THE EFFECT OF SINGLE GENDER EDUCATION ON THE ACHIEVEMENT OF SIXTH GRADE MATHEMATICS STUDENTS

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Education

Liberty University

October, 2011

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Liberty University, Lynchburg, Virginia
October, 2011

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ABSTRACT

The purpose of this study was to investigate the impact on students' academic achievement when served with a single-gender instructional model. Sixth grade students enrolled in single-gender classes were compared to heterogeneous classes utilizing the Measures of Academic Progress (MAP). MAP data from the fall and spring administrations were evaluated to determine academic growth. In the analysis of growth in academic achievement between groups based upon MAP scores, there was no significant difference found between academic growth and gender. While there was group variability that may have impacted achievement scores, overall growth of MAP scores and the amount of achievement was not significant at the .05 level. With all student groups achieving gains, educational setting and academic growth may be simply a matter of individual learning style and preference. Future studies should focus on longitudinal patterns of student growth, corroboration of multiple sources of data, such as student grades and additional test scores, and student perspectives of single-gender classes.

Acknowledgements

I am so grateful to my Lord and Savior Jesus Christ who has given me His knowledge and wisdom to complete this stage of my journey. God is to receive all the glory. This would not have been possible without Him.

To my mother Sandra Bailey, you have seen me through this very arduous process. I thank you for your continued support and encouragement as I triumphed on the mountains and struggled through the valleys. You have been my biggest advocate, and I would not be where I am today without you.

To my committee chair, Dr. Mark Lamport, you were my first professor at Liberty University. I have never forgotten your words of encouragement that still resonate today. I appreciate your wisdom and understanding throughout this dissertation process. I am blessed to have had you as part of my educational career.

To Dr. Carol Mowen, thank you for being an invaluable part of my committee. Your encouraging and timely feedback was a Godsend. I appreciate your dedication in ensuring my success.

To Dr. Kimberly McLaren, thank you for serving on my committee, being a mentor, and assisting me in becoming a better educator and administrator. You have always been supportive of me. I appreciate your words of confidence and encouragement.

Thank you to my family and friends for their love and prayers. All things work together for good to those who love the Lord.

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List of Abbreviations

Dynamic Indicators of Basic Early Literacy Skills	(DIBELS)
Individual with Disabilities Education Act	(IDEA)
Measures of Academic Progress	(MAP)
Palmetto Assessment of State Standards	(PASS)
Rasch Unit	(RIT)
Response to Intervention	(RtI)

CHAPTER ONE: INTRODUCTION

Education systems are constantly changing and evolving in an effort to improve the quality of instruction in the United States. An ever-present concern with the underachievement of student learning has prompted the development of strategic approaches targeted for the improvement of quality instruction (Gray & Wilson, 2006). The goal remains to increase academic standards while subsequently reducing the gender disparity in achievement. The gender gaps are genuine problems and continue to expand. During the past 20 years, the number of female students studying computer science and physics has declined by more than 50%. In regards to Advanced Placement exams, more than 80% of students taking the Spanish exams are females. In comparison more than 75% of students taking the physics exams are male (Sax, 2008). Males demonstrate a higher self-concept in the academic areas of math and science, while females' self-concepts are elevated within the English content (Sullivan, 2009). Although detractors would blame graduation rates and college admission percentages as the culprit, the true gender gap has to do with the motivation and interest of wanting to learn in certain ways (Sax, 2008).

School organization and structure may have a significant impact on gender disparity in academic achievement (Gibb, Fergusson, & Horwood, 2008). Currently, the majority of public educational programs in the United States are designed with heterogeneous classes in terms of gender. Schools are considering more options as a way to combat this educational battle, as educators believe that a more extensive list of educational settings will yield positive results. Some alternatives that have been

implemented in schools include: magnet schools, charter schools, Montessori schools, or schools specializing in arts infusion, technology, math and science, and the environment (Rex & Chadwell, 2009). Within the United States there are more than one million students who do not graduate every year. In 2008, eighteen states maintained stagnant graduation rates, and three states reported clear declines. Although progress has been made, it has been very slow with a gain of approximately 3% in the national graduation rate during the last decade (Balfanz, Bridgeland, Moore, & Fox, 2010). In 2008, the Southern and Western United States' regions held the highest dropout rates with 8.8% and 9.1% respectively (Chapman, Laird, & Ramani, 2010). Upon graduation, less than 50% of American students are adequately prepared and ready for college (Balfanz, Bridgeland, Moore, & Fox, 2011).

Academics are not the only area of interest. Within the middle and high school levels, disciplinary issues are problematic. Daily or at least once a week, the following issues have been addressed in schools: student bullying was 38.6% at the middle level and 19.8% at the high school; sexual harassment was 6.1% in middle and 3.2% in high; student verbal abuse of teachers was 6.8% in middle and 8.6% in high; classroom disorder was 4.1% in middle and 4.4% in high; cyberbullying was 18.6% in middle and 17.6% in high; and student disrespect towards teachers other than verbal abuse was 13.7% in middle and 14.3% in high (Neiman & Hill, 2011). As drop-out rates and discipline issues have shown little progress or even increased, those struggling schools are striving to employ initiatives, programs, and strategies which will provide effective instruction for today's learners. The consideration of a return to single-gender education has been one such model that states have been considering for the improvement of

academic achievement (Mulholland, Hansen & Kaminki, 2004). The goal is not to treat boys and girls equally but equitably by consciously addressing the specific needs and preferences of each gender (Friend, 2007). The promotion for single-gender programs has gained popularity, and even fervor. In South Carolina—where single gender programs have increased from 41 schools to over 100 in a one year time span, a state department position has been devoted to the single-gender initiative, monthly workshops and webinars are presented, and monthly newsletters are distributed. Researchers, educators, and advocates are exploring the legitimacy of claims that single-gender programs will improve student achievement, behavior, socialization, attendance, and self-concept (Anfara & Mertens, 2008). Education has implemented many programs throughout the years that become abandoned, replaced, or modified (Gray & Wilson, 2006). However, education can ill afford to implement programs without data and research to support and validate the production of positive outcomes.

"In many classrooms, the classroom climate, learning style, instructional style, and experiences offered to boys and girls may not address the needs of either gender," (Geist & King, 2008, p. 43). Neuroscientists and pediatricians have been investigating the brain process for areas such as: developing and storing memory, emotion, attention, patterns, language, social cognition, attention cueing, eye gaze, and context (Bayliss, Pellegrino, & Tipper, 2005; Scherer, 2006; Weiss, 2000). Out of these findings, brain theories have evolved which provide information of delineated physical structures and chemical attributes of the brain between males and females. Structural variations between brains include the organization of the retina and cochlea, as well as the sympathetic, parasympathetic, and the autonomic nervous systems (Sax, 2006).

According to Amunts et al. (2007), real gender differences are present in areas of interhemispheric asymmetry volumes, the right-hemispheric volumetric ratio, and asymmetry in the brain surface area. Educators are utilizing this data to validate differentiated learning styles and instructional strategies between genders.

Background

Single-gender education has reemerged in the public education arena over the past few years as the Bush administration encouraged and endorsed both the ease of restrictions of Title IX legislation of the Federal Education Amendments and the increase of the quantity of single-gender programs (Herr & Arms, 2004). In October, 2006, federal regulations authorized the utilization of single-gender classrooms, programs, and schools within districts as an alternative method for meeting the educational needs of students. Although organizations such as the Civil Liberties Union and National Organization for Women have opposed this move (Hughes, 2006; Sax, 2002), there is a current trend towards the implementation of single-gender education at all academic levels throughout the international educational community as they have opted to implement single-gender programs as an educational alternative for those students who are unsuccessful or underperforming in the coeducational environment (Jackson, 2002; Malacova, 2007; Mulholland et al., 2004).

With federal mandates in place to ensure compliance with the spirit of the law, single-gender programs enroll students on a voluntary basis. These gender programs must have an educational objective and be reviewed every two years (Rex & Chadwell, 2009; Sneed & Anderson, 2009). The main purpose of single-gender programs is not for segregation as an attempt to thwart the educational success of individual groups of

students but rather to enhance the academic achievement of both genders with new learning strategies and activities (Friend, 2007). Boys and girls are to receive equitable educational services as evidenced by learning the identical content and curriculum standards, with the same textbooks and materials, the same access to technology, the same qualified teachers, and the same achievement tests (Rex & Chadwell, 2009). With the inclusion of equitable services, materials, and content, highly qualified educators will then utilize instructional strategies best suited for the specific gender served within the classroom setting. According to Geist & King (2008), there are many strategies that can be employed to support boys and girls. These strategies include: avoid labeling; know student learning styles; know children's developmental differences; provide children with the opportunity to solve problems in different ways; utilize active and exploratory teaching methods; develop activities based on differences in attention levels; and design group work based on gender.

Problem Statement

Within educational circles, there is continual conversation as schools struggle to serve the needs of their students. There has been an increase of interest for single-gender public education (Anfara & Mertens, 2008), which provides the focus of this study. The study looks at the focal point of education, the students, and centers around single-gender education and its impact on students. Girls' needs were in the forefront of discussion during the early 1990s, without complete understanding of children and their needs (Gurian, 2006). Gender-based performance gaps have been witnessed, as the climate, learning styles, instructional methods, and classroom experiences may not address gender needs (Geist & King, 2008). In the state of South Carolina, high-stakes achievement test

scores have shown unmistakable gender gaps among percentages of students in grades three through eight over the past five years, indicative through the scoring discrepancy in below basic competence on both the English-language arts and math exams (Rex & Chadwell, 2009). Table 1 highlights these scores. In 2007, score discrepancies among genders for grades three through eight ranged between 8.0% and 14.5% in English-language arts and between 1.6% and 7.9% in math. In 2008, score discrepancies for grades three through eight ranged between 7.5% and 13.7% in English-language arts and between 0.9% and 5.3% in mathematics. In 2009, score discrepancies for grades three through eight among genders ranged between 6.1% and 9.6% in English-language arts and between 0.9% and 7.4% in mathematics. In 2010, score discrepancies for grades three through eight ranged between 6.8% and 12.1% and between 1.3% and 7.0% in mathematics. In 2011, score discrepancies for grades three through eight among genders ranged between 6.1% and 11.4% and between 1.7% and 7.1% in mathematics. In both subject areas of English-language arts and mathematics for the past five years, females had a lower percentage of their population scoring below basic. Thus more male students are scoring at a below basic standard than their female counterparts (South Carolina Department of Education, 2011a).

Table 1

Score Discrepancy Percentages between Genders on SC High Stakes Testing

	2007		2008		2009		2010		2011	
	ELA	Math	ELA	Math	ELA	Math	ELA	Math	ELA	Math
3rd Grade	8.3	3.3	7.5	0.9	7.1	2.2	7.0	2.1	6.1	1.7
4th Grade	8.0	1.6	9.3	1.9	6.1	0.9	7.7	1.3	8.8	2.7
5th Grade	11.0	3.3	9.2	3.1	8.0	3.3	7.6	2.9	6.7	3.7
6th Grade	14.3	7.9	13.7	5.3	9.3	7.4	8.7	7.0	8.1	6.1
7th Grade	14.5	2.9	13.7	3.5	9.1	6.1	6.8	4.0	10.3	3.7
8th Grade	13.6	3.2	12.4	2.1	9.6	3.7	12.1	4.3	11.4	7.1

Albeit the intention and priority focus of the educational system, achievement is not the only concern within the school setting. Student self-concept and well-being are integral as students grow and develop into adults. The middle-school years are a crucial stage in which to address gender distinctions relative to interest and confidence in academic content, specifically math and science (Reid & Roberts, 2006). Girls experience a decline in confidence of ability during their middle-school years (Kommer, 2006). They doubt their abilities and performance (Geist & King, 2008). Boys, on the other hand, demonstrate more confidence to the extent of arrogance at times. During this same period of time, girls judge themselves according to their perception of how the male gender recognizes them. They lose their own identity to meet the expectations of others (Kommer, 2006).

Growing evidence indicates that middle-school students exhibit positive outcomes in relation to the class environment and self-esteem within single-gender programs (Belcher, Frey, & Yankeelov, 2006; Sax, 2002). When interviewed, girls have responded

more favorably to single-gender classes, as they expressed more confidence, increased their attitudes towards math, and believed their progress in math improved (Shapka & Keating, 2003). Single-gender settings have afforded the opportunity to experience more intimate and meaningful conversations with other students and teachers (Hubbard & Datnow, 2005).

Single-gender differences have been researched; however, instruction in single-gender classes has not been common in the public schools since the early 1970s. The educational landscape has changed in the past thirty years, including instructional techniques, technology, and learning preferences. Previous studies have provided inconclusive evidence of the impact of single-gender education on achievement (Gibb et al., 2008; Herr & Arms, 2004; Shah & Conchar, 2009). Smithers and Robinson (as cited in Shah & Conchar, 2009) have emphasized the lack of evidence that supports single-gender education and reduce the concept to a matter of judgment. Research has presented conflicting data in regards to the consideration of whether single-gender education is markedly enhanced for one gender above the other (Shah & Conchar, 2009). There are firm, yet unsubstantiated, opinions that single-gender education is more advantageous for girls; however, coeducational groups are valuable for boys (Jackson & Bisset, 2005). Jackson (2002) found that girls-only classes furnished positive effects for girls; however, boys-only classes yielded no positive impact on their achievement. Kessels and Hanover (2008) concluded that girls reported an enhanced self-concept of ability in relation to physics while boys' self-concept yielded no change. To appropriately integrate instructional models into the schools, there must be evidence of their ability to positively impact student achievement. A fair and accurate assessment of

implementation of single-gender within a school setting is linked to many factors such as: the school's mission and vision, school culture, success indicators, school status and historical context, and student selection processes (Shah & Conchar, 2009).

Purpose Statement

The purpose of this study is to examine the academic outcomes of single-gender education on sixth grade students enrolled in a mathematics course, with curriculum based upon the state standards and district pacing guide. Through the research outcomes, educators can have a more clear understanding of the impact that the single-gender delivery model has on young adolescents. It has been argued that the single-gender model has the potential to increase achievement within a setting that utilizes differential teaching strategies that are logically and efficiently planned and definitively implemented, examined, and assessed (Shah & Conchar, 2009). To be successful, educators must create explicit details in regards to the emotional and social aspects of the educational community in addition to the academic knowledge (Hubbard & Datnow, 2005). This realization will encourage educational programs to consider single-gender classrooms as a viable option for improving academics and self-esteem during a very tumultuous period of development.

Research Questions

The research questions addressed in this study are: (a) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade male students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom? (b) To what extent is the mathematical achievement, as evidenced by growth of Measures of

Academic Progress (MAP) scores, of sixth grade female students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom?

To evaluate the data regarding the effects on students, a causal-comparative design has been employed.

The researcher hypothesizes:

a. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

b. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

c. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade male students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

d. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

e. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade female students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

f. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students and sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies.

Identification of Variables

For this study, the independent variables are the single-gender instructional setting and single-gender instructional strategies. The dependent variable for this study is achievement in mathematics as evidenced by yearly growth on the Measures of Academic Progress test.

These instructional programs, consisting of members of the same-sex only, are led by teachers having professional development in gender-learning styles. For female groups, the instructor will use a softer voice tone, collaborative learning with groups,

more communication opportunities, additional teacher direction, and encouragement. For male groups, instructors will use a louder voice tone, collaborative learning with partners, strategies that provide students the opportunity to actively move about the room, and competitive activities.

Academic achievement is that for which both educators and students strive. For the purpose of this study, academic achievement will be measured in terms of growth on the Measures of Academic Progress (MAP), which is a nationally norm-referenced computerized test.

Assumptions and Limitations

The single-gender educational model can only be offered as a program of choice due to federal laws, thus enrollment in single-gender classes is optional. With this boundary, grouping and sample sizing for the study is affected, and there is no true randomization, thus a causal-comparative design is employed. With consideration to grouping, classes are chosen based upon similar demographics and achievement scores. Sample sizes are chosen based upon the number of courses within the instructional setting.

Part of the uniqueness of single-gender classes is the implementation of different strategies geared towards specific genders. This can create an issue if instructors are female, regardless of the gender of the students. Educators within the single-gender model have received staff development honing in on particular strategies. With knowledge of strategies and potential bias, instructors are more cognizant of educational styles within the classroom.

The goal of educational programs is to enhance academic achievement. This achievement is measured in educational circles through course grades and standardized test scores. With test scores, the use of the MAP test over several administrations gives a more accurate measurement of student growth.

Operational Definition of Terms

Measures of Academic Progress (MAP): An adaptive, nationally norm-referenced computerized multiple choice test for grades two through nine. On the goals-survey version, 52 questions are presented at varying levels of difficulty. The test adapts in real time to narrow and pinpoint an accurate level of achievement. If a student gets one question wrong, the level of difficulty will decrease. If a student answers correctly, a more challenging item will be presented. Test items correspond to a vertical scale utilizing the Rasch model, and scores are reported in terms of RIT scores. Tests are given on a range of skills in mathematics, reading, and language usage (Northwest Evaluation Association, 2004).

Palmetto Assessment of State Standards (PASS): PASS testing is the statewide assessment program for the state of South Carolina. Administered to students in grades three through eight, its subtests include: English language arts (reading and research), writing, mathematics, science, and social studies. With the exception of the writing portion, all subtests consist of multiple choice items. PASS measures student performance on the South Carolina curriculum standards. Scores are reported in terms of scaled scores and performance levels. The three performance levels of achievement are:

1. Exemplary: Students demonstrated exemplary performance on the grade-level curriculum standards.

2. Met: Students demonstrated the ability to meet grade-level curriculum standards.

3. Not met: Students did not demonstrate satisfactory achievement on grade-level curriculum standards (South Carolina Department of Education, 2011c).

Rasch Unit (RIT): Units of measure for student achievement and growth. RIT scores estimate and report student achievement as part of MAP testing. The RIT scores report the instructional level of students (Northwest Evaluation Association, 2004).

Response to Intervention (RtI): A multi-tiered approach in making instructional decisions and interventions based upon student progress (Sugai & Horner, 2009) with the purpose of increasing student achievement and decreasing problematic behaviors. Data from student progress provides evidence to continue with current interventions at the classroom level or progress to the next level, which entails more outside resources.

Single-gender education: The educational program in which students of exclusively one gender are educated within a classroom setting.

Conclusion

With the resolute commitment for educational improvement, single-gender education has resurfaced as an alternative for traditional educational settings in many states throughout the United States. Being offered as a choice within the public education setting since the relaxation of Title IX regulations, single-gender education has been implemented in many schools throughout the state of South Carolina. The door has been opened to provide teachers of the opportunity to implement lessons that are better able to meet student needs (Rex & Chadwell, 2009). Single-gender settings afford teachers the ability to develop and modify curriculum for gender-specific instructional

needs (Hughes, 2006; Mulholland et al., 2004). There are many factors which interact to create positive results for students in a single-gender learning environment. The dynamics of a student's well-being in conjunction with academic achievement are associated with the opportunity to learn in a single-gender educational setting. The single-gender program has afforded the unique ability to satisfy stakeholders with invigorated teachers, engaged students, and involved parents (Rex & Chadwell, 2009).

CHAPTER TWO: LITERATURE REVIEW

Theoretical Framework

Education and the Law

In 1972, Title IX legislation was passed to prohibit discrimination on the basis of gender or race within any educational program that received federal funding. With this legislation, classrooms were required to provide equal education within integrated classrooms. In 2001, Public Law 107-110, commonly known as the No Child Left Behind Act, allocated federal grant money for the encouragement of single-gender research programs in the public schools (Friend, 2007). There began the renewed interest in single-gender programs as an alternative for students unsuccessful in coeducational settings. Title IX of the Federal Education Amendments was rewritten and passed in October, 2006, which authorized the utilization of single-gender classrooms, programs, and schools as an alternative method for meeting the educational needs of students. To incorporate single-gender classes into any educational program, school districts must comply with the following stipulations: provide a rationale for the program, enroll students on a voluntary basis, conduct bi-annual reviews, and offer coeducational classes (Meyer, 2008).

Single-Gender Implementation

Currently, there is a trend towards the implementation of single-gender education at all academic levels throughout the United States: however, it has a long history and tradition within the international educational community (Gurian, Stevens, & Daniels, 2009; Younger & Warrington, 2006). Even though the thought of single-gender

programs is not an innovative one, its arrangement is much different today based upon research and knowledge, hastened by an urgency to improve achievement. Thus single-gender education is resurfacing as an alternative for traditional educational settings in South Carolina (Rex & Chadwell, 2009). With the resolute commitment for educational improvement, for example, the State of South Carolina has made earnest endeavors in the initiation of single-gender programs (Rex & Chadwell, 2009), as the state created the first state-level position to lead, facilitate, and assist in training individuals in the single-gender initiative (Gurian et al., 2009).

With single-gender classes being conducive to higher levels of learning and achievement, as well as an increased state of wellness (South Carolina Department of Education, 2008b), single-gender education has been implemented in many schools across the state. By providing students with a different instructional setting, the implementation of single-gender programs generates positive impacts on middle-school students.

As instructional leaders, teachers are responsible for implementing strategies that are beneficial for students. Single-gender education enhances the teachers' abilities to accommodate the array of students' needs (Hubbard & Datnow, 2005). With the unconscious inclination to focus the center of instruction on males and provide them frequent, direct attention, the absence of students from the opposite sex allows the opportunity to increase teacher attention and enhance student performance (Sadker, 1999).

Brain Theory

With the reworking of Title IX, schools have relied on brain theories to rationalize

their implementation of single-gender education. According to Gurian (2006), there are distinct differences between boys' and girls' brains, such as structure of the retina, the cochlea, and autonomic nervous system (Sax, 2006). In a girl's brain, there is more blood flow to the cerebral cortex, which contains the verbal center, and the sensorial centers. There are more connections between the verbal and sensorial centers. In addition, more neural connections are made between the verbal and emotive centers within the limbic system. According to Gurian, Sousa, and Walsh (as cited in Kommer, 2006), the system of nerves that connect the right and left brain hemispheres, known as the corpus callosum, is 20% larger on average. Typically, girls do not dominantly utilize one hemisphere over the other, while boys' brains are primarily right-hemisphere dominant. Girls are able to discern facial expressions due to different eye chemistry and brain receptors (Sax, 2005). Both optically and neurally within the female vision center, girls are dependent upon P cells that connect the color variety with the functioning in the upper portion of the brain. On average, a girl's hearing is significantly more sensitive, especially at the higher frequencies, which are most necessary in speech discrimination. Their stress responses are impacted by the parasympathetic sector of the autonomic nervous system (Sax, 2006).

In contrast to girls, average boys' stress responses are controlled by the sympathetic section of the autonomic nervous system (Sax, 2006). Boys rely on M cells which provide quick accessibility for them in regards to spatial activities and graphic clues (Gurian, 2006). Boys' brains shift into a rest state many times a day, which disengages them in learning (Kommer, 2006). Although their brains may rest, boys are more likely to appear restless and squirm. This is due to a smaller amount of serotonin

moving through the pre-frontal cortex area of the brain. Girls' brains never rest, as their cerebral cortex remains on (Gurian, 2006). Boys' brains develop areas of visuospatial processing and memory and targeting earlier than girls (Sax, 2005). The specific brain activity accountable for emotion remains in the amygdale area; therefore, the ability to verbalize feelings is more problematic for boys. There are "a surge of findings that highlight the influence of sex on many areas of cognition and behavior, including memory, emotion, vision, hearing, the processing of faces and the brain's response to stress hormones" (Cahill, 2005, p. 42). Regions of the brain responsible for language, spatial memory, motor coordination, and relationship development grow at various rates, times, and sequences between the two genders (Sax, 2005).

Gender and Learning Styles

With the research and development of brain theories, researchers are investigating how the physiological and developmental differences between boys and girls are manifesting themselves in the educational process (McNeil, 2008). "To support excellence in both boys and girls, we must design experiences and curriculum that meet the needs of both . . . by understanding their uniqueness" (Geist & King, 2008, p. 50). In his book *Why Gender Matters* (2005), Leonard Sax identified how gender differences have a significant impact on instruction and effective teaching strategies within the classroom. These differences spill over into student relationships with their teachers, their motivation to study, and the credence they assign to their teachers' opinions.

Academics

Academic achievement is the ultimate goal for any educational system. Single-gender education provides students the opportunity to reach their full potential in

supportive, nurturing environments that are conducive to their gender-specific styles of learning. Research has supported the notion that males and females have different styles of learning (Geist & King, 2008; Gurian, 2006; Gurian & Stevens, 2004; Sax, 2005; Sax, 2006). With the segregation of sexes, teachers are better able to provide instructional activities that accentuate the gender-specific learning styles to improve academic achievement for both boys and girls.

Students' educational experiences can vary greatly according to gender and across ethnic, racial, and socioeconomic groups. Girls are statistically behind boys on high stakes testing such as the SAT. Males outperform females on both the math and the verbal sections. In comparison, females do perform better on the verbal section of the ACT (Gurian, 2006; Sadker, 1999). Male students score better on science and math achievement tests. In Vrooman's study (2009), students within the single-gender classrooms demonstrated significant differences in mathematics test scores in comparison to coeducational settings. Although there is a closing of the gender achievement gap, boys continued to lead in terms of raw math test score averages (Vrooman, 2009). Within coeducational environments, female students lose interest in the core subject areas of science and mathematics. In fact, girls already lag behind boys on science and math scores in elementary school (Gurian, 2006; Rueter, 1997). In the verbal domain, such as language arts, boys fall behind the girls. Nationally, the literacy skills of boys are below that of their girl counterparts by an average of one and one-half years (Gurian, 2006).

In single-gender classes at Thurgood Marshall Elementary School in Seattle, male achievement on math standards rose from 10% to an astounding 73% proficiency (Friend, 2007). During the first year of implementation of single-gender, seventh grade students

in Whittemore Park Middle School in South Carolina reported a decrease from more than 50 failing grades to only four during a comparable time period. On high-stakes standardized testing at Geiger Elementary School in South Carolina, boys' math scores improved from 16.5% to 31.3% in the proficient/advanced category when moving from a coeducational setting to one of single gender. Single-gender girls' participants increased from 19% to 42.9% in the proficient/advanced category within the reading content area (Rex & Chadwell, 2009). On Dynamic Indicators of Basic Early Literacy Skills (DIBELS) testing, scores in a Florida school rose from 40% in all boys' class in the first assessment to 84% after the new strategies were in place. The girls' scores rose from 47% to 75%. (Gurian, 2006). Many schools are reporting results, although not as dramatic.

The creation of single-gender programs affords students the opportunity to learn in an environment free from opposite sex distractions. As such, educators are reiterating that the eminent priority for public schools is academic performance, not social interaction (Hughes, 2006).

Girls' Learning Styles and Preferences

According to Sax (2005) gender influences the students' responses to light and color, as well as different methods for expression and communication, which in turn impacts the learning process. Girls physically hear at different levels, actually enhanced levels, as compared to boys. They are innately created with hearing that is significantly more sensitive, especially in higher frequencies that are connected to speech discrimination (Sax, 2006; Sax, 2010). Girls use both brain hemispheres, enabling them to have superior skills in literacy-related activities (Gurian & Stevens, 2004; Sax, 2005).

Girls usually do not learn as well within a competitive setting but prefer to work in groups. Although human competitiveness is a life skill necessary to survive within the work environment, cooperative learning is as well (Gurian, 2006). Girls are generally more verbal and tend to perform better in group situations with teacher direction and encouragement (McNeil, 2008). The prominence of cooperative learning gives students the opportunity to develop skills necessary in a diversely populated educational culture and society (Gurian, 2006). Providing girls with the accessibility to talk through the progression in problem-solving aids their comprehension of the curriculum. Additionally, the quieter environment affords girls the opportunity to learn in a more subdued environment, which enhances concentration (Vrooman, 2009).

Learning differences are evident in specific academic content areas. This rings true particularly within the writing content. The gender gap is explained by the incorporation of details. Girls have a tendency to enjoy writing and to use more words in written activities. Their writing is often more detail oriented with descriptive and complex sensory information, such as color, texture, shape, emotions and feelings, to add depth to their work (Gurian, 2006; McNeil, 2008). Because girls generally enjoy the communication process, they need additional opportunities to work together (Girls and Boys, 2008).

In the content area of math, girls tend to fall behind when instruction of complex skills is presented through abstract formulas and symbols on the board. The addition of words, writing, and active group work to the delivery of content provides a more even distributed field of academic performance (Gurian, 2006).

Boys' Learning Styles and Preferences

Single-gender classes can address the significant number of gender differences that have an impact on student learning abilities, as well as different learning styles specific to each gender group (Meyer, 2008). For classroom success, boys regularly need more opportunity for physical activity due to their need for movement (Gurian, 2006; King & Gurian, 2006; McNeil, 2008; Sax, 2006). As a result, boys prefer cooler temperatures within the classroom. The temperature in the classroom should be kept at about 69 degrees, six degrees cooler than for girls (Sax, 2006).

In terms of hearing, the average male student needs for teachers to speak approximately six to eight decibels louder in order to hear the teacher as well as the average female student. Within the single-gender male classroom, the most effective teachers speak with a louder voice. The result of louder teachers is boys who are more attentive and engaged in the instruction. Typically, boys also withstand a higher level of background noise within the classroom setting, again about six to eight decibels louder (Sax, 2010).

Boys thrive on competition more than girls, in general. They learn better through competition and perform better under pressure; however, competitive learning has been obliterated from many classrooms. This is a natural learning strategy for boys, in part because of neural and chemical differences. As evident on any school classroom or recess field, they relate more successfully through aggressive love, in which there is horse playing, hitting, and "dissing" one another. Once teachers gain insight and training on how to integrate competitive learning into the classroom, while preventing an outbreak of chaos, they begin to notice students successfully challenging one another to

learn better (Gurian, 2006). Boys are typically more successful working in partner settings because they are task-oriented in regards to discussions and interactions.

Boys, on average, require non-verbal planning tools, such as pictures and moving objects, to help them write their thoughts and to assist in making word connections (Gurian, 2006; King & Gurian, 2006; McNeil, 2008). There are even differences in how the genders draw, as boys tend to draw verbs while girls draw nouns (Sax, 2005). Due to a habitual display of great strengths in spatial tasks, most boys have a greater advantage and excel in academic areas such as math, graphing, and geography (Gurian, 2006).

Special Needs

There are alarming statistics regarding boys, which Anfara and Merens (2008) refer to as a boy crisis. Typically boys are more likely to be diagnosed for special education services, and they encompass approximately 70% of the learning disabled population in schools today (Anfara & Merens, 2008; Girls and Boys, 2008; Gurian, 2006). This figure does not account for other disabilities in which male students dominate special needs populations, such as behavior disorders. Through the alteration of learning styles for boys, they can become more successful (King & Gurian, 2006), with the potential to decrease behavioral difficulties, increase academics, and serve special education students in the least restrictive environment within their home school (Fry, 2009).

Response to Intervention

Response to Intervention, commonly referred to as RtI, is a multi-tiered approach in which instructional decisions and interventions are based upon student progress (Sugai & Horner, 2009). RtI is a framework to assist in the early identification of

students who are struggling academically and behaviorally and assists in the appearance and prevention of further learning and disciplinary problems in school (Hoover, 2010). It has become a precursor to special education with the reauthorization of the Individuals with Disabilities Education Act (IDEA) in 2004. Schools have been provided the opportunity to identify students with disabilities based upon their response to validated interventions (Ysseldyke, Burns, Scholin, & Parker, 2010). RtI has revived the dispute over valid interventions and relevant data. It is believed the most effective way to make decisions regarding instruction is to actually teach the alternative instructional strategies and then gather data on their effectiveness (Ysseldyke et al., 2010). Validity of interventions and strategies are demonstrated through the link of student performance on achievement assessments with interventions that yield better academic outcomes (Ysseldyke et al., 2010). RtI endorses a range of interventions that are organized with an increasing intensity based upon student needs (Sugai & Horner, 2009).

The key purpose of RtI assessment is to facilitate conversations and decisions regarding student learning in order to provide instructional practices that will help students learn. It offers a set of guiding principles to improve the decision-making process in terms of assessment and intervention (Sugai & Horner, 2009). With the goal of academic achievement, RtI focuses on devising and implementing alternative instructional practices for those students whose prior strategies proved to be ineffective (Ysseldyke et al., 2010). Within the RtI structure, instructional decisions need to reflect the rate of growth on assessment measures. "Using assessment to guide instructional decision making is the only means to assure individualized instruction to meet the

unique learning needs of a child with, or without a disability" (Ysseldyke et al, 2010, p. 60).

RtI has evolved into more than an identification program for special education students. It has become a new avenue with which to deal with academic issues in the general education population. With the responsibility, accountability, and ever-increasing pressure to provide positive educational results for all students, it has become essential for public schools to investigate RtI methodologies and tiers of interventions (Sansosti, Noltemeyer, & Goss, 2010). Through research, creativity, and planning to investigate needs, resources, and systems within the school setting, a system of RtI interventions for successful student achievement is possible (Sansosti et al., 2010). Currently, secondary school principals reveal the belief in a deficit of research-based interventions for their students and an inefficient method for systematically collecting data (Sansosti et al., 2010).

The reauthorization of IDEA also highlighted the need for research-based interventions and supports for the prevention and consideration of problematic behaviors (Sugai & Horner, 2009). Behavioral interventions may include school-wide programs, specific classroom settings, or smaller school organizational entities, such as small learning communities, schools-within-a-school, grade teams, or school academies (Sugai & Horner, 2009).

External Factors

External factors, such as cultural and religious beliefs, quality teachers, and the satisfaction of teachers and parents, influence the educational climate of single-gender classrooms. With many schools desiring to improve their parent and community

relations, the single-gender classes offer alternatives in providing appropriate education for all students.

Cultural and Religious Impact

When considering the implementation of a single-gender program, cultural and religious implications are a vital factor. The United States was founded on a conglomeration of cultures and beliefs, and this phenomenon has continued throughout its history. Today, there continues to be an influx of different cultures within the school community. Shah and Conchar (2009) found a common perception that single-gender classrooms yield high academic achievement. Research conducted by Shah and Conchar (2009) illustrated an overwhelming response of support for single-gender education, particularly by minority ethnic groups practicing Islam. Muslims alleged that single-gender schools were religious requirements. When evaluated further, the following percentages demonstrate responses of single-gender education being very important or important: 90% Muslim respondents, 27% Christian respondents, 28% no religion, and 52.9% other (Shah & Conchar, 2009).

Teacher Perceptions

Success of a program is dependent upon how a program is presented. Stakeholders involved with the program must have ownership. Teachers have to believe in the initiative and its benefits for children. In education there are many new and improved programs aimed at increasing academic achievement. The organizational factors impact teachers' attitudes toward new strategies (Gray & Wilson, 2006). Often the perception is that the latest program will last for one or two years or until a new principal, superintendent, etc. comes along. At that point, things will go back to the way

they were or something else will be introduced.

Teachers have a momentous influence on student achievement, as they "directly affect how students learn, what they learn, how much they learn, and the ways they interact . . . ." (Korkmaz, 2007, p. 390). Teachers are the major contributors towards the success or failure of single-gender education. Their beliefs, attitudes and expectations have determined the success or failure for single-gender programs (Fry. 2009; Warrington & Younger, 2000). Often, teacher interest and willingness directs and guides the introduction of single-gender programs (Rex & Chadwell, 2009). They must experience an epiphany of sorts in the realization of gender learning styles and express a willingness to become an innovator of instruction (Gurian, 2006). Teachers' ability to address a full range of student needs, from physical to emotional to educational, is enhanced with single-gender classes. Data indicates that when there are caring teachers in a supportive setting, teachers are able to assist in relieving anxiety and stress that hinders student achievement (Hubbard & Datnow, 2005). Teachers tend to have a more positive regard to a single-gender setting in comparison to a heterogeneous one (Fry, 2009). Those teachers that truly invest in the program and apply gender-specific learning strategies certify the success of single-gender education.

Teacher responses and insight into the single-gender initiatives in South Carolina have been enlightening to educators considering the implementation of these programs. More than 80% of teachers (from all grade levels) agree that single-gender programs have impacted student improvement in each of the following areas: self-confidence, desire to succeed, self-esteem, independence, participation, attitude, behavior, and collaboration. The categories with the greatest area of improvement are collaboration,

participation, and self-confidence. At least 70% of teachers agree that single-gender programs affect student behavior. Considering that discipline is one of the major complaints of teachers in regards to the hindrance of student instruction, this is significant (South Carolina Department of Education, 2008a; South Carolina Department of Education, 2008b).

Administrators and teachers cite the main benefits of single-gender education are increased student achievement, decreased learning distractions, and the ability to concentrate on specific general learning styles and interests (Riordan et al., 2008). Teachers feel that benefits for girls outweigh boys in terms of "better peer interactions, a stronger emphasis on academic behaviors, a greater degree of order and control, socio-emotional benefits, and safe behavior" (Riordan et al., p. xiv). Both genders equitably profit in terms of sensitivity to learning and maturation. Harris' (2009) teacher survey concurred with the belief that single-gender impacted non-academic areas. Teachers indicated that coeducational programs incur more distractions for students and sexual harassment is more prevalent. In Fry's (2009) study, teachers' perceptions of single-gender settings were positive, as teachers agreed that students received benefits, both academic and behavioral, which directly resulted from the single-gender classroom. Yet, a majority of teachers within programs from another study have asserted a decline in overall academic performance and classroom behavior. The single-gender program was unpopular with some teachers, as 71% prefer the coeducational classroom, with girls' only classes following with 55% (Gray & Wilson, 2006).

The State Department of South Carolina places the onus on individual schools or districts to decide their fate for single-gender programs. Schools take ownership in the

decision-making process to determine the appropriateness of single-gender programs based upon their own culture and climate. This ownership affords schools the opportunity to be responsible for success (Rex & Chadwell, 2009). Although some teachers struggled to accurately recall the implementation process, Gray and Wilson's (2006) participants were unhappy with the single-gender initiative, as they expressed that their concerns and input were not desired or requested. Their perception of being intimidated and coerced into accepting the program paved the way for failure, as opposition and animosity increased over time. The lack of communication and lack of preparation further intensified the aversion and opposition to the single-gender program.

With two perspectives on opposite ends of the spectrum, therein lies the dilemma. Why are some programs successful while others are not? Why are some teachers faithfully devoted to teaching within the single-gender confines while it remains unpopular with other teachers?

Teacher Training

The outcomes of student achievement are established on the foundations of teacher quality, the instructional program, practices and policies, and teacher leadership (EdSource, 2010; Korkmaz, 2007). There has been little research regarding teachers' experiences and engagement during the introduction and implementation phase of single-gender initiatives (Gray & Wilson, 2006). As with any new initiative or program, staff development and training is essential to the positive outcomes expected. The initial introduction for change and implementation must be a collaborative effort, as the consultation phase of any new program must involve all stakeholders (Fry, 2009; Gray & Wilson, 2006). Not only training teachers, but also district staff, in the manner with

which boys and girls learn differently is overwhelmingly reflected in grades, standardized testing, discipline referrals, and school climate and culture (Gurian, 2006).

To ensure a successful transition for single-gender education, many factors must be considered. One of the top factors involves teacher training (Rex & Chadwell, 2009). It is crucial for preliminary training to occur that concentrates on gender learning styles and specifically how gender influences learning within the classroom. One of the primary aspects that influences teaching and learning is gender stereotyping and bias, as girls receive less attention; therefore, they receive fewer opportunities in comparison to their male counterparts (Shah & Conchar, 2009). Follow-up training that supports teachers throughout the year and provides reflection on classroom strategies and practices, as well as collaboration with other single-gender teachers, is necessary to continue successful implementation (Gray & Wilson, 2006, Rex & Chadwell, 2009). In one study, 71% of teacher participants described their prior training as inadequate. Seventy-five percent commented that additional support training after implementation was nonexistent. Sadly, the majority of teachers were disenchanted, as they were dissatisfied with the training where "they felt let down by the lack of training offered" (Gray & Wilson, 2006, p. 291). In the study for the United States Department of Education (Riordan et al., 2008), only 33% of elementary teachers and 24% of middle-school teachers acknowledged receiving any professional development.

For successful programs, teachers must be provided with the necessary materials, strategies, and preparation to implement the single-gender initiative. With the training and application of gender learning strategies and brain-based research, students in single-

gender classrooms are able to achieve significantly more (Vrooman, 2009). Upon implementation, guidance and reflection is required as schools embark on this venture.

Parent Perceptions

One of the primary and most basic responsibilities of parents is to ensure the safety and welfare of their child, and education provides the opportunity for a healthy development of both physical and emotional well-being (Korkmaz, 2007; Theisen, n.d.). As such, parents are no longer accepting status quo within the school systems but are becoming more actively involved in the school programs and educational opportunities for their children. In the duration of four years, from 2002-2003 to 2006-2007, there was an increase in parental involvement inside the school setting in regards to general meeting attendance, parent-teacher conference meetings, school/class event attendance, and volunteerism (Herrold, O'Donnell, & Mulligan, 2008; Vaden-Kiernan, McManus, & Chapman, 2005). Student enrollment in assigned public schools decreased 7% between 1993 and 2007. During that same timeframe, there was a 5% increase in enrollment of chosen public schools. Within a four year span, from 2003 to 2007, 88% of students attended their parents' first choice in school programs, which was a 5% increase (Grady, Bielick, & Aud, 2010). There is a growing interest and support among parents in regards to single-gender programs (Mulholland et al., 2004; Rex & Chadwell, 2009) They have heard other parents speak of positive responses to these programs; consequently, this is thrusting schools and districts to examine the potential for single-gender within their communities (Rex & Chadwell, 2009). Many believe that single-gender education provides better learning environments, citing the argument that students' focus is on

education instead of the opposite sex and the belief in the trend that teachers favor one gender over the other when in a coeducational setting (Shah & Conchar, 2009).

South Carolina parents are approving of the initiative and are trusting teachers to understand and meet the needs of the children. According to the South Carolina Surveys on Single-Gender Education and the South Carolina Department of Education (2008a), 75% of parents believe that single-gender classes have helped their children, and approximately 73% would enroll their children in the classes again for the next school year. Shah and Conchar (2009) discovered that 58.6% of adult respondents rated single-sex schooling as very important or important. When disaggregated between male and female supporters for single-sex education, males expressed the need for a girls-only school, while females noted that both boys and girls should be separated. The compromise is for schools to be coeducational with specified subjects taught in the single-gender format.

Student Perceptions

Ultimately, the goal of education is student learning and achievement. Students must believe in and see relevance and importance in order to invest their time and effort into the process. One question to consider is the students' perceptions of their own abilities and how their perception is impacted within the single-gender setting. In a coeducational environment, students can be mocked and discouraged and sent other messages of social disapproval when displaying gender-atypical interests (Sullivan, 2009). Within the confines of a single-gender program, girls view math and science curriculum differently. No longer are these courses considered male-dominated fields; therefore, girls display stronger preferences in these courses (Anfara & Mertens, 2008).

Twenty-one percent of boys estimated their abilities in math to be above average, while only 11% of girls ranked themselves as above average. Girls in single-gender classes are more likely to enroll in courses such as computer science, physics, and engineering in comparison to those within the coeducational setting (Sax, 2008).

Students' perceptions of single-gender classes in relation to their academics and achievements are both positive and negative. Girls' perceived single-gender classes in a more favorable light in comparison with boys (Hoffman, Badgett, & Parker, 2008; Jackson, 2002; Spielhagen, 2006). According to the South Carolina Surveys on Single-Gender Education and the South Carolina Department of Education (2008a), 69% of students in single-gender programs are more interested in trying new ways to learn. Homework and class work completion has improved by 64% and 71% respectively, and 67% of students feel their grades have improved. Among those students that disagreed, 16% said the single-gender classes did not improve their interest in new ways of learning; 19% said their homework completion did not improve; and 12% said class work did not improve. A majority of students perceived that single-gender classes are facilitating higher academic achievement.

In one study, younger participants expressed concern that single-gender schools are not indicative of the real world, as they do not provide them with access to learn appropriate social skills and to prepare for real life situations and activities (Shah & Conchar, 2009). Students want a school which provides a good education and equitable opportunities and participation. They desired an inclusive and democratic environment, regardless of the setting involved (Shah & Conchar, 2009).

Psychological

Academic Self-Concept

Self-concept, self-esteem, and self-worth are all synonymous for an individual's discernment and belief of whom and what one is. One's academic self-concept focuses on the area of education and a person's perception of their own academic abilities (Shavelson, Hubner, & Stanton, 1976). Self-concept can also be associated with self-efficacy, which is "the belief in one's own ability to do something or to achieve a desired effect" (Sullivan, 2009, p. 259). As such, one's academic self-concept is characterized as self-confidence. Overall, according to Colwill (as cited in Sullivan, 2009), males exude more confidence in their own abilities and competence than females, including self-assessment of academic aptitude and ability. The social class and parental education have been linked to this self-assessment, wherein those students with parents of higher education display more self-confidence and higher self-concept (Sullivan, 2009).

Self-concept in school is dependent upon the curriculum area. Boys exhibit higher self-confidence within the math and science content, while girls' higher self-confidence is in the area of English (Sullivan, 2009). This is not surprising when considering that girls are more verbal and enjoy using more words (Gurian, 2006; McNeil, 2008). Reasoning has been presented that single-gender programs affect self-concept and efficacy in sex atypical content (Sullivan, 2009). Single-gender education is beneficial for a girl's academic self-concept within the predominantly masculine domains, such as math and science (Kessels & Hannover, 2008).

Even though girls have increased educational accomplishments, the gender gap within specific academic areas remains. The blame continues to lie with the persistence

of gendered perceptions of abilities (Sullivan, 2009). However, alternative explanations, such as socialization with parents and peers, media portrayal, bias within the actual curriculum, and instructional delivery, can further impact individual perceptions (Kelly, 1985). Whether consciously or subconsciously, these societal gender norms are impressed upon both genders. To fight against this mindset, schools have leaned on single-gender programs. Single-gender schools have reduced these gaps in self-concept (Sullivan, 2009).

Student Well-Being

Whether it is physical or emotional, student wellness is a societal concern. Single-gender classes, directly and indirectly, serve the whole individual. In the single-gender environment, students encounter a sense of belonging and an increase in self-esteem. "Girls' moral and student identities were the strongest predictors of their achievement, whereas their moral, student, physical, and peer identities predicted their overall well-being" (Roeser et al., 2008, p. 115). Many female adolescents encounter self-esteem issues, and for those girls in coeducational settings, their self-esteem plummets (Rueter, 1997). Middle school is difficult for pre-pubescent and pubescent children, as they are in turmoil due to the bombardment of changes. They are becoming self-conscious about their bodies and appearance as they enter puberty, being engulfed in mounting peer pressure, experiencing increased bullying and increased sexual harassment, creating and being accepted within friend and social groups, struggling to maintain academic requirements, coping with family issues, and so forth (Belcher et al., 2006; Kommer, 2006; Sullivan, 2009). Their attractiveness, acceptance by peers, ability to make friends, and being wanted by those of the opposite sex impacts the adolescents'

self-worth and well-being (Roeser et al., 2008). During this time, they need a stable, supportive climate in which they can feel secure and focus on academics (Belcher et al., 2006).

It is an issue of concern for middle-level educators who observe the decrease in confidence that girls experience during middle-school years (Kommer, 2006; Reid & Roberts, 2006). As boys become stereotyped into the specific gender roles that society has for them at earlier ages than girls, these stereotypes are solidified and engrained into their identity (Sadker, 1999). With their desire to belong, students express concerns with how others see them; therefore, they attempt to please others in order to become accepted in the peer group. The coeducation setting promotes these nonacademic values and heightens social pressures, which are distracting students from their academic endeavors and perception of self-identity. (Anfara & Merens, 2008; Vrooman, 2009).

Through the implementation of single-gender education, schools have become successful in offering a system of social supports to address the serious and pertinent needs of these students (Hubbard & Datnow, 2005). Schools with single-gender programs have witnessed an improvement in the self-esteem, confidence, and leadership skills of their students. Advocates have contended that girls' self-esteem is better cultivated within the all-female class, as boys tend to dominate within the coeducational environment (Shah & Conchar, 2009). Girls display more positive attitudes towards traditionally male subjects such as math, science, and technology, which is providing new opportunities for future career endeavors (Anfara & Merens, 2008; Spielhagen, 2006). Harjes (2010) reports more adaptive psychosocial results, in addition to better academics, with benefits dependent upon race and gender.

Most students in the single-gender classes readily admit that their comfort level in classes has increased. There is a heightened sense of empowerment, achievement, and positive self-concept (Shah & Conchar, 2009). They are more willing to raise their hands and answer questions and to acknowledge uncertainty in regards to instructional topics. Girls reported the lack of exposure to harassment (Hubbard & Datnow, 2005; Smith, 2010). The fear of embarrassment or teasing by students of the opposite sex has been alleviated. According to Salomone (as cited in Meyer, 2008) and Spielhagen (2006), girls are less concerned with being ridiculed when just girls are present. There is less concern and preoccupation with personal appearance and that of others (Shah & Conchar, 2009).

Single-gender classes are not only beneficial for girls. Within single-gender environments, boys expressed a lack of necessity to act out and engage in attention-seeking behaviors for the benefit of the girls (Hubbard & Datnow, 2005). Boys enjoy being away from girls, citing they do not like the drama which accompanies girls who are trying to impress them (McNeil, 2008). With increased self-esteem and confidence, students are better able to have more intimate and open conversations with peers and teachers. The absence of the opposite sex students in the classroom provides teachers with the opportunity to engage in candid conversations with students that is essential to their emotional well-being (Hubbard & Datnow, 2005). This provides more options to connect and internalize the instructional content for continuous learning.

Single gender classes provide such a climate for both boys and girls, where they are able to feel comfortable and express themselves without fear (South Carolina Department of Education, 2008a). According to Smith (2010), students expressed

enjoyment in the single-gender classroom because of the ability to openly discuss issues and topics relevant to their gender. Girls acknowledged not being distracted by boys, while boys declared that they lacked girls to get them in trouble. Eighty-three percent of the female participants recognized academic improvement, and 100% of the male participants believed that both their grades and study habits improved (Smith, 2010).

Almost three-fourths of South Carolina student respondents agreed that the single-gender classrooms are integral to their increased confidence, independence, and participation, in addition to their increased desire and ability to succeed. Parents and teachers joined students in agreeing that the classes increase student confidence, class participation, desire to succeed in school and ability to succeed. With the dissenters, only 17% of students disagreed that their self-confidence had improved; 13% disagreed regarding improved participation in class and an increased desire to succeed in school; and 10% disagreed that the classes had improved their determination (South Carolina Department of Education, 2008a; South Carolina Department of Education, 2008b).

Behavior and Discipline Concerns

Behavior and discipline concerns can arise in any educational setting. Single-gender education manages these issues by removing the distractions and themes that evoke negative responses. Teachers and students are better able to focus on the important task at hand – teaching and learning.

Internationally, boys are struggling in school with more discipline problems, more behavior disorders, and consequently lower grades (Gurian & Stevens, 2005 as cited in King & Gurian, 2006). When bored, boys become restless and move around. In turn, they distract themselves and the other students around them, which then leads to

discipline referrals. Boys encompass 80-90% of a school district's referrals and two-thirds of students that are prescribed behavioral medication (Gurian, 2006). Boys are more likely to be suspended and/or expelled from school (Girls and Boys, 2008). When girls were not present, boys felt less pressure to boast, misbehave, or engage in attention-seeking behaviors (Hubbard & Datnow, 2005). Schools with single-gender programs have experienced success in relation to discipline. At Thurgood Marshall School, referrals dwindled from thirty a day to one or two (Friend, 2007). In South Carolina, schools are reporting a decline in disciplinary issues for both boys and girls who are served in single-gender classrooms, with a reduction in discipline referrals from .36 per student during the 2007-08 school term to 0.06 referrals per student during 2008-09 (Rex & Chadwell, 2009). Although the focus of discipline has mainly centered on boys, girls also display behavior problems in class. Their behaviors result from seeking attention from boys and trying to impress others around them.

Particularly in the middle grades, there is a prevalence of sexual harassment. Eighty percent of school-age girls have experienced some form of sexual harassment. Seventy-five percent of boys have reported sexual harassment, usually in the form of taunting them regarding masculinity issues (Rueter, 1997; Sadker, 1999). Single-gender classrooms create an environment that enables students to remove distractions from the opposite sex and focus on academics. With the implementation of single-gender classes, students have explicitly acknowledged that they were not experiencing sexual harassment during class (Hubbard & Datnow, 2005).

Single-gender classes affect attitudes and behaviors in school. Although not ranked as high as other areas on the South Carolina survey, 60% of students maintain that

their attitudes and behaviors have improved due to their single-gender classes, whereas 20-23% disagreed (South Carolina Department of Education, 2008a).

Single-Gender Education Survey

The South Carolina Department of Education posted three surveys regarding Single-Gender Education on their website during the months of April and May 2008. Links for the survey were sent to current schools with single-gender classes. Teachers participated in the survey and were encouraged to have students and parents fill them out as well. With seven levels of agreement ranging from strongly agree to strongly disagree, participants indicated their level of agreement on different categorical statements. With the statewide participation being voluntary and anonymous, approximately 2200 students, 178 parents, and 181 teachers responded to the survey. The survey was implemented with the objective of understanding perceptions of the single-gender program in individual schools and statewide and providing insight on components that were successful and those needing more consideration. It is critical to evaluate the impact that single-gender education is having on students. Students, parents, and teachers agreed that the single-gender classes improved student confidence, participation, and desire and ability to succeed in school. Of the responses, 67% of students, 75% of parents, and 80% of teachers agreed that single-gender classes help students in school performance (South Carolina Department of Education, 2008a).

Conclusion

As pressure mounts and more accountability has been placed on the schools, institutions are searching for ways to create more meaningful educational experiences for children. For some schools, this has begun with implementing different instructional

settings. In light of the vast differences, such as socioeconomic status, curriculum requirements, and assessment procedures, between private and public schools, research on single-gender programs performed within the private school setting does not generalize to a free public education found in the community. It is of urgency to evaluate the potential for increased achievement within public schools through the implementation of single-gender academic programs.

Notwithstanding, single-gender education is not a magic potion or universal remedy for behavioral problems or for academic success. Separate classes are not required to replace the current, ongoing instructional strategies; however, they are the catalyst with which to engage students. Through the alteration of class structure and student dynamics, student accomplishment within the school setting is more accessible than ever before (Rex & Chadwell, 2009). When programs are integrated into the school culture, single-gender classes can create positive and productive educational experiences for boys and girls (Warrington & Younger, 2000). Single-gender success can be the stepping stone to providing more extensive instructional choices and opportunities that will engage students and parents and allow schools to meet the individual needs of all children (Rex & Chadwell, 2009; Spielhagen, 2006).

CHAPTER THREE: METHODOLOGY

The methodology section was organized into the following sections: (a) overview of the study, (b) design of the study, (c) data gathering methods, (d) instrumentation, (e) sampling procedures, and (f) data analysis procedures.

Overview of the Study

The purpose of this study was to examine the academic and psychological outcomes of single-gender education on sixth grade students. It was guided by the following research questions: (a) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade male students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom? (b) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade female students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom? Many past research studies have examined single-gender education; however, the results have been inconsistent. Most of the studies have taken place within the private setting or in other countries. The researcher hypothesizes:

a. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

b. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

c. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade male students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

d. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

e. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade female students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

f. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students and sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies.

Design of the Study

By means of the examination of academic outcomes of single-gender education, the study evaluated the relationship between an exclusive gender class and test scores. The instructional setting and strategies could not be applied randomly. Therefore, a causal-comparative design was utilized to determine if students' academic achievement in mathematics differed based upon receiving instruction in a single-gender educational environment. Within the causal-comparative design, the study specifically investigated the differences in the dependent variable, academic achievement.

Participants

The participants in this study attended a suburban middle school in the southeastern region of the United States. Four single-gender groups, two male and two female, and two coeducational groups served as the participants. The population for these groups consisted of sixth grade students, ages 11-12, enrolled in a mathematics course, with curriculum based upon the state standards and district pacing guide. Enrollment in these courses did not exceed 30 students per group.

Setting

The current enrollment at the school was approximately 1100 students, grades six through eight. The diverse student population consisted of 58% Caucasian, 37% African-American, 4% Hispanic, and 1% other. A majority of the students were from homes with

a lower socioeconomic status based upon the 62% of students who qualified for free or reduced lunch.

The enrollment in the single-gender program, also known as ACE Academy, was limited to the first one hundred males and one hundred females to apply. Classroom instruction within this study occurred in sixth grade mathematics classes, which were located as part of the sixth grade team area in the annex wing. Six sections of sixth grade mathematics courses were sampled for the study. Two sections of students consisted entirely of female students with a female teacher. Two sections of students consisted entirely of male students with a female teacher. Two sections included both male and female students with a female teacher.

Data Gathering Methods

The curriculum taught in each course was identical in that it was based upon on the state curriculum standards and the district pacing guide. Classroom instruction was organized based upon these state curriculum standards and the school district's curriculum and pacing guide; however, classes were varied based upon the instructional strategies employed to teach the curriculum. Teachers of all three groups were expected and did adhere to these guidelines. These instructional programs, consisting of members of the same-sex only, were led by teachers that had received professional development in gender-specific learning styles and instructional strategies. Professional development was provided to each teacher when they began working within the single-gender setting. Teachers then had access to further staff development as they deemed necessary for assistance and support. Under the single-gender initiative through the Office of Public School Choice and Innovation, South Carolina's State Department of Education (2011b)

offered workshops and training throughout the year. Additional resources included newsletters, on-line webinar sessions, curriculum resource guides, links to current research articles, statewide workshops, and site visits (as requested). Teachers were afforded the opportunity to attend sessions and also meet in Professional Learning Communities within the school to address single-gender concerns. The teachers did not attend any specific training this past year; however, in previous years, the state held site visits and workshops at the school during the summer months. Teachers attended and participated at that time. Throughout the year, the teachers read the newsletters and periodic emails regarding general single-gender information, specific instructional strategies, and learning styles.

For male groups, instructors spoke with a louder voice tone with short, directive instructions. Strategies incorporated: collaborative learning with partners, tasks providing students the opportunity to actively move about the room, visual-spatial tasks, quantitative problem solving, deductive reasoning, and competitive activities. For female groups, the instructor spoke in a softer voice tone and provided additional teacher direction and encouragement. Strategies comprised of: collaborative learning with groups, more communication opportunities, open-ended questions, process-based content to encourage independent thinking, and inductive reasoning (Geist & King, 2008, Gurian, 2006). The teacher of the coeducational group did not receive any additional professional development, outside of professional development presented to the entire faculty. Teachers for both the single-gender and coeducational classes were female. Classroom expectations, grading procedures, and formal unit assessments were comparable. To ensure fidelity of the teaching strategies, teacher lesson plans were reviewed periodically.

The Measures of Academic Progress (MAP) test was given to students twice a year. The first administration testing window opened approximately four weeks after school began. The final testing occurred between April and May. The testing schedule was determined by the school district office. According to MAP RIT value norms for mathematics, students were expected to grow an average of six points between fall and spring testing. The median score (50th percentile benchmark) for sixth grade students in the fall was 219 and 225 in the spring (Northwest Evaluation Association, 2008).

Instrumentation

Measures of Academic Progress (MAP)

MAP is a computerized set of adaptive achievement test items designed for grades two through nine. Students were assigned the MAP mathematics survey with goals test. It consisted of 52 multiple choice questions. The test adapted to student responses by adjusting the question difficulty based on those responses during real-time testing (Northwest Evaluation Association, 2009). When students answered correctly, they were provided with a more challenging item. When students answered incorrectly, they were assigned a simpler item. Through this process, the test narrowed in on the student's learning level. Test items corresponded to a vertical scale created utilizing the Rasch model. It provided vertical scale values on the RIT scale (Rasch Unit). RIT assigns value of difficulty to each item and with an equal interval measurement (Pomplun, 2009). Mathematics scores were reported in an overall score and further disaggregated into subtests of numbers and operations, algebra, geometry, measurement, and data analysis and probability (Northwest Evaluation Association, 2009).

The reliability for MAP is a "mix between test-retest reliability and a type of parallel forms reliability . . . as the temporally related and parallel forms of reliability are framed here as the consistency of covalent measures taken across time" (Northwest Evaluation Association, 2009, p. 40). The marginal reliability estimates of the scores for all states are mainly above .90, and the test-retest reliability is above .85 (Northwest Evaluation Association, 2004). The marginal reliability for MAP and South Carolina content aligned Math tests is 0.963. For South Carolina, the correlation for state-content aligned MAP math with different pool test items is 0.864. The marginal reliabilities for the specific subtests of state content-aligned MAP math scores are: numbers/operations 0.836, algebra 0.819, geometry 0.828, measurement 0.837, and data analysis and probability 0.851. In regards to test-retest correlations for state-content aligned math MAP tests, the reliability is 0.877 (Northwest Evaluation Association, 2009).

Validity information includes correlations with state assessment scores and nationally-normed achievement tests. Northwest Evaluation Association provides extensive RIT growth norms by grade and score level for each test (Pomplun, 2009). Data is aligned with state and national standards that provide relevant, detailed information in regards to students' instructional needs.

Sampling Procedures

Participants in the single-gender groups were chosen through convenience sampling. With Title IX federal regulations, single-gender educational models must be an optional choice for parents and students; therefore, randomization was not possible for the experimental group. Parents may request for students to be removed from the single-gender classroom at any time.

Class rosters were formulated during the summer months. Students were grouped according to their ability levels as determined by their scores on the South Carolina state achievement test, Palmetto Assessment of State Standards (PASS). There are three categorizations of achievement: exemplary, met, or not met. Those students scoring exemplary have demonstrated exemplary performance on grade-level curriculum standards. Students scoring met have demonstrated ability to meet the grade-level curriculum standards. Students scoring not met have not demonstrated satisfactory achievement on the grade-level curriculum standards (South Carolina State Department of Education, 2011c). Students were grouped into either an exemplary group or a met/not met group. Upon completion of the schedule, data was compiled in regards to the class enrollment, gender, ethnicity, MAP scores, and socioeconomic status (utilizing free/reduced lunch status) of all sixth grade students. This information was sorted based on enrollment in single-gender math classes versus coeducational math classes. From this information, a coeducational class was selected that best matched the composition of the single-gender classes in terms of the aforementioned variables.

Upon class selections, a letter was sent home explaining the study and requesting permission. Follow-up letters and emails were sent to non-respondents. In addition, extra consent forms were made available for those parents who did not initially return the consent form.

Data Analysis

In the analysis, three groups were compared: the female single-gender section, the male single-gender section, and the coeducational section. The growth between fall and spring scores on MAP data was factored as variants. The class sections served as the

independent variables and the growth between fall and spring MAP data served as the dependent variable. As such, an analysis of variance was utilized. The $p < .05$ level of significance was used to determine possible rejection of the null hypotheses. The magnitude of the effect was calculated for an eta-squared value, which described the proportion of total variability attributable to each factor. The value was analyzed to determine the variability (Howell, 2008). The SPSS program provided estimates of the effect size as partial eta-squared values for each effect and each parameter estimate.

In summary, the research study was designed to examine the effects of the classroom instructional setting, single-gender versus coeducation, upon student academic achievement in mathematics. Measures of Academic Progress (MAP) testing was used as a pre-test and posttest measure. Results will be presented, evaluated, and summarized in chapter four.

CHAPTER FOUR: RESULTS

Overview

Teaching and learning continue to evolve into educators' research methods and strategies in which to instill knowledge in children and improve the educational system within the United States. The goal has been to improve academic achievement, thus increasing high stakes test scores, graduation rates, and progress on No Child Left Behind. One such current alternative has been the incorporation of single-gender education programs within the realm of public education. As presented in chapter one, this study explores the outcomes of single-gender educational programs on student achievement in mathematics.

In chapter two, the literature review presented discussion within some schools of thought that varied learning styles and preferences are based upon gender and physiological differences. Although there have been numerous studies, both nationally and internationally, overwhelming support for or against single-gender education has not been substantiated. There have been conflicting results from numerous studies in regard to the impact that single-gender education has on student achievement.

The design of the study, methods for gathering data, and instrumentation utilized were presented in chapter three. Chapter four describes the six student sample groups involved in the study: two female single-gender sections, two male single-gender sections, and two coeducational sections. Also presented is the Measures of Academic Progress data growth between fall and spring test administrations.

Demographics and Descriptive Data

The study included sixth grade mathematics students enrolled in a middle school located in the southeastern part of the United States. The school had an enrollment count of approximately 1100 students and housed grades six through eight. There was a diverse student population comprised of 58% Caucasian, 37% African-American, 4% Hispanic, and 1% other. Approximately 62% of students qualified for free or reduced lunch. The enrollment in the single-gender program, referred to as ACE Academy, was limited to one hundred males and one hundred females, based on a first come, first served basis. All students were enrolled in an identical general mathematics course in terms of content driven by the state curriculum standards. Classes were structured differently by means of the physical environment and instructional strategies. The physical environment consisted of single-gender placements, room color, room temperature, teacher voice level, and desk arrangement. Instructional strategies for single-gender male classes included: movement within the lessons, timed activities, competitive activities, rapid fire questioning, paired grouping, deductive reasoning, prewriting, and use of non-fictional reading materials. Instructional strategies for single-gender female groups included: cooperative group work, class discussion, open-ended questions, non-timed activities, readings that were fictional and driven towards female interests, and detailed, written work.

There were a total of six groups within the study, which were comprised of two male groups, two female groups, and two coeducational groups. All sixth grade students were scheduled and placed into classes according to achievement scores on the 2010 Palmetto Assessment of State Standards (PASS) by the school. There are three

categorizations of achievement on PASS testing: exemplary, met, or not met. The exemplary category contains students who have demonstrated exemplary performance on grade-level curriculum standards. The met category is assigned to students that have demonstrated ability to meet the grade-level curriculum standards. Those students in the not met category have not demonstrated satisfactory achievement on the grade-level curriculum standards (South Carolina State Department of Education, 2011c).

The researcher utilized the single gender classes and then chose the coeducational groups which were of similar comparison in terms of achievement. Group one consisted of 50 male students taught in single-gender male mathematics classes. Group two consisted of 51 female students in single-gender female mathematics classes. Group three was comprised of 51 students (29 males and 22 females) in coeducational classes. Group four incorporated the 29 males students enrolled within the coeducational mathematics classes. Group five included the 22 female students who were enrolled in the coeducational mathematics classes.

Research Questions and Null Hypotheses

With the investigation of alternatives to regular education programs, specifically single-gender classrooms, the research examined the academic outcomes of single-gender education on a sample of sixth grade students. The study was guided by the following research questions: (a) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade male students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom? (b) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade

female students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom?

The researcher hypothesizes:

a. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

b. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

c. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade male students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

d. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific

strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

e. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade female students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

f. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students and sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies.

Descriptive Statistics

The test utilized for statistical analysis was an analysis of variance (ANOVA) at the $p < .05$ level of significance. Its purpose was to determine possible rejection of the null hypotheses. The magnitude of the effect was calculated for an eta-squared value, to provide insight into the variability. The SPSS program provided the estimates of the effect size as partial eta-squared values for each effect and each parameter estimate and calculated the effect size.

For the purposes of the research, student achievement was measured based upon students' scores on the Measures of Academic Progress (MAP) computerized assessment program, developed by the Northwest Evaluation Association (Northwest Evaluation Association). Scores were reported in terms of Rasch Units (RIT), which is a value of

difficulty assigned to each test item. Northwest Evaluation Association developed normative data in which to compare students' class and grade level performance. The end-of-year mean score for sixth grade mathematics is 223.8 and the end-of-year median score is 225 (Northwest Evaluation Association, 2008). The median score would place students at the 50th percentile. To evaluate student achievement, results in the growth of students' scores from testing on MAP in the Fall of 2010 to Spring 2011 were recorded. Raw data from each of the groups has been outlined in the following tables.

Table 2 outlines MAP scores and growth for group one, which was comprised of 50 male students taught in single-gender classes. The average growth for group one was 3.280, with 60.0 % of students attaining some achievement growth over the course of the school year. Of this group, only 36.0% of students demonstrated at least one year's worth of achievement growth.

Table 2

Group 1: Single-Gender Males

#	RIT		Growth
	Fall 10	Spring 11	
1	222	218	-4
2	234	233	-1
3	220	225	5
4	235	240	5
5	219	225	6
6	224	237	13
7	222	215	-7
8	220	235	15
9	217	237	20
10	228	225	-3
11	230	226	-4
12	229	243	14

13	232	234	2
14	222	220	-2
15	223	221	-2
16	221	218	-3
17	229	232	3
18	232	240	8
19	223	225	2
20	212	230	18
21	217	222	5
22	217	236	19
23	228	235	7
24	222	213	-9
25	228	222	-6
26	243	238	-5
27	211	213	2
28	204	203	-1
29	200	202	2
30	215	225	10
31	207	191	-16
32	213	216	3
33	197	185	-12
34	201	214	13
35	204	199	-5
36	209	214	5
37	187	194	7
38	232	236	4
39	216	231	15
40	215	215	0
41	197	203	6
42	218	216	-2
43	211	220	9
44	220	228	8
45	216	231	15
46	216	223	7
47	208	208	0

48	205	205	0
49	205	207	2
50	202	198	-4

Table 3 outlines MAP scores and growth for group two, which was comprised of 51 females enrolled in single-gender classes. The average growth for group two was 5.941, with 82.4 % of students attaining some achievement growth over the course of the school year. A significantly lower percentage, 54.9%, of students demonstrated at least one year's worth of achievement growth.

Table 3

Group 2: Single-Gender Females

#	RIT		Growth
	Fall 10	Spring 11	
1	216	233	17
2	220	225	5
3	225	235	10
4	234	235	1
5	223	220	-3
6	230	237	7
7	220	221	1
8	225	224	-1
9	229	230	1
10	222	236	14
11	215	236	21
12	218	221	3
13	222	231	9
14	216	214	-2
15	227	233	6
16	223	229	6
17	224	230	6
18	226	228	2
19	221	228	7

20	235	232	-3
21	218	232	14
22	217	223	6
23	212	230	18
24	229	240	11
25	222	230	8
26	217	224	7
27	221	231	10
28	235	238	3
29	212	217	5
30	208	221	13
31	212	224	12
32	217	212	-5
33	198	206	8
34	200	209	9
35	205	209	4
36	199	202	3
37	204	212	8
38	198	197	-1
39	215	220	5
40	206	199	-7
41	204	212	8
42	211	218	7
43	190	210	20
44	207	211	4
45	223	227	4
46	202	204	2
47	212	219	7
48	211	208	-3
49	209	220	11
50	207	214	7
51	215	215	-2

Table 4 outlines MAP scores and growth for group three, which was comprised of 51 students (29 males and 22 females) in coeducational classes. The average growth for group three was 5.059, with 80.0 % of students attaining some achievement growth over the course of the school year. Over half, 54.9%, of the group demonstrated at least one year's worth of achievement growth.

Table 4

Group 3: Coeducational

#	RIT		Growth
	Fall 10	Spring 11	
1	228	230	2
2	223	229	6
3	226	231	5
4	235	231	-4
5	225	228	3
6	220	224	4
7	220	229	9
8	220	219	-1
9	224	230	6
10	220	232	12
11	221	232	11
12	223	235	12
13	227	235	8
14	224	229	5
15	240	246	6
16	220	216	-4
17	208	216	8
18	225	237	12
19	215	216	1
20	231	236	5
21	229	230	1
22	230	218	-12
23	227	227	0
24	234	234	0

25	217	227	10
26	225	233	8
27	234	237	3
28	224	233	9
29	240	246	6
30	212	210	-2
31	203	210	7
32	213	231	18
33	205	215	10
34	216	226	10
35	198	198	0
36	217	223	6
37	212	220	8
38	209	216	7
39	218	227	9
40	213	231	18
41	210	217	7
42	205	198	-7
43	225	226	1
44	206	203	-3
45	207	220	13
46	215	226	11
47	220	225	5
48	209	216	7
49	209	213	4
50	208	214	6
51	213	205	-8

Table 5 outlines MAP scores and growth for group four, which incorporated the 29 male students enrolled within the coeducational mathematics classes. The average growth for group four was 5.931, with 82.6 % of male students attaining some achievement growth over the course of the school year. Half of the class (51.7%) demonstrated at least one year's worth of achievement growth.

Table 5

Group 4: Coeducational Males

#	RIT		Growth
	Fall 10	Spring 11	
1	225	226	1
2	212	210	-2
3	203	210	7
4	213	231	18
5	206	203	-3
6	207	220	13
7	215	226	11
8	216	226	10
9	220	225	5
10	209	216	7
11	209	213	4
12	218	227	9
13	213	205	-8
14	226	231	5
15	225	228	3
16	220	224	4
17	220	229	9
18	220	219	-1
19	220	232	12
20	223	235	12
21	227	235	8
22	224	229	5
23	240	246	6

24	208	216	8
25	225	237	12
26	231	236	5
27	234	234	0
28	234	237	3
29	224	233	9

Table 6 outlines MAP scores and growth for group five, which were 22 female students from coeducational mathematics classes. The average growth for group five was 3.909, with 72.73% of students attaining some achievement growth over the course of the school year. Of this group, 59.1% of students demonstrated at least one year's worth of achievement growth.

Table 6

Group 5: Coeducational Females

#	RIT		Growth
	Fall 10	Spring 11	
1	213	231	18
2	210	217	7
3	205	198	-7
4	205	215	10
5	198	198	0
6	217	223	6
7	212	220	8
8	209	216	7
9	208	214	6
10	228	230	2
11	223	229	6
12	235	231	-4
13	224	230	6
14	221	232	11
15	220	216	-4
16	215	216	1
17	229	230	1
18	230	218	-12
19	227	227	0
20	217	227	10
21	225	233	8
22	240	246	6

In summary, table 7 provides a comparison of the groups on the basis of end-of-year mean scores, mean growth, and percentage of students achieving growth. The highest scoring groups were the coeducational students. The top performing group was the coeducational males with an end-of-year mean of 225.483, which consisted of the male students served within the coeducational classroom. Their scores help to bring up the overall coeducational scores to second place end-of-year mean score of 224.235. Their averages were above the Northwest Evaluation Association mathematics mean norm of 223.8 but below the median norm of 225 (Northwest Evaluation Association, 2008). The coeducational female group, single-gender female group, and single-gender male group all scored below the mean and median grade level norm. Although the coeducational students finished with higher mean scores, all groups demonstrated growth. The single-gender male groups had far less students attaining growth and earning a full year's growth over the course of the year than the female and coeducational groups.

Table 7

Means and Growth

Group	End-of-Year Mean	Average Growth from Fall to Spring	% of Students Attaining Growth	% of Students with Full Year's Growth
1: Single-Gender Males	220.440	3.280	60.0	36.0
2: Single-Gender Females	221.765	5.941	82.4	54.9
3: Coeducational	224.235	5.059	80.0	54.9
4: Coed Males	225.483	5.931	82.6	51.7
5: Coed Females	222.591	3.909	72.7	59.1

An analysis of variance was utilized in order to determine statistical significance. The null hypotheses stated:

a. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

b. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

c. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade male students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

d. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

e. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade female students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

f. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students and sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies.

With comparison of MAP growth between all students served in a single-gender program and all students served in a coeducational program, there was no significance in the level of academic achievement between the two groups. The *F* ratio of .826 (see Table 8) was not significant at the .05 level. Therefore, the null hypothesis was affirmed that there were no statistical difference in Measures of Academic Progress (MAP) mathematics growth scores between students in single-gender classes and students in coeducational classes.

Table 8

Comparison of MAP Growth between All Single-Gender Groups and All Coeducational Groups

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	1241.961	21	59.141	.826	.671
Within Groups	2076.667	29	71.609		
Total	3318.627	50			

Comparing the MAP growth between male students served in the single-gender group and all students served in the coeducational group, there was no significance in the level of academic achievement between the two groups. The *F* ratio of .738 (see Table 9) was not significant at the .05 level. Therefore, the null hypothesis is true that there is no statistical difference in growth scores of single-gender sixth grade male mathematics students and sixth grade coeducational mathematics students.

Table 9

Comparison of MAP Growth between the Single-Gender Male Group and the Coeducational Group

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	1057.413	20	52.871	.738	.757
Within Groups	2076.667	29	71.609		
Total	3134.080	49			

In evaluation of the difference in MAP growth between male students served in the single-gender group and male students served in the coeducational group, there was

no significance in the level of academic achievement between the two groups. The *F* ratio of .482 (see Table 10) was not significant at the .05 level. Therefore, the null hypothesis is upheld that there is no statistical difference between sixth-grade single-gender male achievement and sixth-grade coeducational male achievement in mathematics.

Table 10

Comparison of MAP Growth between the Single-Gender Male Students and the Coeducational Male Students

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	784.701	17	46.159	.482	.914
Within Groups	1052.333	11	95.667		
Total	1837.034	28			

In the comparison of MAP growth between female students served in the single-gender group and all students served in the coeducational group, there was no significance in the level of academic achievement between the two groups. The *F* ratio of 1.660 (see Table 11) was not significant at the .05 level. Therefore, the null hypothesis is true in regards to there is no statistical difference in growth scores of single-gender sixth grade female mathematics students and sixth grade coeducational mathematics students.

Table 11

Comparison of MAP Growth between the Single-Gender Female Group and the Coeducational Group

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	1052.824	21	50.134	1.660	.102
Within Groups	876.000	29	30.207		
Total	1928.824	50			

With the comparison of MAP growth between female male students served in the single-gender classes and female students served in the coeducational group, there was no significance in the level of academic achievement between the two groups. The *F* ratio of .1.155 (see Table 12) was not significant at the .05 level. Therefore, the null hypothesis that there is no statistical difference in Measures of Academic Progress (MAP) mathematics growth scores is accepted between the sixth grade single-gender female achievement and sixth-grade coeducational female in mathematics.

Table 12

Comparison of MAP Growth between the Single-Gender Female Students and the Coeducational Female Students

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	490.064	11	44.551	1.155	.414
Within Groups	385.800	10	38.580		
Total	875.864	21			

Comparing the MAP growth between all male students in the single-gender classes and all female students in the single-gender classes, there was no significance in

the level of academic achievement between the two groups. The *F* ratio of 1.660 (see Table 13) was not significant at the .05 level. Therefore, the null hypothesis is accepted that there is no statistical differences in growth scores of sixth-grade male students and sixth-grade female students who were taught in single-gender classrooms.

Table 13

Comparison of MAP Growth between Single-Gender Male Students and Single-Gender Female Students

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	1132.080	22	51.458	.694	.807
Within Groups	2002.000	27	74.148		
Total	3134.080	49			

To assess the extent to which variation between the groups was accurately credited to the type of educational setting, the magnitude of the effect was calculated. Utilizing the eta-squared value, insight was provided for the group variability (Howell, 2008). The SPSS program provided the estimates of the effect size as eta-squared values for each effect and each parameter estimate. Among the single-gender male group, there was a 33.7% variability between single-gender and coeducational classes. Therefore, 33.7% of the achievement scores can be attributed to group membership. Within the male single-gender group, there was 66.3% variability. In the single-gender male groups, there was 42.7% variability between males in single-gender classes and males in coeducational classes, in which 42.7% of student achievement scores can be attributed to group membership (see Table 14). Although the setting may have impacted the student scores, the growth and amount of achievement was not significant at the .05 level.

Table 14

Eta Squared Values for Male Students

	Single-Gender Males and All Coeducational		Single-Gender Males and Coeducational Males	
	Between Groups	Within Groups	Between Groups	Within Groups
Sum of Squares	1057.413	2076.667	784.701	1052.333
Eta Value	.337	.663	.427	.573

Among the exemplary female groups, there was a 54.6% variability between single-gender and coeducational classes. Therefore, 54.6% of the achievement scores can be attributed to group membership. Within the single-gender female group, there was a 45.4% variability. In the single-gender female groups, there was a 56.0% variability between females in single-gender classes and females in coeducational classes, in which 56.0% of student achievement scores can be attributed to group membership (see Table 15). Although the setting may have impacted the student scores, the growth and amount of achievement was not significant at the .05 level.

Table 15

Eta Squared Values for Female Students

	Single-Gender Females and All Coeducational		Single-Gender Females and Coeducational Females	
	Between Groups	Within Groups	Between Groups	Within Groups
Sum of Squares	1052.824	876.000	490.064	385.800
Eta Value	.546	.454	.560	.440

Summary of Results

The purpose of the study was to evaluate the connection between classroom placement and student achievement in mathematics, specifically between a single-gender classroom model and a typical coeducational classroom model, that can be seen in school settings throughout the world. Through the use of a causal-comparative design, students were evaluated with the purpose to discover connections between single-gender classrooms and higher academic achievement. The researcher hypothesized that there would be no statistical differences in mathematics achievement between sixth grade male and female students receiving instruction utilizing gender-specific strategies within a single-gender instructional environment and sixth grade students receiving a non-specific assortment of instructional strategies in a coeducational environment.

Through the use of SPSS, an Analysis of Variance (ANOVA) calculated data based on achievement growth on the Measures of Academic Progress (MAP) testing administered to students in Fall, 2010 and Spring, 2011 from the following: two single-gender male classes, two single-gender female classes, and two coeducational classes. In studying and analyzing the growth in academic achievement between groups in single-gender programs and those in coeducational programs based upon MAP growth scores, there was no significant difference found between the level of academic growth and achievement and gender. A majority of students, regardless of class model or gender, either maintained or gained points on MAP testing in Spring, 2011. The single-gender males had 60.0% achievement growth; the single-gender females group reached 82.4% achievement growth; the coeducational group attained 80.0% achievement growth; the coeducational males earned 82.6% achievement growth; and the coeducational females

reached 72.7% achievement growth.

In respect to reaching a full year's worth of academic growth over the course of the school year, the class percentages were much lower. The single-gender male group had 36.0% of its students reached a year's growth. The single-gender female group had 54.9% of its students to meet a year's worth of growth. In the coeducational group, 54.9% reached a year's growth. The coeducational male students had 51.7% to meet a year's worth of growth. With the coeducational female students, 59.1% of students reached a year's growth.

To determine variability among groups, the eta squared value was calculated. The variability between single-gender male groups and coeducational groups was 33.7% and 42.7% between single-gender males and coeducational males. Variability between female exemplary groups and coeducational groups was 54.6%, and for single-gender females and coeducational females, the variability was 56.0%. While there was variability between groups that may have had some bearing on achievement scores, the overall growth on MAP scores and amount of achievement was not significant at the .05 level. Students attained academic achievement regardless of their educational setting.

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

Introduction

A cornerstone of American society has been the access of a free public education. The methodology in the educational landscape is ever-changing as new programs are implemented in hopes of enhancing student learning and continuing to provide a quality education. Times are changing, and some parents are losing faith in the public school system and looking elsewhere in provide their children with the best education. Educational stakeholders are creating more demands for educational choice, whether it be school vouchers, specialized programs, or exclusive schools.

Over the years, there have been many educational programs initiated with little or no research to substantiate these new endeavors. One such program that has recently gained popularity is the implementation of single-gender classes. With the lifting of Title IX restrictions, single-gender educational programs and schools are being offered as a choice option in many states. There has been conflicting evidence as to the impact of single-gender settings on the outcomes of enhanced student achievement.

Purpose

Within the middle grade levels in the public school setting, most students are randomly grouped in classes. The exception to the rule occurs when students are considered academically gifted and talented, as defined by achievement on standardized tests, or labeled as special education and provided services based upon individual needs. These students are often placed in accelerated classes in order to challenge them academically. Public school settings have begun to include other placement settings with

the expectation of improving achievement. Single-gender classes have been touted as the solution to academic problems with middle-school children. The purpose of this research was to evaluate the effects of classroom placement, specifically single-gender classrooms, on student achievement within the core content area of mathematics.

Research Questions

The study was guided by the following research questions: (a) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade male students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom? (b) To what extent is the mathematical achievement, as evidenced by growth of Measures of Academic Progress (MAP) scores, of sixth grade female students affected when taught with the implementation of gender-specific instructional strategies in a single-gender classroom?

Review of Methodology

Participants

The study's participants included 152 sixth grade mathematics students enrolled in a suburban middle school located in the southeastern part of the United States. The school's enrollment was approximately 1100 students in grades six through eight, with a diverse student population comprised of 58% Caucasian, 37% African-American, 4% Hispanic, and 1% other. Approximately 62% of students qualified for free or reduced lunch. All students were enrolled in an identical general mathematics course in terms of content driven by the state curriculum standards. Classes were structured differently by means of the physical environment and instructional strategies.

There were a total of six classes within the study. Two male single-gender classes formed the male group, two single-gender female classes formed the female group, and two coeducational classes formed the coeducational group. Sixth grade students were scheduled and placed into classes according to achievement scores on the 2010 Palmetto Assessment of State Standards (PASS) by the school. There are three categorizations of achievement on PASS testing: exemplary, met, or not met. In the exemplary category, students demonstrated exemplary performance on grade-level curriculum standards. The met category contained students that demonstrated ability to meet the grade-level curriculum standards. Those students in the not met category did not demonstrate satisfactory achievement on the grade-level curriculum standards (South Carolina State Department of Education, 2011c). Group one consisted of 50 male students taught in single-gender male mathematics classes. Group two consisted of 51 female students in single-gender female mathematics classes. Group three was comprised of 51 students (29 males and 22 females) in coeducational classes. Group four incorporated the 29 males students enrolled within the coeducational mathematics classes. Group five included the 22 female students who were enrolled in the coeducational mathematics classes.

Methods

A causal-comparative design was utilized to determine if students' academic achievement in mathematics differed based upon receiving instruction in a single-gender educational environment. The study specifically investigated the differences in the dependent variable, academic achievement.

Participants in the single-gender groups were chosen through convenience sampling. Due to Title IX federal regulations, single-gender educational models are

designated as optional; therefore, randomization is not possible for the experimental group. Class rosters were formulated during the summer months, and students were grouped according to their ability levels as determined by their scores on the South Carolina state achievement test, Palmetto Assessment of State Standards (PASS). There were three categorizations of achievement: exemplary, met, or not met. Students scoring exemplary demonstrated exemplary performance on grade-level curriculum standards. Students scoring met demonstrated ability to meet the grade-level curriculum standards. Students scoring not met did not demonstrate satisfactory achievement on the grade-level curriculum standards (South Carolina State Department of Education, 2011c). Students were grouped into either an exemplary group or a met/not met group. Upon completion of the schedule, data was compiled in regards to demographics, which was utilized to select a coeducational class that best matched the composition of the single-gender classes in terms of demographics.

The mathematics curriculum taught in all sixth grade classes was planned and taught in consistency with the state curriculum standards and the district pacing guide. Single-gender classes were distinctive based upon the instructional strategies developed and implemented in order to teach the curriculum. These instructional programs were taught by teachers with professional development in gender-specific learning styles and instructional strategies.

The Measures of Academic Progress (MAP) test, a computerized test consisting of 52 adaptive achievement test questions, was given to students twice during the year, once in September and once in April. The test adapted to student responses by adjusting the question difficulty based on their responses to determine the student's learning level.

Scores were furnished in terms of a vertical scale value on the RIT scale (Rasch Unit). According to MAP RIT value norms for sixth grade mathematics, student scores were expected to increase six points between fall and spring testing, which would reflect a year's academic growth. The median score (50th percentile benchmark) for sixth grade students in the fall is 219 and 225 in the spring (Northwest Evaluation Association, 2008).

For analysis, the male single-gender sections, the female single-gender sections, and the coeducational sections were compared based upon growth between fall and spring RIT scores of MAP data. The class sections functioned as the independent variable and the growth between fall and spring MAP data functioned as the dependent variable. An analysis of variance was utilized, and the $p < .05$ level of significance was used to determine possible rejection of the null hypothesis. The magnitude of the effect was calculated for an eta-squared value to describe the proportion of total variability attributable to each factor.

Results

There was no evidence that students enrolled in single-gender classes gained higher achievement scores on the Measures of Academic Progress (MAP) mathematics test in comparison with students enrolled in coeducational classes. The null hypotheses stated:

a. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade students who were placed in single-gender classrooms and received instruction utilizing gender-specific

strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

b. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

c. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade male students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

d. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade students who were placed in coeducational classrooms and received a non-specific assortment of instructional strategies.

e. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies as compared to sixth grade female students who were placed in

coeducational classrooms and received a non-specific assortment of instructional strategies.

f. There will be no statistical differences in Measures of Academic Progress (MAP) mathematics growth scores of sixth grade male students and sixth grade female students who were placed in single-gender classrooms and received instruction utilizing gender-specific strategies.

With the comparison of MAP growth between all single-gender students and all coeducational students, there was no significance in the level of academic achievement between the two groups, with an *F* ratio of .826. The null hypothesis was true that there was no statistical difference in MAP math growth scores when comparing all single-gender students and all coeducational students.

Male students grouped in the single-gender classes gained an average of 3.280 RIT points on math MAP testing, with 60.0% of the class demonstrating some growth in achievement between Fall 2010 and Spring 2011 testing. Only 36.0% of the class made academic gains that reflected a year's growth. In comparison to the coeducational classes, who scored an average of 5.059 RIT points, 80.0% demonstrating some growth in achievement, and 54.9% demonstrating a year's worth of academic growth, the *F* ratio of .738 was not significant at the .05 level. Therefore, the null hypothesis was affirmed in the comparison of sixth grade male students in single-gender classes and sixth grade coeducational students.

Male students grouped within the coeducational classes gained an average of 5.931 RIT points on math MAP from Fall 2010 to Spring 2011, with 82.6% of the male students making some achievement gains on testing. More than half, 51.7%, of the

coeducational males made academic gains that reflected a year's growth. There was no significance in the level of academic achievement between the single-gender male students and coeducational male students, with an *F* ratio of .482. Therefore, the null hypothesis was true in the comparison of sixth grade male students placed in single-gender classroom versus sixth grade male students placed in coeducational classrooms.

Female students grouped in the single-gender classes gained an average academic growth score of 5.941 RIT points on math MAP testing between Fall 2010 and Spring 2011, in contrast to the coeducational students who gained an average academic growth score of 5.059 RIT points. The single-gender females had 82.4% of their class attain some achievement growth over the year, with 54.9% of students reaching a full year's academic growth. The coeducational class had 80.0% of its population attain some achievement growth over the year, with 54.9% of students reaching a full year's academic growth. In evaluation of the difference in MAP growth of single-gender female students in comparison to the coeducational classroom, there was no significance in the level of academic achievement, as the *F* ratio was 1.660, which upheld the null hypothesis.

Female students within the coeducational classes gained an average academic growth rate of 3.909 RIT points on math MAP testing between Fall 2010 and Spring 2011, with 72.7% of the class demonstrating some achievement gains and 59.1% of the class earning a full year's academic growth. There was no significance in the level of academic achievement between the single-gender female students and coeducational female students, with an *F* ratio of 1.155. Therefore, the null hypothesis was true in the

comparison of sixth grade female students placed in single-gender classroom versus sixth grade female students placed in coeducational classrooms.

With the comparison of MAP growth between all single-gender male students and single-gender female students, there was no significance in the level of academic achievement between the two groups, with an *F* ratio of .694. Therefore, the null hypothesis was accepted that there is no statistical difference in MAP math growth scores between sixth grade male students and sixth grade female students placed in single-gender classrooms.

Variability among groups was calculated based upon the eta squared value. The variability between all single-gender students and all coeducational students was 37.4%. Between single-gender males and all coeducational students, the variability was 33.7%, and it was 42.7% between single-gender males and coeducational males. Variability between single-gender females and all coeducational students was 54.6%, and for single-gender females and coeducational females, the variability was 56.0%. Variability between single-gender males and single-gender females was 36.1%. While there was variability between groups that may have had some bearing on achievement scores, the overall growth on MAP scores and amount of achievement was not significant at the .05 level.

Discussion

Academic achievement and growth can be defined and assessed in a variety of ways. This study chose to utilize the Measures of Academic Progress (MAP), which is a standardized test given twice a year throughout the school district, as a means to chart and track academic growth. Scores are reported in terms of Rasch (RIT) units. The

measurement was chosen due to its accepted use within the district, ability to track students longitudinally, and fluidity of questioning to pinpoint a more precise level of achievement.

For the particular group of single-gender students in this study, their classroom placement had little bearing on making academic gains in comparison to their coeducational peers. All student groups presented at least 60% growth over the school year. The lowest percentage of students demonstrating some achievement growth (60.0%) occurred in the single-gender male group. Their overall end-of-year average RIT of 220.440 was below all other groups and placed them four and a half points lower than the end-of-year norms for sixth graders (225). These scores actually reflected a beginning-of-the year sixth grade value. With that being said, the group increased an average of only 3.280 points between the fall and spring, which was below the expected growth of six points per year.

The single-gender female students earned an overall group average score of 221.765, which was the second-lowest of all groups, placed them at the middle-of-year sixth grade level. Therefore, they were achieving slightly below grade level standard. However, 82.4% of these female students displayed some achievement growth, and 54.9% of students reached the full year's growth of six points. Their growth of 5.941 points over the year falls very close to the norm of a six point gain throughout the year, and they achieved the highest growth of all groups.

The group with the second-highest end-of-year average was the coeducational group, with an average of 224.235. Their average was very near the end-of-year sixth grade norm of 225. Their average increase of 5.059 RIT points was in the middle of all

groups and was near the expected norm growth of six points. As such, this group of students is functioning at an end-of-year sixth grade level, which is on grade level, with 80.0% of students attaining some growth and 54.9% attaining a full year's growth.

The group with the highest RIT gains was the coeducational male group with an end-of year average of 225.483, which placed them on grade level. Their average growth from fall to spring was almost on target with a score of 5.931. The coeducational males had the highest percentage of students attaining growth with 82.6%. At least 51.7% of the students earned a full year's growth.

The coeducational female students slightly below level with an average RIT of 222.591. This placed them at the middle-of-year sixth grade. Their average growth gain of 3.909 was below the norm of 6 points for the sixth grade year. Seventy-two percent of students attained some growth, with 59.1% of students reaching a full year's growth.

Students attained academic achievement regardless of their educational setting, but the academic gains in all groups were not sufficient in order to allow students to recover instructional material, decrease the gap between what they are expected to know and what they do know, and maintain their grade level functioning. However, it is clear that there is more to learning than the classroom placement. Student investment and engagement are among the vital components for growth and achievement. It is undetermined how each individual single-gender student's growth related to their growth when served in coeducational programs.

Limitations

With the evaluation and review of this study, there are several limitations that must be considered. Primarily, the study has limited generalization. The location of the

participating school, along with student demographics, is not easily replicated. The school is a large middle school, currently serving approximately 1200 students. The school is in the county seat and is situated in a rural area that has been rapidly developing into a suburban community as more big business and industry are increasing. However, this process has been decelerated by the recession and unstable economy that has impacted the community. The county encompasses a diverse population, which is reflected through the school population.

Student enrollment in the single-gender program was on a volunteer basis, with the first 100 male and first 100 female students receiving allocation for the classes. Therefore, some willing student participants may have been unable to enroll in classes. In addition, there are determinants that may have influenced parental decisions to register their children for single-gender classes, such as student maturity, parental and student buy-in to the single-gender model, student behavior, and student achievement, which were not measured in the study. Students with no involvement in the decision may be less than willing participants.

There are a myriad of factors that impact student learning, many of which were not measured within this study. With the research methodology and nature of the research, actual teaching was not observed. Therefore, it is unclear as to the implementation and frequency of gender strategies within the classroom. Although instructional strategies were written into lesson plans, it is unrealistic to reason that the plans were implemented fully and consistently as written. Teaching has multiple unexpected and unpredicted moments that occur within the instructional day which impact teaching and learning, whether it be classroom management issues, student

difficulty in comprehension of the material and need for remediation, student interest, or time management.

Another aspect not considered was the classroom and teacher dynamics. Classroom dynamics play a key role in student learning, as the composition of the classroom impacts student learning and achievement. Student attitudes regarding the subject material, the overall classroom structure, and satisfaction with the single-gender instructional design were not addressed. Students feeling more comfortable in a single-gender setting would be more apt to focus, participate, and engage in their learning in comparison to students who had no desire or investment.

The teacher has a momentous impact on student learning and is a major contributor to the success or failure of single-gender programs (Korkmaz, 2007; Rex & Chadwell, 2009). Teachers voluntarily agreed to teach within the single-gender setting, but their attitudes towards teaching math curriculum, the specific gender of students in the classroom, and the overall perception of the single-gender program were not considered. It was unclear as to the teacher-student relationships within the classroom, which would greatly influence student achievement and learning (Korkmaz, 2007; Leren, 2006; Montalvo, Mansfield, & Miller, 2007). A student's relationship with the teacher, enjoyment of her teaching style, and overall impression of the teacher would be important pieces in attaining to their potential. All groups were taught by female instructors. With there being differences in gender learning and styles, the gender of the teacher may have significantly impacted the outcomes of student learning.

Lastly, but certainly not least, the students' differences and backgrounds create a limitation. Student motivation for achievement, family support, self-perception of

intelligence, beliefs on the importance of education, and parental education were not the focus of the study. These differences would play a vital role in student achievement.

Implications of Findings

The results of this study yielded a great many questions related to student achievement in single-gender programs. Research has been divided on the success of single-gender on student achievement. According to Jackson (2002), single-sex male classes are not the deliverance from poor academics and disruptive behaviors. Other studies have confirmed the lack of significant differences in academic achievement and single-gender classes (Friend, 2006). Some research has relegated the benefits of single-gender programs to the group of students who choose this setting (Billger, 2009). P. Ferrara and M Ferrara (2004) reported improved student attendance and behavior but no significant changes in achievement. Within the same report issued through the United States Department of Education, there are discrepancies as to the effectiveness of single-gender classrooms. On one hand, the outcomes of academics had a 53 percent null result, in which there was no preference in single-gender versus coeducational classes. Yet, the same report testified to the observation of more positive academic and behavioral exchanges among single-gender programs in the elementary and middle school site visits (Riordan et al., 2008).

The results of this study further complicate the debate on the success of students in classrooms that are organized on gender. The question of whether single-gender education increases student achievement is not fully answered. According to this study, there was no significant difference in the growth of test scores when comparing students enrolled in single-gender classes and those taught in a coeducational environment. One

group did not outperform significantly higher than any other. With that said, students did make gains in both single-gender and coeducational classes. The acceptance of the null hypotheses, which stated that there are no significant differences in Measures of Academic Progress (MAP) mathematics growth scores between genders, single-gender classes and coeducational classes, does not imply that there is no value in single-gender programs. Students achieved academic gains in both settings. At this juncture, the inclusion of single-gender programs may simply be a matter of individual learning styles and preference.

Recommendations for Further Study

Even though the study's findings do not support a significant disparity of student achievement when comparing single-gender classrooms versus coeducational ones, the findings of this study lead to suggestions for further research and opportunities. The study focused on the growth of test scores from Fall 2010 to Spring 2011 on the Measures of Academic Progress (MAP). Of interest would be to conduct a longitudinal study in the pattern of student growth through middle school. The individual growth in scores of students for the school year prior to placement in single-gender classes should be compared to students' individual growth in scores while participating in single-gender placement. If students decided to leave the single-gender placement after a year, it would be equally important to evaluate growth after exiting the program and evaluate the overall trend of student achievement in testing.

Measures of Academic Progress (MAP) was only one determinant to consider academic growth. In conjunction with the evaluation of test scores on (MAP), further consideration should be given to the high-stakes state-wide assessment test, such as

Palmetto Assessment of State Standards (PASS), and students' final course grades to corroborate testing gains or losses. PASS testing is mandated for grades three through eight and correlates to score ranges on MAP testing. It is recommended to also review students' academic grades and averages from one school year to the next, taking into consideration classroom enrollment prior to single-gender placement and upon exiting the single-gender program.

Although the study found the null hypotheses to be true, many other factors have been influential in student learning and achievement. Other important areas to be addressed in student achievement and development include the gender of the teacher, overall student well-being, and disciplinary issues. This study examined classroom settings with female instructors only. It would be of benefit to evaluate the impact of learning and achievement with a male instructor in a male single-gender classroom in comparison to a female instructor in a female single-gender program.

Self-esteem and overall well being have been proposed reasons for the implementation and participation in single-gender programs. Particularly at the middle school level, self-esteem and peer pressure are daily confrontations. It would be of value to interview students and gain insight of their perspectives and perceptions of their experience in the single-gender program, which could further validate its importance as an alternative in the public school setting.

Single-gender placement may be linked to improvement in student disciplinary issues. Behavior issues within the classroom consume teacher time and detract from learning in the classroom. The assessment of the impact on single-gender classroom on student behavior will lead to potential solutions for engaging students in learning,

increasing achievement, keeping students in the classroom and out of the office, and decreasing distractions within the learning environment.

Lastly, student success is critical in the evaluation of school initiatives. To determine the effectiveness and importance of the single-gender initiative, it is essential to track the number of students that remain enrolled in single-gender classes. The students' and parents' commitment to the single-gender classroom setting will provide substantiation and necessity for its continuation as an instructional choice within public schools.

Summary

The research as to the impact on single-gender education on student achievement continues to be disputable. Although this study did not determine that single-gender placement had a significant bearing on student achievement, it cannot be concluded that placement did not affect student achievement in some fashion. Each child is an individual that comes to the classroom with a myriad of experiences, specific learning styles, educational deficits, and specific needs. Students demonstrated learning in both the single-gender and coeducational classrooms. There are many factors that intertwine to create a successful learning environment for children. It cannot be clearly stated whether single-gender significantly impacts learning; however, it is clear that single-gender classrooms do not negatively impact achievement. Although it is not the panacea or magic potion that should be prescribed for all students to cure the educational ills, single-gender should continue to be offered as a viable option for certain students.

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APPENDICES

APPENDIX A

IRB Application

11/06 Ref. # _____

APPLICATION TO USE HUMAN RESEARCH SUBJECTS

Liberty University

Committee On The Use of Human Research Subjects

1. Project Title: SINGLE-GENDER EDUCATION: ACHIEVEMENT AND WELL-BEING IN 6TH GRADE MATHEMATICS
2. Full Review ☐ Expedited Review ☒

3. Funding Source (State N/A if not applicable): N/A

4. Principal Investigator:
   Rhonda L. Hill, SRI Assistant Principal
   201 School House Lane, Summerville, SC 29483
   843-820-3850
   Liberty University Doctoral Candidate
   hillr@berkeley.k12.sc.us or rlhill@liberty.edu,

5. Faculty Sponsor (if student is PI), also list co-investigators below Faculty Sponsor, and key personnel:
   Mark A. Lamport, Assistant Professor of Education
   School of Educ., Liberty University
   Malamport@liberty.edu

6. Non-key personnel: n /a

7. Consultants: n /a

8. The principal investigator agrees to carry out the proposed project as stated in the application and to promptly report to the Human Subjects Committee any proposed changes and/or unanticipated problems involving risks to subjects or others participating in approved project in accordance with the Liberty Way and the Confidentiality Statement. The principal investigator has access to copies of 45 CFR 46 and the Belmont Report. The principal investigator agrees to inform the Human Subjects Committee and complete all necessary reports should the principal investigator terminate University association. Additionally s/he agrees to maintain records and keep informed consent documents for three years after completion of the project even if the principal investigator terminates association with the University.

Principal Investigator Signature	Date
Faculty Sponsor (If applicable)	Date

Submit the original request to: Liberty University Institutional Review Board, CN Suite 1582, 1971 University Blvd., Lynchburg, VA 24502. Submit also via email to irb@liberty.edu

APPLICATION TO USE HUMAN RESEARCH SUBJECTS

10. This project will be conducted at the following location(s): (please indicate city & state)

☐ Liberty University Campus
☒ Other (Specify): Summerville, SC

11. This project will involve the following subject types: (check-mark types to be studied)

☐ Normal Volunteers (Age 18-65)	☐ Subjects Incapable Of Giving Consent
☐ In Patients	☐ Prisoners Or Institutionalized Individuals
☐ Out Patients	☒ Minors (Under Age 18)
☐ Patient Controls	☐ Over Age 65
☐ Fetuses	☐ University Students
☐ Cognitively Disabled	☐ Other Potentially Elevated Risk Populations
☐ Physically Disabled	☐ Pregnant Women

12. Do you intend to use LU students, staff or faculty as participants in your study? If you do not intend to use LU participants in your study, please check "no" and proceed directly to item 13.

YES ☐ NO ☒

13. Estimated number of subjects to be enrolled in this protocol: 200

14. Does this project call for: (check-mark all that apply to this study)

☐ Use of Voice, Video, Digital, or Image Recordings?
☐ Subject Compensation? Patients $_____ Volunteers $_____
Participant Payment Disclosure Form ☐ Advertising For Subjects?
☐ More Than Minimal Risk?
☐ More Than Minimal Psychological Stress? ☐ Alcohol Consumption?
☐ Confidential Material (questionnaires, photos, etc.)? ☐ Waiver of Informed Consent?
☐ Extra Costs To The Subjects (tests, hospitalization, etc.)? ☐ VO2 Max Exercise?
☐ The Exclusion of Pregnant Women?

☐ The Use of Blood? Total Amount of Blood _____Over Time Period (days) _____
☐ The Use of rDNA or Biohazardous materials?
☐ The Use of Human Tissue or Cell Lines?
☐ The Use of Other Fluids that Could Mask the Presence of Blood (Including Urine and Feces)?
☐ The Use of Protected Health Information (Obtained from Healthcare Practitioners or Institutions)?

15. This project involves the use of an **Investigational New Drug** (IND) or an **Approved Drug For An Unapproved Use**.
☐ YES ☒ NO
Drug name, IND number and company:

16. This project involves the use of an **Investigational Medical Device** or an **Approved Medical Device For An Unapproved Use**.
☐ YES ☒ NO
Device name, IDE number and company:

17. The project involves the use of **Radiation or Radioisotopes**:
☐ YES ☒ NO

18. Does investigator or key personnel have a potential conflict of interest in this study?
☐ YES ☒ NO

EXPEDITED/FULL REVIEW APPLICATION NARRATIVE

A. PROPOSED RESEARCH RATIONALE

The purpose of this study is to examine the academic, psychological, and sociological outcomes of single-gender education on 6th grade students enrolled in a general education mathematics course. Through the research outcomes, educators can have a more clear understanding of the impact that the single-gender delivery model has on young adolescents. This understanding will encourage educational programs to consider single-gender classrooms as a viable option for improving academics and self-esteem during a very tumultuous period of development.

B. SPECIFIC PROCEDURES TO BE FOLLOWED

1. Students are enrolled in single-gender classes on a voluntary basis, thus class rosters are set without possibility for randomization.
2. Demographics (gender), final mathematics grades for 5th grade, and Measure of Academic Progress (MAP) test scores for Fall 2010 and Winter 2011 will be extrapolated for students in the all male and all female classes. MAP testing is administered district wide for all students. This data will be retrieved through TestView, the school district's Data Warehouse.

3. A comparable heterogeneous class will be chosen based upon grades and test scores. Final mathematics grades for 5th grade, MAP test scores from Fall 2010 and Winter 2011 will be evaluated. MAP testing is administered district wide for all students. Data will be retrieved through TestView, the school district's data warehouse.
4. Upon completion of the district testing window, MAP test scores for Spring 2011 will be collected and retrieved through TestView.
5. The Piers Harris 2 Children's Self-Concept Scale will be administered to the single-gender and heterogeneous classes involved in this study. This is a 60 question survey to evaluate self-concept.
6. At the end of the school year for 2010-2011, final yearly grades for mathematics will be collected.

C. SUBJECTS

Students currently enrolled in the 6th grade will participate in the study. Groups will consist of exclusively female, exclusively male, and heterogeneous. All students enrolled in the mathematics class will be included upon parental permission. No exclusions such as students with health issues, students with disabilities, or specific ethnicity is necessary.

The maximum number of students involved in the study will be 180 (120 students enrolled in the single-gender program; 60 students enrolled in coeducational classes).

D. RECRUITMENT OF SUBJECTS AND OBTAINING INFORMED CONSENT

Describe your recruitment process in a straightforward, step-by-step manner. The IRB needs to know all the steps you will take to recruit subjects in order to ensure subjects are properly informed and are participating in a voluntary manner.

1. Potential subjects will be chosen based upon enrollment in 6th grade single-gender classes at Berkeley Middle School, Moncks Corner, SC. Students are voluntarily placed in single-gender classes, with first come first served. The school enrolls a maximum of 200 students (100 girls and 100 boys) per year.
2. Once single-gender classes are identified, two comparable coeducational classes will be identified based on terms of ethnicity, ability levels, and socioeconomic levels.
3. Informed consent letters will be sent home to students enrolled in the identified courses.
4. A follow-up letter and contact will be sent for non-respondents.

E. PROCEDURES FOR PAYMENT OF SUBJECTS

No compensation will be provided for study participants.

F. CONFIDENTIALITY

Confidentiality is of utmost importance. Student information will be extrapolated from a school district website within a local school of the district. Student names will be replaced with numbers prior to saving the data on an external hard drive and transporting it to an office location. Data will be recorded and reported in terms of class percentages and averages, not individual students. Research records will not be destroyed, as they

may be used in future research studies to evaluate behavioral and discipline data in relation to single-gender programs.

G. POTENTIAL RISKS TO SUBJECTS

For this study, there is minimal risk to students. To access academic achievement, grades and test scores will be reviewed. These items are part of the students' educational experience, regardless of the study.

Students will also be asked to take a 60 question survey, which will yield information about their self-concept. Students will be assured that the information is anonymous, as they will be directed to not write their names. Per testing protocol, students will be reminded that there is no right or wrong response.

H. BENEFITS TO BE GAINED BY THE INDIVIDUAL AND/OR SOCIETY

There are no direct benefits to the subjects for participation in this study. However, there are benefits for the educational society as a whole. With the decline of test scores, graduation rates, and such, schools are looking for strategies and instructional models to increase academic achievement. The resurgence of single-gender education has been proposed as an alternative to increase educational gains.

However, single-gender education has been prohibited from public schools until recently. This research study evaluates single-gender education within the public school environment to assess its potential as a viable instructional model alternative.

I. INVESTIGATOR'S EVALUATION OF THE RISK-BENEFIT RATIO

This study has extremely minimal risks. Through their educational program, students are already receiving grades and required to participate in assessments. They have no pressure to perform based upon the research. The survey portion has minimal risks. It asks personal questions that students may feel ashamed or embarrassed to answer. Unfortunately, these feelings can be prevalent in the middle school setting. The benefits greatly outweigh the risk. If the instructional model (specifically single-gender programs) can provide students with a greater sense of self, this will be further reflected in overall achievement and academic success.

J. WRITTEN INFORMED CONSENT FORM ***(Please attach to the Application Narrative. See Informed Consent IRB materials for assistance in developing an appropriate form. See K below if considering waiving signed consent or informed consent)***

K. WAIVER OF INFORMED CONSENT OR SIGNED CONSENT: N/A

L. SUPPORTING DOCUMENTS: N/A

M. COPIES:

For investigators requesting **Expedited Review** or **Full Review**, email the application along with all supporting materials to the IRB (irb@liberty.edu). Submit one hard copy with all supporting documents as well to the Liberty University Institutional Review Board, Campus North Suite 1582, 1971 University Blvd., Lynchburg, VA 24502.

APPENDIX B

CONSENT FORM

SINGLE GENDER EDUCATION: ACHIEVEMENT AND WELL-BEING IN 6TH GRADE MATHEMATICS

Rhonda L. Hill
Liberty University
School of Education

Your child has been selected to participate in a research study of single-gender education due your child's instructional mathematics class. Please read this form and ask any questions before your agreement to have your child participate in this study.

This study is being conducted by: Rhonda L. Hill, Liberty University. I work as an assistant principal at Sangaree Intermediate School. I am conducting this study as part of my doctoral degree requirements.

Background Information

The purpose of this study is to evaluate how enrollment in a single-gender classroom affects students' grades, test scores, and overall well-being.

Procedures:

If you agree for your child to be in this study, I will only ask that he/she participate in a single 15 minute survey. Each child will anonymously answer yes or no to statements in regards to how each individual feels regarding behavior, school and intellectual status, physical appearance and attributes, anxiety, popularity, and happiness and satisfaction. Nothing else will be required. With your permission, I will obtain Measures of Academic Progress (MAP) test scores through the district's data warehouse. Identifying information of your child will be removed once the data has been collected.

Risks and Benefits of being in the Study

The risk of this student is minimal. It is no more than what your child would encounter during the course of any school day or in everyday life. There are no tangible benefits to participation in this study. The data from this research could help our district in making decisions regarding continuing single-gender programs.

Confidentiality:

The records of this study will be kept private. Students will not be asked for their names when completing the surveys. Grades and test scores will be stored as a randomly assigned number, not individual student names, prior to saving the data on an external

hard drive and transporting it to a school office location. Data will be recorded and reported in terms of class percentages and averages, not individual students. Research records will not be destroyed, as they may be used in future research studies to evaluate behavioral and discipline data in relation to single-gender programs. In any sort of report I might publish, I will not include any information that will make it possible to identify a student. Research records will be stored securely and only I will have access to the records.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the Liberty University or Berkeley County School District. If you consent for your child to participate, he/she is free to not answer any question, and you may withdraw your child at any time with out affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Rhonda Hill. Please feel free to ask any questions at any time. **Please** contact me at Sangaree Intermediate School, 820-3850. My school email address is: hillr@berkeley.k12.sc.us. My dissertation advisor is Dr. Mark Lamport. He can be reached at malamport@liberty.edu.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at fgarzon@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understood the above information. I have asked questions and have received answers. I consent to allow my child to participate in the study.

Check one:

_____ I give consent for the researcher to access my child's MAP test score data.

_____ I do not give consent for the researcher to access my child's MAP test score data.

Student Signature:_____ Date: _____

Signature of parent or guardian:_____ Date: _____

Signature of Investigator:_____ Date: _____

APPENDIX C

Instrument

The Measures of Academic Progress (MAP) is a computerized multiple choice test. Students were administered the goals survey test, which was comprised of 52 questions. Within the testing, MAP adjusts the level of questioning based upon student responses to determine a Rasch Unit (RIT) and provide a score based on the RIT scale. Subtest for the mathematics section include: numbers and operations, algebra, geometry, measurement, and data analysis and probability. According to Northwest Evaluation Association (2009), the sixth grade mathematics norms (RIT values) for mathematics are 219 for the beginning-of-the year median, 222 for the middle-of-the-year median, and 225 for the end-of-the year median.