The study looked at the effects of single-gender and heterogeneous education from birth to age 25 on the gap in educational achievement based on gender.

When the participants reached 14, 15, and, 16, the type of high school they attended was documented. Those who attended both single-gender and coeducational programs were not included in the study. The participants were grouped into two categories according to the type of education received during the three-year period. At heterogeneous programs, there was a significant gap favoring females, while there was a non-significant gap favoring females for those who received single-gender programs. The results of this study showed that single-gender instruction may be instrumental in decreasing male disadvantages in educational accomplishment (NASSPE, 2007).

The findings of this study do not sustain the argument by Sax (2006) which is that single-gender education improves student achievement for the different genders. Research by Sax (2005), Salomone (2003), and others indicate that boys and girls learn differently. King and Guirian (2006) reported on the differences of males and females with regard to emotional development. The brain differences between males and females

are both chemical and physical, which may account for differences in the ways in which the genders learn, speak, attain, process, and keep information. Although the primary focus of this research was not differences in the male and female brain, understanding these difference might be prove to be important when considering the type of instructional implementation which may have the most beneficial outcomes.

Although the results did not provide data to support the single-gender initiative in South Carolina, there is still the need for students to experience success in the classroom in closing the achievement gap between males and females. Through the diverse studies examined in this study, the results seem to be the same. Males are currently performing academically at a rate below females and this cannot be ignored and be expected to just go away. Whether it is single-gender instruction or other educational initiatives, the gap in academic achievement needs to be improved if we are to meet the needs of all students (Friend, 2007).

Limitations of the Study

1. Because this study only investigated one year of data, a longer study may provide data necessary to establish the impact of single-gender education on student achievement.
2. It was not possible to establish which gender-based strategies were implemented in the classroom because this study used archival data to evaluate student achievement.
3. This study did not consider teaching methodology.
4. This study only investigated PASS results for middle school students in grades six through eight.
5. This study did not address the specific factors that can impact student achievement and performance on tests:

6. This study did not focus on the impact of the classroom teacher in this study. Although professional development should have been provided, there may not have been sufficient opportunities provided to teachers prior to the beginning of the single-gender program initiative in South Carolina. Without adequate preparation, the teachers may not have been able to formulate curriculum adjustments needed in the single-gender classrooms. Ongoing staff development would help teachers to comprehend how to set up their classrooms, amend their lesson plans, differentiate their instruction, and use a variety of approaches in their delivery the of curriculum (D.Chadwell, personal communication, September 23, 2010)

7. The study is limited in understanding the significance of the reading scores for males in single-gender settings. It is not clear why the single-gender reading scores for males were significantly different from the other groups.

8. The researcher did not know the genders of the teachers in both instructional types since this study focused on archival data.

9. The extent this study investigated student achievement by type of instruction and gender is limited to South Carolina.

Implications

For this study, academic performance was the most important factor in measuring the impact of single gender implementation with respect to research design. Investigations on student achievement of the 2010 PASS assessments in reading and math showed no significant difference when comparing test data in the single-gender and mixed-gender schools. For the rationale of this study, student accomplishment was identified by the percentage of students scoring proficient and exemplary on the PASS in

reading and math. The schools used in this study rated from below average to excellent in their overall rating. If the study had focused on the schools' ratings before single-gender implementation and compared them with the school's current performance, the research may have provided a better understanding of the impact on South Carolina's single-gender initiative.

Recommendations for Future Research

Single-gender education in public schools in the United States became legal in 2006. Since that time, there has been an increase in single-gender programs across the country. At one point, South Carolina had more single-gender schools than any other state (D. Chadwell, personal communication June 24, 2010). This study compared the test performance on South Carolina's PASS results in reading and math comparing single-gender and mixed-gender middle schools. Based on the study's findings, the following recommendations are offered:

1. Studying student academic performance over a longer period of time could provide a more accurate picture for schools to follow in closing the gap in student achievement.
2. Future research may be needed in order to study the teaching methods and strategies used by educators who teach in single-gender schools and mixed-gender schools to find out if there are noteworthy variations in instructional construction, delivery and evaluation techniques to answer: Are teachers adjusting their teaching methods based on what they know about how males and females learn? Are teachers providing instruction based on a range of learning styles that may or may not relate to gender?

3. Further single-gender research that includes public school populations of various levels and subpopulations may be necessary in order to determine the impact of single-gender instruction.

4. More research needs to be conducted to find out what made the difference in the results of the math and reading scores for schools used in this study. Although the findings were not significant, the females in both instructional type groups scored better than the males. Curricula modifications may be needed to insure that the sequence of skills is introduced at the appropriate time based on gender development.

5. There should be more research on the impact of professional development for the classroom teachers who provide single-gender instruction. Sax (2005) and Desimone et al., (2002) stressed the value of providing professional development for educators employing instructional methods based on gender. If single-gender instruction is a practical means of improving academic accomplishment, staff development based on cognitive and physiological distinctions of males and females is necessary.

6. Future research of the teacher's gender in a same gender setting opposed to teacher gender based on an opposite gender setting may provide insight to understanding the impact of single-gender achievement.

7. Additional research in single-gender education is needed to see if changes in student achievement occur in middle schools in other parts of the United States.

Conclusion

Since the new amendments to Title IX legislation, many have not taken sides either for or against same sex classrooms (Hambrook, 2009). These classrooms continue to persevere because of the expectations held by teachers: Sitting quietly, waiting to be

called on, and reading quietly. These behavioral characteristics are often demonstrated by female students but are not demonstrated as often by the male students. From the results of this study, it appears that there are no significant distinctions in what both genders can achieve in the classroom. However, it is essential that educators recognize when children are able to learn and remain alert in the educational setting in order for successful instruction and comprehension to occur (Sax, 2005).

The intent of this study was to provide insight on the impact of single-gender instruction by comparing PASS reading and math data from 39 public single-gender middle schools to 39 public mixed-gender middle schools in South Carolina. However, Analysis of variances of student accomplishment on PASS reading and PASS math scores showed no significant difference between single-gender and mixed-gender education learning environments.

Of all the reform measures available to educational leaders, single-gender schools are just one of numerous options designed to increase the efficiency of public schools. U.S. Secretary of Education, Arne Duncan stated:

> We know that not every child learns the same way. Some children learn better in a classroom surrounded by all boys or all girls. Some learn better when they can take classroom material and immediately apply it to real-world situations. Other children need a residential school that allows them to better focus on academics. We want to provide all of these education options and more (Duncan, 2008, para. 3).

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Appendix

IRB Approval Letter

IRB Exemption Approval 1187.101811: Comparison of Pass Results for Single-Gender and Heterogeneous Middle Schools in South Carolina - Google Chrome

https://bl2prd0511.outlook.com/owa/?ae=Item&a=Open&t=IPM.Note&id=RgAAAAC8rR%2b3OCrJQK9cXI8zDY2JBwDWwJlpBlbQbMt1gUCO3QCAAAEDIgZAAAr8CanCjbvRJ5r290VH46kAGDr27jrAAAJ8qspid=_1341260491275_682454236

Reply Reply All Forward Chat

IRB Exemption Approval 1187.101811: Comparison of Pass Results for Single-Gender and Heterogeneous Middle Schools in South Carolina

IRB, IRB

Tuesday, October 18, 2011 11:30 AM

To: Canada, Patricia O

Cc: Nichols, Leldon W; IRB, IRB; Garzon, Fernando

Attachments: (2) Download all attachments

Annual Review Form.doc (34 KB) [Open in Browser] CanadaExemptionApproval_10~1.pdf (110 KB) [Open in Browser]

- You replied on 10/18/2011 12:19 PM.

Good Morning Patricia,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required unless your data collection extends past the one year approval granted by this memo, in which case you would submit the annual review form attached to your approval email.

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

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

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

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

Sincerely,

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

4:22 PM
7/2/2012