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Dameion J. Crook

May 2016

THE IMPACT OF PUBLICLY- FUNDED SINGLE-GENDER LEARNING
ENVIRONMENTS ON SIXTH GRADE MALE ACADEMIC PERFORMANCE

A Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

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May 2016

Acknowledgement

I dedicate this body of the work to the Knights of Mickey Leland College Preparatory Academy and to the entire Mickey Leland College Preparatory Academy School Community.

We Believe!

THE IMPACT OF PUBLICLY- FUNDED SINGLE-GENDER LEARNING
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An Abstract
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ABSTRACT

This study compares two educational models to investigate whether differences exist in academic achievement among boys in single- gender model and those in a traditional co-gender model. Specifically, the study analyzed archival data from the State of Texas Assessment of Academic Readiness to ascertain the efficacy of single-sex education for middle school boys. A quantitative comparative research design was chosen to compare the student achievement outcomes between two educational models to determine if the single-gender model offers advantages over the traditional co-educational model. The study utilized numerical datasets archival data consisting of the STAAR reading and STAAR math scores of student samples at two different school models: one sample comprised of minority males attending a single-sex publicly-funded middle school and another sample comprised of minority males attending a traditional co-gender publicly-funded middle schools.

The study results, affirm that students attending a single-sex school fared better academically than their peers educated in co-gender learning environments, are consistent with the research of Brown (2008), which evaluated the academic outcomes of a specific group of students after they were separated into single-sex classes, although in the same school, and compared their academic performance with their peers that remained in co-gender classes. The result: students in the single-sex classes excelled over their peers that remained in the co-gender classes, even to the extent that students who had been

academically unsuccessful in the past became very successful in the single-sex environment and test scores showed drastic improvement. This research study is essential because it examines a relatively new academic model in public education.

It is widely held that separating boys from girls into single-sex learning environments is the best way to meet the unique academic needs and improve the educational outcomes of both groups. A focus on the impact of publicly funded single-sex learning environments is especially important considering that the number of single-sex public schools is on the rise in the United States and that they are most often developed as a means to target and address the low academic performance of minority males.

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Chapter One

Introduction

According to the National Center for Education Statistics: (1) girls seem to have fewer problems with school in the early grades than do boys; (2) girls in elementary and middle school are less likely than boys of the same age group to have repeated a grade since starting school; (3) half as many girls as boys ages 1-12 are identified as having a learning disability; (4) females consistently have outperformed boys in reading and writing; and (5) more than half of all bachelor's and master's degrees are awarded to females (Bae et al., 2000). Further, the gap widens notably when a consideration of race is factored into the analysis. For example, the National Center for Education Statistics reports that minority males perform disproportionately worse than their non-minority counterparts in all categories of overall academic achievement (NCES, 2011).

Specifically, approximately 47 percent of males graduated within four years from U.S. high schools in 2008, while 78 percent of their white male counterparts graduated (Schott Foundation for Public Education, 2010). Minority males also fall short in reading and math as compared to their peers, even those peers with disabilities. For example, in many large school districts in urban areas, White males with disabilities had higher reading scores in the fourth, eighth, and twelfth grade than Black males without disabilities (Howard, 2013).

In order to become more effective in their strategic efforts and more productive in their outcomes to close the achievement gaps that exist, administrators and practitioners in the field of public education must have access to educational alternatives

that help them to effectively address the root causes of the problem. One educational alternative is that of removing boys, particularly low-income minority boys in publicly-funded schools, from co-educational classrooms and placing them in single-sex classrooms within a co-educational school or in a single-sex school. Providing learning in single-sex environments can improve the educational experiences, and consequently, the performance outcomes, of low-income minority students, in particular, and many public schools that utilize single-sex learning environments have high populations of this demographic that can benefit from the approach (Hubbard & Datnow, 2005; Klein, 2012; Goodkind et al., 2013). However, while research supports that single-sex learning environments can increase the educational outcomes of low-income minority students in public schools as a whole, little to no research has been conducted about how this educational alternative impacts the academic performance of sixth-grade minority boys, specifically.

Therefore, the purpose of this study is to compare two educational models to investigate whether differences exist in academic achievement among sixth-grade boys in single-gender model (SGM) schools and those in traditional co-gender model (TCM) schools. Specifically, the proposed study will analyze archival data from the State of Texas Assessment of Academic Readiness (STAAR) to ascertain the effectiveness of single-sex education on the academic performance of sixth-grade minority boys attending publicly-funded middle schools.

The research problem addressed by this study is that of the differing positions surrounding whether single-sex learning environments can have a greater impact on the outcomes of minority students or whether minority students can realize the same desired

educational outcomes in traditional co-gender learning environments. Some research studies on single-sex education have reported findings in support of the notion that children from single-sex schools and/or classrooms outperform students from co-educational schools (Journal of Educational Psychology, 2002), and various other researchers and practitioners present defensible arguments that support the notion that students fare better in single-sex learning environments. Thus, researchers generally contend that single-sex learning environments can play an integral part in empowering teachers and students to achieve academic proficiencies at greater levels and can increase the academic performance of male students overall (Goodkind et al., 2013). However, while much research has been conducted with male students in general to support this assertion, little research has been conducted to support if and how single-sex learning environments are useful in increasing the academic performance of minority males, especially those who are low-income, as a specific demographic. More research is necessary to fill the void in knowledge concerning if, how, and in what ways single-sex learning environments can impact the academic performance of minority males in relation to their non-minority counterparts.

This research study is significant because it examines the impact of an alternative learning environment on the academic performance of a key target population that is in need of solutions to boost its sagging educational outcomes, sixth-grade minority boys. Research containing such a focus is absent from the literature, and this research study will address the void by filling the gap of knowledge that exists about the topic. A focus on the impact of publicly funded single-sex learning environments is also especially important considering that the number of single-sex

public schools is on the rise in the United States and that they are most often developed as a means to target and address the low academic performance of minority males.

The remainder of chapter one will be organized according to the following format: First, a background of single-sex education in the United States; second, research questions; third, key terms relative to the study; fourth, methodology and analytical techniques; fifth, limitations; and sixth, a summary outline of the remainder of the thesis.

A Background of Single-Sex Education in the United States

The single-sex “movement” gained its momentum as a result of numerous prominent educational theories that promoted the significant benefits of single-sex education. This occurred in concert with the relaxation of Title IX regulations, which purposed to eliminate race- and gender-based discrimination in schools (Schachter, 2003) and allowed school districts more flexibility to provide single-sex education (Doris et al., 2013). Much of the pressure that has motivated administrators to address the performance disparities plaguing minority males is fueled by external legislation, specifically the No Child Left Behind (NCLB) act signed into law in 2001, which was designed to ensure that students of all backgrounds, racial and ethnic compositions, and socioeconomic statuses receive a quality education and reach acceptable levels of academic proficiency (Goodkind et al., 2013). Similarly, the blueprint for reauthorization of the Elementary & Secondary Education Act (ESEA), which was implemented in 2009 as a means of increased accountability for educators, was designed to reform American schools by ensuring the academic success of students,

providing a world-class public education to children of all backgrounds (Schachter, 2003).

One group of students for whom attaining academic success has represented a great challenge is that of minority boys. The disproportionate rates at which males, particularly minority boys, fail to succeed in the public school system justify the consideration of alternative means of providing learning to them – means like single-sex education. On average, male students fall academically short of the performance of their female counterparts across the United States (Bae et al., 2000); however, minority male students demonstrate even lower levels of overall academic achievement than their non-minority counterparts in school districts across the United States (NCES, 2011).

The body of research that exists about single-sex education provides strong support for the impact that it has on students' academic performance. For example, proponents of single-sex learning environments promote its benefits of fostering better academic achievement among boys and girls (Sikora, 2014). In general, research promoting the benefits of single-sex learning environments reports that separating boys from girls is the best way to meet the individual needs of children and provide whatever is necessary for each child to become academically successful (Schachter, 2003).

Additionally, research suggests that single-sex educational environments have different impacts on girls than on boys. For example, single-sex learning environments tend to influence girls to engage in studies of science, technology, engineering and mathematics at levels significantly higher than they would in a co-educational learning environment (Signoralla et al., 2013) while single-sex learning environments also encourage boys to engage in areas of study that are not traditionally considered to be

masculine (Ivinson and Murphy, 2007). Single-sex schools weaken threats of gender stereotyping that tend to steer boys and girls into areas of academia traditionally associated with their gender (Sikhora, 2014). According to Ivinson and Murphy (2007) (cited in Sikhora, 2014): “The basic argument is that in single-sex environments, youth do not feel pressure to enact their gendered identities before peers of the opposite sex and thus can more freely engage in activities culturally constructed as incongruent with their gender” (Sikhora, 2014, p. 402). Research also exists that focuses upon the numerous theories surrounding the actual mechanisms by which single-sex learning environments might positively impact the performance of boys and girls, including the effect of peer interactions, differential attitudes to competition, and gender differences in the approaches that boys and girls take when learning in the classroom (Doris et al., 2013).

Some elements of the research studies used to support the argument that single-sex learning can produce better academic outcomes for minority students challenge the generalizability of the research; they call into question whether the benefits of research reported by certain samples can be applied to the general population, particularly for boys and girls across all grade levels, economic levels, ethnicities, and socioeconomic levels. For example, most research surrounding single-sex education in the United States has been conducted through the examination of more privileged students opting to attend private and parochial schools rather than low-income minorities designated to attend single-sex schools as a means of elevating their levels of academic achievement (Goodkind et al., 2013). Additionally, according to Doris et al. (2013), who performed a comprehensive review of research literature surrounding single-sex education, “almost all of the previous studies of single-sex schooling focus on education at either secondary

or university level” (p. 106). When the results of studies like these are used to defend the use of single-sex education in general, they are considered to be incredible sources of support, because they generalize results to the larger population that actually only apply to the sample that was utilized for the study.

Another limitation to the body of research is that it tends to be of a qualitative nature; despite the research that has been conducted on single-sex education, research studies that are quantitative in nature and considered academically rigorous are limited. To date, the only rigorous quantitative research examining how single-sex education impacts the academic achievement of low-income youth of color in a publicly-funded middle school in the United States is that of Hayes, Pahlke, and Bigler (2011), who compared low-income girls of color in a single-sex school with girls in a public magnet school that utilized a similar method of student selection, and found that though there were improvements in academic achievement, they were attributable to the “overall levels of prior achievement among that student body” rather than to the single-sex school in which the girls were educated (Goodkind et al., 2013). Although this study is one of the few that produced findings that sharply contrasted the findings of the vast majority of research literature on single-sex schooling that find it to have a positive impact, the study represents the most recent quantitative study of low-income students and single-sex schooling. Greater quantitative research is necessary to expand academic knowledge surrounding how single-sex education can improve the academic performance of minority boys. Goodkind and colleagues (2013) support the notion that research on the topic is limited and explain that prior to the widespread use of the teaching style as a fixture in schools that educate low-income minority boys, further

exploration of the topic is necessary:

“Little attention has been paid, however, to whether or how racial stereotypes are affected and to intersections of race and gender. Related to this, we need to explore students’ and other stakeholders’ understandings about why low-income youth of color, in particular, are the focus of the single-sex public education movement. Obviously it is important to hear from youth themselves, as without their buy-in and support, single-sex public schools are unlikely to succeed” (p. 1176).

Skeptics argue that the support that has been generated for the alternative educational approach of single-sex schooling is not grounded in sound research but is rather based in mere theories and assumptions. For example, Fergus and colleagues (2009) contend that proponents of providing a single-sex education to increase the academic achievement of low-income youth is based operate more off of assumptions rather than off of sound, rigorous quantitative research. Similarly, Goodkind and colleagues (2013) also highlight the notion that advocates do not ground their confidence in empirical research, criticizing advocates for their persistence in promoting single-sex public education as a vehicle to increase the academic performance of low-income minority boys and girls even though there is not enough empirical evidence in the literature to support their assertion. Thus, they remain skeptical about whether the approach really can have an impact on the academic performance of students that are placed in these learning environments and advocate for additional resource to provide the necessary support to believe that single-sex education can indeed make a difference.

As a result, the verdict is out regarding whether single-sex learning

environments can serve as an effective solution to narrow the performance gap between low-income minorities and their non-minority counterparts, and its scientifically-documented advantages remain unknown for the minority male demographic. Further scientific investigation is needed to determine the implications of educating minority males in such a context in efforts to improve their overall academic performance.

Research Question

It is widely held that separating boys from girls into single-sex learning environments is the best way to meet the unique academic needs and improve the educational outcomes of both groups (Schachter, 2003). However, the impact that single-sex education has specifically on the educational outcomes of sixth-grade minority boys attending publicly-funded middle schools is unknown. Thus, the research question that the study is designed to answer is:

Research question 1. Are single-gender schools better than co-gender schools at producing high STAAR achievement scores in reading and math among low-income minority 6th grade boys?

H1. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in reading than boys attending co-gender model middle schools.

H2. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in math than boys attending co-gender model middle schools.

Methodology and Analytical Techniques

Methodology. A quantitative comparative research design has been chosen to

compare the student achievement outcomes between two educational models to determine if the single-gender model offers advantages over the traditional co-educational model. This study will utilize archival data consisting of sixth-grade STAAR reading and STAAR math scores of student samples educated in two different school models: One sample comprises minority males attending a non-charter, single-sex, publicly-funded middle school and another sample comprises minority males attending a traditional co-gender publicly-funded middle school. Data sets will be provided for the research by the principals of each respective middle school.

The study is distinctly quantitative. The study (1) is framed utilizing numbers instead of words, (2) utilizes closed-ended research questions rather than open-ended research questions (Creswell, 1994), (3) is designed to respond to research questions requiring numerical data, and (4) creates meaning through objectivity uncovered in the data (Williams, 2007). Creswell (2003) explains that most quantitative research starts with the testing of a hypothesis; in this study, the hypothesis being tested is that educating minority middle-school boys in a single-sex public school learning environment will result in academic outcomes higher than those experienced by their counterparts educated in co-gender environments.

Analytical Techniques. The SPSS 18 statistical software package will be used to conduct a factorial ANOVA to test the null hypotheses over the 2011-2012, 2012-2013, and 2013-2014 school years using school model as the focal independent variable (“the variable whose effect on the dependent variable is thought to vary as a function of the moderator variable” (Jaccard & Turrisi, 2003, p. 3)) and school year as the moderator variable. The researcher will also investigate whether any interaction

affects are present regarding the effect of school type on STAAR reading and math scores. The factorial ANOVA was selected because of its usefulness in being able to test the significance of the main effect of the school model, the main effect of the school year, and the interaction effect between school model and school year when they are considered together.

Assumptions and Limitations

Assumptions. There is one basic assumption taken for granted in conducting the research study. The researcher assumes that equal amounts of course hours are given towards providing reading instruction to 6th grade students attending each of the three public middle schools and that any supplemental instruction that is provided for reading improvement in one school is also provided in the other school.

Limitations. There are several limitations to the research study. First, the study does not control for any other observable differences at the school level and at the student level. Second, the researcher is unable to control for unobservable differences, including the fact that the students attending the single-sex school selected to attend the school, which suggests the potential that they are qualitatively different from their counterparts that selected to remain at the neighborhood school. Thus, the inability to randomly assign the groups is a limitation. A final limitation of the research study is that although the researcher is examining test scores for three different academic years, a growth analysis is not conducted, which might lead some to conclude that the tests that are compared for the research study might not be comparable.

Definition of Key Terms

The following terms are operationally defined in the context of this study:

Achievement gap: the disparity in academic performance between groups of students.

An achievement gap is identified through grades, standardized test scores, course selection, dropout rates, and college-completion rates, among other success measures (Sparks 2011).

Evidence: the data used to support a claim (Hart 1998) or "something (including testimony, documents and tangible objects) that tends to prove or disprove the existence of an alleged fact" (Gamer, 1999).

Expert: a person, who, through education or experience, has developed skill or knowledge in a particular subject, so that he or she may form an opinion that will assist the fact-finder (Gamer, 1999).

Gender-related issues: perceptions of challenges or obstacles encountered by the male and female gender (Shakeshaft, 1988, 1999).

Gender roles: the social and behavioral norms that are generally considered appropriate for either a man or a woman in a social or interpersonal relationship (Riordan, 2009).

Learning styles: the characteristic cognitive, affective, and psychological behaviors that serve relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Felder, 2005).

Masculinity: a set of qualities, characteristics or roles generally considered typical of, or appropriate to, a man. Masculinity can have degrees of comparison such as "more masculine" or "most masculine". The opposite can be expressed by terms such as "unmanly"(Reeser, 2010).

Pedagogical content knowledge: "Teachers' specialized knowledge and

understanding of what makes the learning of specific concepts easy or difficult for learners, awareness of what concepts are more fundamental than others and knowledge of ways of representing and formulation subject matter to make it accessible to learners” (Loucks, 2003)

Professional development: a “planned, collaborative, educational process of continuous improvement for teachers that helps them do five things: (1) deepen their knowledge of the subject(s) they are teaching; (2) sharpen their teaching skills in the classroom; (3) keep up with developments in their fields, and in education generally; (4) generate and contribute new knowledge to the profession; and (5) increase their ability to monitor students' work, so they can provide constructive feedback to students and appropriately redirect their own teaching” (NCMST. 2000).

School transitions: transitions that mark the time period when students move from one school environment into another (Edwards, 2006).

Sex segregation: the physical, legal, and cultural separation of people according to their biological sex. This is distinct from gender segregation, which is the separation of people according to social constructions of what it means to be male versus female (Riordan, 2009).

Single-sex education: the practice of conducting education where male and female students attend separate classes or in separate buildings or schools (Riordan, 2009).

Stereotype: a thought that may be adopted about specific types of individuals or certain ways of doing things. These thoughts or beliefs may or may not accurately

reflect reality. However, this is only a fundamental psychological definition of a stereotype (Friske and Lee, 2008).

Teacher practice: the skills and outcomes, classroom practices, procedures, strategies, and methods used in the classroom by a K-12 teacher, (e.g., classroom management, lesson planning, grouping methods) (Garet, 2001).

Organization of the Remainder of the Study

The remainder of the study will be organized according to the following format. First, Chapter 2 will present a conceptual framework for the research study and offer a presentation, analysis, and synthesis of literature related to the problem described in Chapter 1. Next, Chapter 3 will expound upon the research methodology that will be used to investigate the problem and to answer the research question. Following this, Chapter 4 will offer an analysis of the collected data in accordance with the methods outlined in the previous chapter. Finally, Chapter 5 will conclude the completed dissertation with a summary of the findings, conclusions drawn from the data presented in Chapter 4, the implications for practice, research, and policy as it pertains to relationship of the findings to the literature review, and the researcher's recommendations for future research.

Chapter Two

Literature Review

The purpose of this research study is to investigate the impact that single-sex schooling has on the academic performance, specifically the math and reading levels, of minority males in publicly-funded middle schools. This chapter will present, analyze, synthesize, and critique existing research literature directly addressing the topic of single-sex education as well as topics surrounding the issue that are relevant to the research theme.

First, the chapter will discuss the conceptual framework in which the research is grounded: The belief that single-sex public schooling is a solution for enhancing the academic achievement of minority students. The literature surrounding this claim will be investigated in order to fully establish the theoretical base upon which the research study is constructed. Following an introduction to the conceptual framework, the chapter will introduce the themes of the literature review.

The literature view will address the following topics: (a) Disparities between boys and girls in U.S. middle school education; (b) Single-sex learning environments and minority males; (c) The emergence, evolution, and construction of single-sex schools in the U.S.; and (d) The impact of single-sex learning environments on academic Performance.

Various measures were taken to locate and compile the literature for this review. The researcher utilized various resources, including electronic databases to search for books, online journals, and scholarly peer-reviewed articles. JSTOR (short for “Journal Storage”), an online digital library featuring numerous academic journals, was heavily

accessed to locate, articles, and other current and relevant resources in order to provide the most thorough review possible.

Conceptual Framework

This study is built upon a conceptual framework that promotes that single- sex public schooling is a solution for enhancing the academic achievement of minority males. Based on a qualitative research study investigating single-sex educational spaces in two Los Angeles County high schools, Terry et al. (2014) asserts that when males are separated into all-male spaces, their educational experiences are positively transformed, in large part due to the all-male environment's ability to "shield Black males from the marginalizing effects of urban schooling while serving as platforms for productive re-engagement in positive school trajectories" (p. 666). This is to say that when black males are separated into single-sex learning environments, because they are no longer distracted by members of the other gender, they are able to re-engage, or actively participate in the learning process, and as a result, they attain favorable academic outcomes. Terry's (2014) understanding forms a foundation for this research study by supporting the notion that due to the positive benefits that a single-sex learning environment offers to minority males, receiving instruction in these environments can increase their levels of academic performance. Specifically, this hypothesis provides grounds to argue that male minority students attending the single-gender publicly-funded middle school in the study will experience greater levels of improvement in their reading scores and math scores as a result of being shielded from the marginalizing effects of urban schooling, thus re-engaging them in school at a level that will result in

better academic performance.

One theory that supports and adds a deeper layer of understanding to this research study emerges from the research of Fergus and Noguera (2010). They conducted a three-year study on seven single-sex schools in search of intervention strategies specifically targeted towards minority males. The researchers discovered two theories that guided their work: (a) it is necessary to understand the social and emotional needs of Black and Latino boys, and (b) it is necessary to understand how the academic needs of Black and Latino boys surface and how to target strategies and interventions to address those specific needs. This research serves to undergird the current research study by providing two additional sub-theories that rationalize the type of specific and necessary support needed by minority males in order to perform well academically – support that is offered in single-sex learning environments.

Some researchers assume that because the single-sex school offers a more culturally-unique experience to its minority students than the co-gender school, it builds into its system similar mechanisms as those discovered in Fergus and Noguera's (2010) work. These same researchers anticipate that administrators and faculty members at the single-sex school will understand the social and emotional needs of their minority students and that they have identified, understood, and developed targeted strategies and interventions designed to address the specific needs of their students. Thus, this second theory provides grounds for believing that the single-sex school will foster a more culturally-friendly and understanding atmosphere in which its minority students can excel at a greater academic level than they would if they attended a co-gender school. Together, these interrelated concepts offer a clear picture of the underlying foundation

for the research study.

This research study will test both concepts that have emerged from qualitative research by engaging them in a quantitative research study utilizing empirical data. Testing of these concepts will provide evidence to either support or reject the hypotheses of the quantitative research study.

Review of Research Literature Regarding Disparities between Boys and Girls in U.S. Education

Biological Considerations in How Boys & Girls Learn. Many supporters of single-sex education maintain that sex plays a considerable role in how students learn in the classroom. Differences in learning between boys and girls are categorized both biologically and socially. From the biological perspective, some research studies support the position that there are neurological and chemical differences between boys and girls that directly affect learning.

For example, females tend to use the left hemisphere of the brain more often and have higher levels of estrogen in the brain, which reduce aggressive behavior and create a calmer classroom atmosphere (Sax, 2002). Research findings also reveal that females tend to listen better than males. However, in the typical classroom, the traditional seating arrangement consists of males seated towards the rear of the classroom with females tending to sit closer to the front of the classroom in order to better hear the teacher's instruction. Educating males in a single-sex learning environment would reduce the distance between the males seated in the classroom and the teacher's voice of instruction (Sax, 2002).

A number of researchers have investigated the innate differences between how

boys and girls learn in the classroom and utilized their data to affirm the need for greater numbers of children to be educated in single-sex learning environments that tailor their approaches to each gender's needs in order to increase their levels of academic achievement. For instance, Doris et al. (2013) reports that boys learn algebra more effectively when the instructor uses numbers to teach the concepts, while girls learn algebra more effectively when topics are introduced as word problems. Another major difference in learning styles is that girls are able to follow lengthy, unstructured assignments (like reading time) better than boys, who require more structure (Brown, 2008).

Research by Schachter (2003) in a Seattle-area single-sex school highlights additional differences concerning how boys learn. For example, one teacher described boys as being "squirmier, chattier, and more easily distracted" than girls (p. 22).

According to the principal of the school, "A lot of boys learn kinesthetically, and it doesn't mean that they're bad kids when the teacher says, 'Sit down,' and they're still moving in their seats. It also doesn't mean they have Attention Deficit Disorder" (p. 22).

In contrast, while some researchers insist that there is no evidence that gender differences exist in learning, other researchers cite various neuroscience research studies that claim that the differences that exist between boys and girls are significantly greater than the similarities (Eliot, 2011; Halpern et al., 2011). According to Eliot (2011), much of the conventional understanding that exists concerning the differences between the learning styles of boys and girls far outweighs any scientific evidence that

such differences actually exist.

Social Considerations in How Boys & Girls Learn. From the social perspective, single-sex learning environments can help students learn more effectively by helping to subvert stereotypical gender roles that are prevalent in society. For example, in a single-sex learning environment, boys are more likely to pursue the arts, and girls more likely to pursue math and science (Elliott, 1971; Cone-Wesson & Ramirez, 1998; Kadidy & Ditty, 2001).

Akerlof and Kranton (2000) examine questions concerning why same-sex peer groups have a differing effect on boys versus girls. For example, girls in a co-gender environment might view displaying competitiveness as something that boys do instead of girls. Consequently, the girls might be inclined to experience greater levels of gender identity conflict because they feel the pressure to be feminine, a characteristic that would seem contradictory to their desire to be competitive, in order to maintain their attractiveness to boys. In contrast, boys do not feel the same type of pressure, because competitiveness and being attractive are both regarded as desirable characteristics in a man in today's society. However, though boys in a co-gender setting might not experience conflicts in their gender identity, they might experience other types of conflicts, including feeling the pressure of developing their masculinity through being more assertive and competitive in order to appear more attractive to girls (Akerlof & Kranton, 2000).

Gender Essentialism & Differences in Academic Achievement Between Boys & Girls. Numerous research studies document the disparities in academic performance between boys and girls, particularly in reading and writing. Scores on the main

assessment of the National Assessment of Educational Progress (NAEP) reveal that females in the fourth, eighth, and twelfth grades consistently outperform males in reading (U.S. Department of Education, 2003). Females in the fourth, eighth, and twelfth grades outperformed their males' peers in writing in 2002 and 2005 (U.S. Department of Education, 2008).

Disparities also persist between boys and girls in the STEM-related (Science, Technology, Engineering and Math) subject areas. In 2002, males made up a higher proportion of students than females among those who took Advanced Placement (AP) exams in science and calculus. Males also obtained higher average scores on these examinations compared to females (U.S. Department of Education, 2008).

Sikora (2014) utilized data from the Longitudinal Survey of Australian Youth that was collected from 15-year old students to compare science subject choices and science-related career plans of adolescents from single-sex and co-educational schools. Data indicated that boys were overrepresented in physical science courses and careers and that girls were overrepresented in life sciences. However, girls who were educated in all-girls schools reflected trends that were more consistent with the choice of boys, as they were more likely to take physical science subjects in addition to being more likely to choose male-dominant careers than girls who attended co-educational schools.

Doris et al. (2013) investigated the impact of single-sex education on the gender gap that exists in mathematical achievement in primary schools that serve the general community. The results of the research study offered no support in favor of the claim that single-sex learning environments reduce the gender gap and that the gender differential in math, which favored boys, was lower in co-educational learning

environments than it was in single-sex learning environments.

While students entering school around ages 5 or 6 tend to display similar levels of academic achievement in key areas, by the time they reach early adolescence, around 10 or 11 years old, a gap in performance appears. In a 2010 study utilizing the Early Childhood Longitudinal Study Kindergarten Cohort (ECLS-K), Fryer and Levitt discovered that when boys and girls entered kindergarten, their performance in math and reading were almost equivalent; however, by the end of the fifth grade, the girls' performances in these same subject areas fell behind that of the boys'.

There is also a pervasive societal belief surrounding gender essentialism that there are some fields that are naturally suited for males while others are naturally suited for females. "Gender essentialism in this context refers to the widely shared belief that certain fields of study, like psychology, medicine, or biology, are culturally and functionally compatible with what is perceived as naturally feminine skills of nurturance, care, or human interaction. In contrast, abstract, analytical thinking and problem-solving are construed as naturally masculine skills" (Sikora, 2014, p. 401). In many countries, girls who desire to engage in STEM-related fields are encouraged to undertake more 'feminine' domains of science in areas like living systems and healthcare, while their male counterparts are encouraged to undertake more 'masculine' domains of science like engineering, physics, geology, and advanced mathematics (Sikora, 2014).

While some believe that differences exist between the brain functions of boys and girls that makes tailoring academic topics, particularly STEM-related topics, appropriate to their biological needs, Halpern et al. (2007) refutes this notion, arguing

that there is no difference in brain function between the two genders and that this is not a valid justification for the development of single-sex schools and learning environments.

Impact of Single-sex Classrooms on Gender Stereotypes & Gender

Perception. A long-standing debate has persisted in the education arena surrounding whether single-sex learning environments serve to affirm or subvert the power of gender stereotypes in adolescents (Sikora, 2014; Bigler and Signorella, 2011; Ivinson and Murphy, 2007). One of the greatest points within the debate is how single-sex education impacts the gender gap in science (Sikora, 2014) and other STEM-related subjects. Further, Goodkind et al. (2013) explains that single-sex learning environments “have the potential to shape students’ perceptions of themselves as innately inclined or disinclined in particular ways,” and in doing so, reinforces gender stereotypes among the students about themselves as well as the stereotypes that the teachers have about their students (p. 1175). Fabes et al.’s (2013) research supported the notion of the conflation of gender stereotypes with the number of single-sex classes that middle school students took. Goodkind et al. (2013) concludes that “gender becomes increasingly salient when students are divided by sex and sends the message to students that girls and boys are essentially different” (p. 1176).

Review of Research Literature Regarding Single-Sex Learning Environments & Minority Males

A Bleak Picture from the Birth

Minority males, particularly African-American males, face disproportionate challenges throughout life beginning at the point of birth. Howard (2013) states (citing

Anderson, 2008) that, “disproportionately high infant mortality rates, born and reared into chronic poverty, overrepresented in underfunded schools, Black males, like many other individuals reared in economically depressed areas, face major life challenges from the outset” (2nd para.). Without question, these challenges follow minority youth into the classroom and impact their levels of academic performance. The great majority of research that has been undertaken to address the widespread academic achievement of minority males has centered on finding “reasons that explain the persistent underachievement of Black males in U.S. schools and society” and developing “viable interventions that can help improve the educational aspirations and life chances of Black males” (Howard, 2013, p. 55).

Benefits of Single-sex Learning Environments on Low-income Minorities.

Researchers consider single-sex schooling to be of great benefit for increasing the academic performance of minorities, particularly those who are of a low-income socioeconomic status. According to Goodkind et al., “Single-sex public schooling is viewed as a means to improve the educational experiences and performance of low-income youth of color” (2013, p. 393). Schachter (2003) investigated the Thurgood Marshall School, a Seattle school that was 95% minority, low-income, and considered to be the worst performing school in its district. Research on this school revealed that though single-sex learning environments make a positive difference in the academic performance in students overall, the benefits are especially visible in such schools serving minorities and low-income demographics. In the two consecutive years that followed the separation of the boys from the girls into single-sex classrooms, standardized state achievement test scores significantly increased. Schachter writes that, “in 2000, only 27

percent of the students in co-ed classes met the state standards for reading and 11 percent for math. The results in reading increased to 51 percent in 2001 and 60 percent in 2002. And while students showed a small decline in math for 2001, an impressive 45 percent met state standards in the following year” (2003, p. 22).

A 2001 study of six school districts in California that implemented middle school and high school male and female academies in single-sex, private Catholic schools in urban areas documented that “there does appear to be a consistent positive effect on academic outcomes, largely limited to disadvantaged students” and that the “implications are that it is a viable alternative for the kind of schools that at-risk students should attend, particularly those in African-American and Hispanic communities” (Schachter, 2003, p. 23).

Considerations for Implementing Single-sex Learning Environments with Minority Males.

There are notable factors to be considered when contemplating the use of single-sex learning environments to boost minority academic performance, especially as it pertains to African-American males. Noted Harvard Medical School child psychiatrist Alvin Poussaint, who specializes in the study of African-American children, is of the same expert opinion as the body of researchers that study single-sex education. Poussaint agrees that single-sex classrooms present a unique opportunity to help African-American boys in their educational attainment (Schachter, 2003). According to Poussaint, “Nowadays, schools take a lot of black boys they can’t work with, and they put them in special education” (p. 23).

Poussaint challenges schools to make the classroom instruction and school-day

activities appropriate to meet the needs of black male children in particular. He submits several ideas for consideration, asking, “Let’s say that black male children think they need to fight more. How do you set up the classroom in terms of discipline? How many recesses should you have to let the boys run around and burn up more energy? How can you integrate some real things that they like into the curriculum – whether [it’s] their greater use of black English or video games – and use them as a stepping board in helping to educate them?” (Schachter, 2003, p. 23)

Fergus and Noguera (2010) conducted a three-year study on seven single-sex schools that were having a positive influence on the educational experiences and outcomes of the Black and Latino males that attended them. They report that these schools focused on the following: (a) social/emotional programming; (b) rites of passage programs; (c) community service requirements; (d) culturally-responsive instruction; (e) rigorous curriculum; and (f) an emphasis on basic skills. Of Fergus and Noguera’s (2010) work, Howard (2013) explains a key aspect of the researchers’ findings when working to improve the academic performance of minority males:

What is important to note about the findings from Fergus and Noguera is the focus on changing boys’ notions of masculinity, helping forge an academic identity that is connected to their social identities, and an explicit and sustained focus on developing and enhancing core basic academic skills (Howard, 2013, p. 61).

Additionally, Camangian (2010) conducted a qualitative study utilizing African-American high school youth with the goal of increasing their levels of literacy engagement. An effective means that the researcher discovered to accomplish this goal

was that of using cultural narratives, which helped students to build strong social analyses of their lives and communities. Consequently, they invested more effort into their literacy development and performed better in their classes.

Counter-perspectives on What Really Makes Single-sex Learning

Environments Effective for Increasing the Academic Performance of Minority

Males. Advocates of single-sex education promote separate learning environments “as a means to provide low-income youth of color with access to opportunities previously afforded to more privileged youth” (Goodkind et al., 2013, p. 1176). Indeed, being educated in a single-sex school typically has been a luxury accessible only to students whose families occupied a higher socioeconomic status and could pay the costly tuition for an exclusive private school education, while their poorer counterparts’ only educational option was publicly-funded co-educational schools. However, Goodkind (2013) reports that there are some who believe that the positive outcomes that result from single-sex public schools might not be directly related to the fact that they have separated the genders from one another in the learning environment. Instead, the benefits that are realized from these environments might have more to do with the fact that additional resources are often invested into schools of this nature and that teachers who instruct students in these settings are held to higher teaching standards

Goodkind’s (2013) perspective is supported by the research of James (2010), who conducted a case study on African-American boys attending a first-year public charter school and recorded testimonies that the boys were enjoying new learning experiences such as discussions of current events, engaging in scientific experiments, debating, and adding fractions. In James’ estimation, it was not the fact that the school

was single-sex that elicited these positive testimonials; it was the fact that these new and enjoyable learning experiences were introduced into a single-sex learning environment in the same way that they could have been introduced into a co-educational learning environment.

Similarly, Hubbard and Datnow's (2005) research concluded that the single-sex learning environments that they investigated were successful not as a result of the fact that the school was single sex, but because of the "interrelated contributions of the schools' organizational characteristics, positive student-teacher relationships, and ample resources" (p. 115). Their research suggests that these same elements could reasonably be integrated into a co-educational learning environment and produce similar results.

Noguera's (2012) research identified several key factors in both co-educational schools and single-sex schools that were successful in working with boys of color, including personalized learning environments, student-teacher relationships that were positive and strong, and environments that were personalized for the learning needs of the students, suggesting that it is not the separation of boys from girls in the learning environment that brings the success, but the culture of success and the attention to resources that are deliberately infused into the school environment that results in the success of the student. Goodkind et al. (2013) cites Noguera, who concludes, "there is nothing 'magic' in separating boys of color from their peers and that we should be thinking about 'not who we serve but how well they are served'" (2013, p. 1176). Rather, the enhanced learning context that students experience in single-sex schools is a direct result of good pedagogy that often goes hand in hand with the implementation of this non-traditional teaching method.

Goodkind et al. (2013) highlights the importance of recognizing that many of the challenges that low-income students of color face are much greater than the distraction of the opposite sex student in the classroom; significantly greater distractions come when students are off of the school grounds. Low-income minority students are more prone to live in unstable living environments, be homeless, live in physically, emotionally, or verbally abusive households, be victims of sexual assault, be surrounded by drug use, violence, or illegal activities, be hungry, come to school sick, and live distressed lives outside of school that have a tremendous impact on their academic achievement. “Telling students that their distractions can be reduced by simply separating them by sex ignores and minimizes these challenges” (Goodkind et al., 2013, p. 1178).

Potential Detriments for the Use of Single-sex Schools for Low-income Minority Youth. Datnow et al. (2001) offers a caution to advocates of single-sex education for low-income, low-achieving boys of color in the United States, particularly as a remedy to this targeted demographic potentially could become a new form of tracking or segregation. While privileged families would be applauded and rewarded for opting into an exclusive, private, single-sex education, if low-income, low-achieving boys are placed within these learning contexts without choice, they could easily be stigmatized throughout the course of their academic career.

For example, when Goodkind et al. (2013) interviewed low-income minority students attending single-sex classes at a co-educational middle school, the students’ comments indicated their feelings of stigmatization. None of the students, for example, connected the single-sex classes with prestigious high schools or colleges. Instead,

many associated separations by sex with ‘alternative’ schools for students who had been suspended or expelled from their neighborhood schools and with juvenile justice institutions, both of which routinely separate girls and boys. This association makes sense, given that few of these youth had family members who attended private schools or college, while many had themselves spent time in alternative schools and the juvenile justice system. Thus, it is not surprising that students perceive they are being punished when they are separated by sex.

The low-income minority youth in the Goodkind et al. (2013) study also explained their understanding of why their schools were chosen for single-sex classes while schools in more economically advantaged areas were not, and their commentary revealed more stigmatization. For example, when researchers asked students why they thought their schools were chosen to implement single-sex classes, even though none of the other public schools in the city were undergoing this type of transition, Goodkind et al. (2013) explains that,

Their responses centered around the... poor academic performance of their school, racialized beliefs and assumptions about their neighborhood, and stereotypes about the hypersexuality of African-American youth, all of which, some participants felt, had justified policy makers’ ‘experimentation’ with their school. (p.1179)

Echoing this sentiment, other students commented that they thought their school was targeted for same-sex classes because they were “the lowest in rank in the city” and had “some of the most violence around”, because their school was “in the hood”, because “they think we need discipline”, and because “they probably thought that the

girls is, like, a Black school and most of the girls at this school is, like, pregnant and stuff” (Goodkind et al., p. 1179). A parent responding to the same question replied, “Cause they act more crazier here and they act more wilder here” (2013, p. 1179). According to Goodkind et al. (2013), “These comments illustrate ways in which the decision to institute single-sex classes at this school reinforced perceptions of racism and problematic beliefs about the hypersexuality of African-Americans” and “how students have internalized and interpreted the pervasive rhetoric around ‘failing’ schools” (p. 1179).

Goodkind et al. (2013) conducted a community-based participatory research project in a low-income, African-American high school in which they implemented single-sex learning environments. The goal of the research study was to challenge beliefs that are prevalent in the education community regarding the effectiveness of single-sex education that maintain that educating low-income minority youth in single-sex environments would increase academic performance by: 1) eliminating distraction from the other sex; 2) addressing the different learning styles of girls and boys; and 3) remedying inequities by offering these youth opportunities traditionally afforded to more privileged youth.

Based upon their findings, Goodkind et al. (2013) concluded that while some distractions were decreased, others were increased or ignored, racialized stereotypes of hypersexuality and essentialized notions of gender were reinforced, and students felt punished rather than privileged by being separated by sex. We conclude that single-sex education, as a public school option, is a neoliberal approach to addressing low achievement that deflects attention from the structural inequities that created the

problem and implicitly blames those experiencing oppression (p. 1174).

Review of Research Literature Regarding The Emergence, Evolution, and Construction of Single-sex Schools in the U.S.

Emergence of Single-sex Classes and Schools in the U.S. The Elementary and Secondary Education Act (ESEA), as amended by the No Child Left Behind Act of 2001, authorized school districts to use local or innovative program funds to provide single-gender schools and classrooms consistent with applicable law (Title V, Part A, Subpart 3, Section 5131 (a) (23)). As a result of amendments to the regulations for implementing Title IX of the Education Amendments of 1972 made in October 2006, the number of single-sex schools is expected to increase substantially over the coming years (Mael, 2005).

Operational model considerations. Publicly-funded single-sex schools may be developed according to one of two models: the “classic model” or the “dual academy model.” Under the “classic model,” a school serves either exclusively boys or exclusively girls in a physical building. Under the “dual academy model,” boys and girls attend the same school, but they attend classes separately. Dual academies vary with regard to the extent to which boys and girls intermingle throughout the school day. For example, in some schools that operate according to this model, administrators will permit boys and girls to interact in the cafeteria, hallways, and during any non-academic extracurricular activities. In other schools utilizing the same model, boys and girls are permitted to interact to either a greater or a lesser extent.

Implementation of Single-sex Classes in a Co-educational

Environment versus the Development of Single-sex Schools. Research supports the argument for the development of single-sex schools rather than the implementation of single-sex classes within a co- educational school. Implementing single-sex classes into a co-educational learning environment is a challenging task that requires much patience, primarily as a consequence of the work that must be done to generate buy-in amongst the students, parents, and teachers (Brown, 2008).

Goodkind et al.'s (2013) research is in favor of developing single-sex schools, rather than merely implementing single-sex classes in a co-educational school. The study interviewed boys and girls who attended a co-educational school and found that rather than reducing distraction from the opposite sex, the separation exacerbated it, which led to students being even more distracted from their learning. For example, one boy's sentiments were characteristic of many other boys and girls interviewed in the research study. He said,

you go to a class that's all boys, you don't feel like being there... So you go roam the halls, and you go into the girls' classroom, and they be all excited to see the boys. ... I think it's more off task than what there was before. You got to understand, like if I had the girls in my class, I'd be doing my work and at the same time sitting right next to them. I wouldn't be worrying about what she's doing right now. (p. 1177)

Considerations for the Effective Implementation of Single-sex Classes or Schools. Single-sex school developers must consider teacher quality, school resources,

and how students are granted admission, as the overall functioning and success of the school will be directly attributable to these factors (Sikora, 2014). Also, Fryer and Levitt (2010) suggest that a concentration on the early education of boys and girls when considering single-sex schooling is important, because it is during these years that the gender gap first appears between boys and girls, especially in mathematical studies.

When developing a single-sex educational program, some schools allow students a choice of whether to participate or remain in co-educational classrooms. Students are permitted to make the choice to participate in the non-traditional classes at the beginning of the school year or mid-year. A principal of a Florida school that implemented single-sex classes reported that some of the students who started the year in single-sex classes chose to switch to co-educational classes mid-year, while other students who started the year in co-educational classes switched mid-year to single-sex classes (Brown, 2008).

In order to teach single-sex classes, teachers must venture outside of their boxes of traditional teaching methods. Instead, they must curtail their teaching techniques towards the needs and interests of their single-sex learners. For example, one teacher selected to teach a single-sex class in an experimental study that implemented one all-girls and one-all boys class per grade level in its school realized that his previously-utilized techniques of mitigating the chattiness of students in the mixed learning environment would no longer work in the single-gender environment. He reported that, “the old trick of placing a quiet boy between two chatty girls or a quiet girl between two rowdy boys isn’t possible in single-gender classes,” and that apart from not being the solution, the “quiet girls have a lot more to offer than being between two noisy

boys” (Brown, 2008, p. 115).

Training is essential for any teachers switching from teaching co-educational classes to single-sex classes. This training might include assigned readings, workshops, and formal trainings. For example, when a principal at a Florida elementary school introduced single-sex classrooms, he assigned *Why Gender Matters* by Leonard Sax and *Boys Adrift: The Five Factors Driving the Growing Epidemic of Unmotivated Boys and Underachieving Young Men* by Leonard Sax, in addition to sending teachers to a specialized training at a university that specialized in educating students in a single-sex classroom (Brown, 2008).

Physical classroom considerations. According to Leonard Sax, founding director of the National Association for Single Sex Public Education, adjusting the physical learning environment is an important part of meeting the differing needs of boys and girls in the classroom. The principal of a Florida school that realized significant results after experimentally implementing one all-girls and one all-boys classroom per grade level based the development of the schools’ program on Sax’s research. This principal noted, “Girls learn better if it’s at 75 degrees and (less bright), while the optimal temperature for boys is about 69 degrees,” and that, “When you walk from one classroom to the other, you can tell the difference immediately. The girls’ classes are relaxing, whereas the boys’ classrooms are a little more vibrant” (Brown, 2008, p. 115).

Schachter (2003) describes the configuration of single-sex classrooms in a co-gender school that has consistently demonstrated the effectiveness of the educational method, noting that, “the boys’ and girls’ classrooms stand side by side and mirror each other, right down to the bank of computers on one side, the brightly colored inspirational

sayings on the walls, and the U-shaped arrangement of tables at which the student sit. The parallelism stops there” (p. 21).

School funding considerations. The funding source of a single-sex school is a critical factor to be considered in the development of the institution. If a school single-sex school is privately funded, its selectivity criteria might be more inclined to accept only the best students with high levels of academic motivation and self-concept, as opposed to students who are performing poorly. Additionally, single-sex schools in the private sector usually charge tuition and fees, eliminating the opportunity for students of lower socioeconomic status from enrollment; only those students whose families possess a level of wealth to pay the tuition are able to participate in the school (Sikhora, 2014).

Review of Research Regarding the Impact of Single-sex Learning Environments on Academic Performance.

Is There Credible Evidence that Single-sex Schooling Affects Academic Performance? The debate surrounding the impact of single-sex education on academic performance is centered on the assertion that there is little solid evidence in the literature that single-sex education improves academic performance. In October 2003, the U.S. Department of Education’s initiated a Study of Single-Sex Schools, which provided the first real, comprehensive look into public single-sex schools in the United States. The study’s mission was to investigate (a) what was known about the effects of single-sex schooling on student achievement and other outcomes; (b) what was known about the causes of the outcomes; (c) what the characteristics were of public single-sex schooling; (d) what perceived benefits or disadvantages were associated with single-sex schooling;

and (e) what studies, including research questions and methodology, would be most appropriate to advance the knowledge base in the field (Mael, 2005).

To address these questions, the study team conducted an extensive, systematic review of the research literature in 2004, a review of the theoretical arguments for and against single-sex schools, a survey of public single-sex schools in the spring of 2005, and an observational study of a small subsample of public single-sex schools operating in the fall of 2005. Both the survey and the observations included only those single-sex schools that were operational as of fall 2003.

In order to address the first evaluation question concerning the current body of knowledge about single-sex schools, the systematic review of the literature examined national and international research on the effects of single-sex public and private education. In conjunction with this review, the authors prepared a separate review of studies that discussed the theoretical advantages and disadvantages of single-sex schools (Mael, 2005).

The study team organized the findings from its review into 14 theoretical benefits of single-sex education and used these categories to develop questions for the surveys and observations at selected schools. The surveys of teachers and principals addressed evaluation questions concerning characteristics and benefits of single-sex schooling and identified topical areas that should be explored further in the school observations. The observational study also addressed the evaluation questions regarding characteristics, advantages, and disadvantages of single-sex education. In addition, the study team commissioned a publication designed to define what studies would advance the knowledge base in the field (Mael, 2005).

Although the study describes characteristics that are somewhat more prevalent in single-sex schools, the results did not provide causal evidence that single-sex schools improve the quality of academic performance or the behavioral interactions between teachers and students. Instead, these descriptive findings are a potential source of hypotheses for further investigations that utilize experimental or quasi-experimental designs (Mael, 2005).

Benefits of Single-sex Learning Environments. Research reports on the varied benefits of single-sex learning environments. Riordan's (1985) research supported the notion that single-sex education increased the academic achievement of girls, but not boys, while Bryk et al. (1993) discovered that single-sex education had positive effects for girls, not only academically, but also socially and personally in terms of their development.

Brown's (2008) research highlights a Florida elementary school that was motivated by research from the National Association for Single Sex Public Education, which asserts that there are marked differences in education and learning styles between girls and boys. The school "experimented" by implementing one all-girls and one all-boys class at each grade level (with the exception of kindergarten). Students participating in the program were separated into single-sex classes for core academic subjects, including handwriting, reading, math, spelling, writing, social studies, and science, and they were re-integrated into mixed-gender settings only during recess, lunch, and to study non-academic subjects.

Students in the single-sex classes excelled over their peers that remained in co-educational classes, and students who were academically unsuccessful in the past

became very successful when educated in their new environments. Brown reported that, “Students’ test scores have shot up, discipline records have dissipated, and attendance has improved.” These benefits prompted administrators to double, and then quadruple, the number of single-sex classrooms per grade level after the first exploratory year (2008, p. 132). A fifth-grade teacher in the program noted that, “improvements were apparent for both sexes”, and that “boys learned social and leadership skills, discipline, and teamwork, while girls gained self-confidence and assertiveness” (Brown, 2008, p. 132).

A Greatest Perceived Benefit: Separation of the Sexes Reduces Distraction by the Opposite Sex. Proponents of single-sex education contend that one of the primary reasons that students fare better academically in separate learning environments is due to the distractions of the opposite sex being removed from the classroom so that students of the same sex can concentrate on learning rather than their counterparts. Schachter (2003) reports that when girls are separated from boys, they perform notably better in math and science. A teacher interviewed during the research suggested that girls focus better without the boys because the need for concern about what the boys might make fun of is eliminated with the removal of the boys from the classroom. Additionally, the teacher explained, “They know that the boys influence them, and they really do have more confidence to speak for themselves when boys aren’t there. Now it’s to the point that even if there are boys in the room, the girls don’t care. They have enough confidence to speak out and say what they feel” (p. 22). Without the presence of the opposite sex in the classroom, students are less distracted from their academic work. Consequently, in lieu of having to devote class time to

administering discipline and correcting distracted students, teachers are able to devote more time to providing academic instruction.

However, there are counterarguments to the belief that separating the sexes in the learning environment reduces the level of distractions that students experience in school. Goodkind et al. (2013) maintains that members of the opposite sex are not always to blame for the distractions that students encounter in the classroom. Woody (2003) established that boys tend to be distracted by boys and girls tend to be distracted by girls even when they are educated in same-sex environments and concluded, “single-sex education may result in an increase in teaching and harassment, as a result of students’ heightened awareness of issues of gender and sexuality” (p. 157). Thus, Woody’s (2003) research suggests that separating the sexes oftentimes does not eliminate distractions in the classroom; rather than being distracted by members of the opposite sex, when students are separated, they tend to be distracted at a greater level by members of the same sex. The same research study disclosed “boys reported increased physical harassment in single-sex environments, while some girls reported increased fighting” (Goodnight et al., p. 1175).

Similarly, Spielhagen (2011) conducted a mixed-method study in which teachers at a low-income public middle school were interviewed and reported “teachers changed their overall impression that there were fewer behavior problems in single-sex classes” (p. 9). Further, the teachers in the study reported that boys exhibited greater levels of aggression and acted less maturely when they were educated in single-sex learning environments than they did when they received instruction in co-educational classes.

Hence, while separating girls from boys in the classroom might result in fewer distractions from the opposite sex, as a result of the “heightened focus on gender and sexuality among all youth”, these single-sex distractions are replaced by same-sex distractions, often at more heightened levels (Goodkind et al., 2013).

Counterarguments to the Existence of Benefits of Single-sex Learning

Environments. There are mixed reviews concerning the benefits and disadvantages of single-gender learning environments. Schachter (2003) reports that in a 2001 study of six school districts in California that implemented middle school and high school male and female academies, “single-sex education inadvertently reinforced gender stereotypes”, and two years later, only one of the schools is still in operation (p. 23).

According to Booth and Nolen (2012), while girls who are a part of single-sex schools demonstrate higher levels of competitiveness than girls who are a part of co-educational schools, whether boys attend single-sex schools or co-educational schools does not impact their level of competitiveness.

While many supporters of single-sex schools exist, there are others that resist separating the sexes in an educational environment due to various concerns about the impact that the non-traditional learning environment will have on students. The National Organization for Women (NOW) hold the concern that if boys and girls are separated, the quality of education that girls receive relative to their male counterparts will be compromised. NOW stated in Schachter (2003):

Unfortunately, decades of experience in related areas, such as job training, college athletics and professional sports, indicate that female-dominated programs consistently receive fewer resources than boys in primary and

secondary educational programs. Separating girls and boys in primary and secondary educational programs therefore threatens to exacerbate, rather than ameliorate, inequities between boys and girls (p. 23).

Also among those who resist single-sex learning environments is Harvard Education School professor emeritus, Charles Willie, a noted expert researcher of the effects of racial desegregation. According to Willie, the only way to raise students' academic performance is to keep them integrated with their peers and have them compete in the same setting. Schachter (2003) cites Willie's research, highlighting that schools that have the "highest achieving students tend to be in schools most diversified in terms of race, gender, and socioeconomic status" (p. 23).

Others who remain skeptical of single-sex education believe that it is not the single-sex learning environment that increases academic achievement, but other factors. Doris et al. (2013) highlights the work of Billger (2009), noting that "much of the effect of single-sex schooling among private schools in the U.S. accrues to students already likely to succeed. Closely associated with parental wealth are the parental social and cultural capital that directly impact and influence their children in such a way that their children are academically successful (Sikora, 2014). Accordingly, those who attend private single-sex schools are expected to be more academically successful as a function of the built-in support mechanisms that accompany their socioeconomic status.

Thus, because much of the research that has been conducted on single-sex schools has been conducted on students attending single-sex private schools, the results are not deemed relevant when considering the impact of single-sex education of students attending public schools who might not be as likely to succeed as their private school

peers.

One of the primary challenges facing advocates of the expansion of single-sex education is that while research exists lauding the benefits of the instructional method, a scarce few of them have been conducted within the context of the United States within publicly-funded schools that have an open-enrollment process (as opposed to selectively choosing students who are high academic achievers). Studies that advocates have traditionally referred to in order to reinforce how schooling children in these environments have typically been conducted in other countries that have historically employed the teaching method as a part of their longstanding cultural norm, as opposed to the United States, which has most commonly employed the use of the method as a means of improving the achievement of students struggling academically (Goodkind et al., 2013).

Differences in How Single-Sex Learning Affects the Academic and Social Development of Boys and Girls. Doris et al. (2013) cite Hoxby (2000) and Lavy and Schlosser (2011), who promote that while the presence of girls in the classroom has a positive effect on both girls' student achievement and on the teacher, when girls are a part of the peer group, the boys in the class tend to pay the cost in their levels of academic achievement. Students who have more female peers report a lower level of classroom violence and better relationships with other students and teachers. In addition, their evidence suggests that teacher fatigue and burnout are inversely related to the proportion of girls in a class, in which case, single-sex schooling will increase the performance of girls, but at the cost of poorer achievement of boys (p. 106).

Evidence for the beneficial impact of single-sex learning environments on the

academic and social development of girls is strong. According to Fryer and Levitt (2010), educating girls in single-sex learning environments might reduce the gender gap that exists between boys and girls, as boys tend to fare more favorably in STEM subject areas. Eisenkopf et al. (2012) conducted a study investigating the impact of single-sex classes on girls' mathematical achievement and found that while single-sex classes improve girls' math performance, the increases in their performance grow even larger when their math class is taught by a male teacher. Park et al. (2012) randomly assigned Korean children into single-sex and co-educational secondary schools and found a significant causal effect on the math scores of girls educated in a single-sex school, as well as a strong positive effect on the outcomes of boys in all STEM subjects who were educated in single-sex schools.

Single-sex educational environments help girls achieve higher scores on standardized exams, reduce the level of pressure that they experience to maintain their gender identity, and lower their focus on being personally attractive to boys because they are less concerned with trying to "conform to boys' expectations of how girls should behave to avoid social rejection" (Booth & Nolen, 2012, p. 544). In the absence of boys, certain triggers are not present that cause girls to be less academically competitive.

Booth and Nolen (2012) examined the role that a girl's nurture plays in her level of competitiveness as a woman. The researchers conducted an experiment to answer two questions: (a) does the gender composition of the group to which a student is randomly assigned affect competitive choices, and (b) does the gender mix of the school a student attends affect competitive choices? Utilizing a sample of students just

under 15 years old attending publicly funded single-sex and co-educational schools, the researchers identified “robust differences between the competitive choices of girls from single-sex and co-ed schools” and that “girls from single-sex schools behave more like boys even when randomly assigned to mixed-sex experimental groups” (p. 542). The study’s results supported the body of educational literature that asserts that girls educated in a single-sex school environment choose to compete more, academically and otherwise, than girls educated in co-educational learning environments.

Booth and Nolen’s (2012) experimental research suggests that not only do girls from single-sex schools behave more competitively than girls from co-educational schools, but even being assigned to an all-girls group, regardless of the type of school the girl attends, for 20 minutes prior to being assigned to a random group, affects a girl’s decision-making. In light of this finding, the researchers posit that “Single-sex classes in subjects where behaving competitively is desirable could produce better outcomes” (p. 554).

Thus, the researchers argue that the composition of the learning environment makes a significant difference in shaping a girl’s level of competitiveness. The affects that a single-sex learning environment has on shaping competitiveness in girls ultimately impacts them later in life in an “economically important way,” as they are inclined to prefer making more competitive choices in their lives and careers (p. 544).

Chapter Two Summary

Single-sex education has been growing in popularity since the 2002 No Child Left Behind Act was passed, allowing local educational agencies to use funds to support same-gender schools and classrooms consistent with existing law. The U.S.

Department of Education loosened its Title IX regulation in 2006 to diminish prohibitions on single-sex education. Today, there are more than among one hundred single-sex public schools in the United States, according to the National Association for Single Sex Public Education (NASSPE). In addition, more than 445 public coed schools offer single-sex classrooms. While simply separating boys and girls does not guarantee success, schools that use best practices for gender-specific teaching may be more successful at teaching to boys' and girls' strengths. In a coeducational classroom, teachers are more restricted in that there are certain teaching styles that are not conducive to a mixed sex class setting.

Since boys and girls learn differently, teachers in single sex schools can adapt to the inherently different learning style of boys and girls. In turn, the students learn better because by default, they are being taught according to their needs. The establishment of single-sex education permits students the opportunity to learn in an environment free from other-sex distractions demonstrating that social interaction is not the priority of public schools rather it is academic performance. Also, in single-sex settings teachers are able to design the curriculum to tailor to the individual needs of each sex.

Chapter Three

Methodology

This chapter describes the quantitative methodological procedures that will be used to conduct this research study. After a review of the guiding research question, the narrative will explain the initial data collection procedures and analytical techniques that will be utilized. Prior to conducting the research, a copy of the research proposal was presented to and approved by the University of Houston Institutional Review Board (IRB). The researcher also petitioned to and was granted formal approval by the selected school district to access State of Texas Assessment of Academic Readiness (STAAR) records as numerical datasets to be used for the purposes of this research study.

Research Questions and Hypotheses

The research question that the study is designed to answer is:

Research question 1. Are single-gender schools better than co-gender schools at producing high STAAR achievement scores in reading and math among low-income minority 6th grade boys?

H1. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in reading, than boys attending co-gender model middle schools.

H2. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in math than boys attending co-gender model middle schools.

Research Design

A quantitative retrospective research design using a secondary data was utilized

to investigate whether differences exist among the reading and math STAAR achievement scores of middle school boys participating in schools employing two different educational models: single gender model (SGM) and traditional co-gender model (TCM). A quantitative approach was selected for the study because of its abilities to measure and analyze relationships among variables, particularly numbered data, using statistical procedures (Creswell, 2013). According to Creswell (2013), this type of non-experimental research is one in which “the investigator compares two or more groups in terms of a cause (or independent variable) that has already happened” (p. 12). BCPS (2015) highlights that causal-comparative research differs from true experiments in the following ways: (1) an independent variable is identified but not manipulated by the experimenter, and effects of the independent variable on the dependent variable are measured; (2) the researcher does not randomly assign groups and must use ones that are naturally formed or pre-existing groups; (3) identified control groups exposed to the treatment variable are studied and compared to groups who are not.

The research examined STAAR achievement scores in reading and math of low-income minority 6th grade boys attending a SGM middle school and compared them with the scores of 6th grade boys in a predominantly low-income African-American TCM middle school (TCM1) and 6th grade boys in a predominantly low-income Hispanic TCM middle school. (TCM2). Each school’s STAAR reading and math scores at the end of the 2012, 2013, and 2014 school years, respectively, will be analyzed. Any mean differences in STAAR achievement scores between the schools in reading and/or math from year to year would denote that differences likely exist among the schools. Higher mean STAAR achievement scores in reading and/or math among the schools

would signify a higher level of academic performance in the subject area, whereas lower mean STAAR achievement scores in reading and/or math would signify a lower level of academic performance in the subject area. Once differences in mean scores are calculated for each school, the differences in means were calculated between the SGM, TCM1, and TCM2 middle schools. The results of the comparisons between the means scores of boys participating in the two types of educational models will be used to answer the research question guiding the study.

Data Collection

The target population for the research study consisted of 6th grade low-income minority boys attending three selected publicly-funded middle schools: a single gender model school (SGM), a predominantly low-income African-American traditional co-gender model school (TCM1) and a predominantly low-income Hispanic co-gender model school (TCM2). The three public schools examined for the study were selected based upon the composition of their student populations. The SGM was selected for participation in the study because it is the only single gender school in the designated school district that exclusively consists of minority boys, half of whom are low-income. Both the TCM1 and the TCM2 schools were selected for participation in the study because their populations were primarily comprised of low-income minority boys and girls who resided in the same zip code in which the majority of the low-income students attending the SGM school resided. By selecting these particular TCM schools as a standard of comparison with the SGM school, the researcher's goal was to make the sample a more homogeneous one, increasing the likelihood that students attending 6th grade at the SGM school and students attending 6th grade at the TCM schools had lived

in the same neighborhoods and attended schools of the same quality when they initially received primary instruction in reading and math through the 5th grade. In light of this consideration, the researcher could compare the students' STAAR scores between schools with a greater level of confidence that the comparison among the populations was an even one, thereby increasing the internal validity of the research results when the students' scores were measured against one another at the end of the 6th grade.

Sampling Method

The sampling method utilized for the selection of the three schools engaged for the research study is purposive sampling, as the schools selected for inclusion in the research were chosen based upon the purpose of the study. The primary characteristic of the purposive sampling method is that it chooses a sample based upon the study of some limited group or a subset of a population (Daniel, 2012). Specifically, the study utilized a homogeneous purposive sampling technique, as its goal was to achieve a homogeneous sample in which the participants within a particular group of interest share the same or similar traits, such as gender, income level, race/ethnicity, and grade level (Daniel, 2012).

Recruitment for Study Participation

The researcher analyzed district records to identify three schools that met the criteria for inclusion in the research study: one SGM school predominantly comprised of low-income minority boys, one TCM middle school primarily comprised of low-income African-American students (TCM1), and one TCM middle school primarily comprised of low-income Hispanic students (TCM2). In the case of the TCM middle schools, the students of the school resided in the same zip code in which the low-income

minority boys attending the SGM originated.

After the three schools were identified, the researcher submitted a formal written application to the selected school district's Office of Research and Accountability requesting permission to conduct the research study and requesting access to archival STAAR achievement scores for 6th grade boys in reading and math for these schools measured at the end of the 2012, 2013, and 2014 school years. When the district's Office of Research and Accountability approved the researcher's request, a district representative sent the requested archival STAAR data to the researcher via e-mail.

Power Analysis

G-Power analysis was used to estimate the required sample size for the factorial ANOVA that would produce results within a given degree of confidence (Faul, Erdfelder, Lang & Buchner, 2007). The required sample size depends on the effect size η^2 , statistical power $(1-\beta)$ and level of significance α . For this study, $\alpha = 0.05$. In order for a study to detect a small effect size $\eta^2 = 0.2$ at power level of $(1-\beta) = 0.95$ at $\alpha = 0.05$, then the minimum required sample size should be $n = 390$. Detection of larger effect sizes would require progressively lower samples. Thus, for the purpose of this study, the targeted minimum sample size is $n = 390$.

Data Sources

The sources of data used for the research study include STAAR reading and math scores for 6th grade boys measured at the end of the 2012, 2013, and 2014 school years. In the selected school district, students undergo STAAR testing in the subject areas of reading and math at the end of the 6th grade. The purpose of STAAR assessments is to evaluate the academic progress of students in the areas of reading and

math to ensure that students are meeting the district's stated benchmark expectations of development in each subject area. Separated by schools and by subject areas within the schools, the archival data arrived in the form of raw STAAR achievement scores for 6th grade boys from each school. According to STAAR (2014), "Records will not be merged together when a student takes one or more subjects at one grade level, and one or more tests at another grade level" (p. 2). Thus, each student's records for each subject, grade level, and year examined were isolated such that they were easily identifiable for use in the dataset.

The state agency regulating the development and oversight of STAAR conducted analyses to determine the reliability and validity of the STAAR test. To estimate the reliability (an estimation that the same test administered repeatedly will consistently yield the same results), investigators used such statistical measures as internal consistency, classical standard error of measurement, conditional standard error of measurement, and classification accuracy. Internal consistency (which measured how consistently students responded to the items within a test) measures ranged from 0.81 to 0.93 on primary STAAR assessments administered in spring 2012, and "estimates across grades and content areas were found to be of a similarly high level with no noticeable increases or decreases across grades or content areas" (TEA, 2012, p. 109). In general, "reliability coefficients from 0.70 to 0.79 are considered adequate, those from 0.80 to 0.89 are considered good, and those at 0.90 or above are considered excellent" (TEA, 2012, p. 109). Classical standard of error measurement (the variance in a score that occurs when factors outside of what the test is designed to measure affect the score) for the 2012 STAAR generally ranged between 2 to 4 raw score points (TEA, 2012). Conditional standard of error of measurement was measured as "an estimate of the

average test score measurement error that is conditional on the proficiency or scale score estimate” and classification accuracy, which estimates the “accuracy of student classifications into performance categories based on current test results” were also measured and reported by the agency administering the STAAR test statewide. Based upon these estimates, the STAAR test was deemed reliable for the 2012 administration. Similar estimates of reliability were obtained for 2013 and 2014.

Evidence of the STAAR test’s validity (an estimate of whether a test measures what it was intended to measure) was also gathered on the 2012 STAAR test an examination of the test content, response process, internal structure, relationships with other variables, and analysis of the consequences of testing (TEA, 2012). According to the TEA,

Texas collects validity evidence annually to support the many uses of the STAAR test scores. Texas follows national standards of best practice to continue to build its body of validity evidence for the STAAR assessments. The Texas Technical Advisory Committee (TTAC), a panel of national testing experts created specifically for the Texas assessment program, provides ongoing input to TEA about STAAR validity evidence (TEA, 2012, p. 111).

After comprehensive consideration of all factors used to measure the validity of the test, the 2012 STAAR assessment was deemed valid by TEA. Similar estimates of validity were obtained for 2013 and 2014.

Raw STAAR scale scores were reported as continuous interval scaled variables in an Excel spreadsheet. For the 6th grade STAAR scores obtained for spring 2012, reading scores ranged from 869 to 2080 in reading and from 954 to 2144 in math among all students district-wide. For the 6th grade STAAR scores obtained for spring 2013,

reading scores ranged from 831 to 2021 and math scores had the potential to range from 867 to 2064 for all students district-wide. For the 6th grade STAAR scores obtained for 2014, reading scores ranged from 895 to 2085 and math scores had the potential to range from 949 to 2138 for all students district-wide (TEA, 2015). The district also reported frequency distributions for STAAR scale scores for reading and math for 6th grade measurements, as the distributions are necessary to convert the raw scale scores into percentages.

Data Analysis Procedures

The research study centered on the effect of school model on the STAAR reading and math scores of 6th grade middle school boys. Initially, it was expected that the data from different years and schools would be pooled into two groups stratified by school types, and then independent samples t-test would be used to compare the two. However, the examination of the data indicated that there was a high degree of heterogeneity of data for different time periods and schools. Due to the presence of subgroup heterogeneity, the data were not pooled. Instead, each subgroup was analyzed separately using 3x3 ANOVA. The first three level factor represented school year, while the second three level factor represented a school – either SGM, TCM1 or TCM2.

A factorial analysis of variance (ANOVA), also known as two-way analysis of variance, was used to test the null hypothesis regarding the effect of school type on STAAR reading and math scores. While a simple ANOVA tests for differences that might exist between two or more groups using one factor or independent variable, a factorial ANOVA allows for the simultaneous exploration of more than one factor or independent variable. According to Salkind (2013), factorial analysis of variance should

be used when: (1) the researcher is examining differences between groups (rather than examining the relationships that exist between variables); (2) the participants in the research study were tested only once (rather than in a before-and-after treatment or repeatedly); (3) the researcher is comparing more than two groups; and (4) the researcher is dealing with more than one factor.

Analyzing data using factorial analysis of variance allows the researcher to identify the presence of any main effects (a significant effect that an independent variable or factor might have on the outcome variable) that exist between the levels of the different factors individually as well as the presence of any interaction effects (the varying effect that one independent variable has on the outcome variable depending on the level of the other independent variable or factor) when the two explanatory categorical variables are examined together (Salkind, 2013). For the purposes of this research study, the ANOVA was selected as a result of its usefulness for testing the significance of the main effect of the school model factor (independent variable 1), of the main effect of the school year factor (independent variable 2), and the interaction effect between school model and school year when they are considered together.

When a factorial ANOVA is used to analyze a data set, it can be concluded that an effect (main or interaction) is present if the resulting p value is less than .05 and that an effect (main or interaction) is not present if the resulting p value is greater than .05 at the $p < .05$ level of significance. Thus, while some variance might occur between factors, if these variances are not statistically significant at the $p < .05$ level, they would be considered as being within an expected margin of error and therefore, likely the result of sampling error and not a real different. Thus, it would result in an inability to reject

the null hypothesis.

Preceding the analysis with the factorial analysis of variance test, Levene's test, or an F -test, will be conducted. Levene's test is used as one of the "adaptive procedures that utilize a preliminary test to choose the estimator or test for the final analysis [to] improve the accuracy of the final inference" (Gastwirth, Gel, & Miao, 2009, p. 348). Glass (1966) asserts that there are three conditions under which preliminarily testing these variances could serve beneficial to the researcher: (a) when one wishes to make inferences about population variances because they are of scientific interest; (b) when one suspects heterogeneity of variances in an analysis of variance in which not all factors have fixed effects; and (c) when one suspects heterogeneity of variances in a fixed-effects analysis of variance in which the numbers of observations in the groups are widely disparate. The condition under which preliminary testing was performed for this research study is that of suspecting heterogeneity of variances in an analysis of variance in which not all factors have fixed effects. The analysis of variance statistical test assumes that variances are equal (also known as having homogeneity of variance) across a variable that is calculated for the two or more groups (k populations) utilized in the analysis. However, Levene's test is an inferential statistic used as a means of verifying whether this assumption of equal variances is correct. Levene's test assesses the null hypothesis that the variances of the populations are equal. The test produces a p -value that is commonly considered significant when $p < .05$, suggesting that any differences between variances that exist between the groups did not occur by chance. If Levene's test is significant, the factorial ANOVA cannot be used. However, if Levene's test does not yield significant results, it is safe for the researcher to apply factorial ANOVA for

the analysis. Out of several variations of preliminary tests used in statistical analysis, Levene's test is one of the most commonly used because of its extreme sensitivity to the normality assumption, particularly when it is used as a preliminary test for a factorial ANOVA (Parra-Frutos, 2009).

After conducting the factorial analysis of variance test, the Bonferroni post-hoc test, also known as the Bonferroni adjustment, will be conducted to identify differences between the individual schools. Post-hoc tests are conducted following the discovery of statistically significant results of an analysis and the rejection of the null hypothesis. These tests are used to analyze differences between all possible pairings of group means for the purpose of ensuring that a Type I error (the incorrect rejection of a true null hypothesis) is minimized (Privitera, 2012). Privitera (2012) promotes the Bonferroni procedure as the best post-hoc test when a researcher yields significant one-way results after conducting an ANOVA within subjects.

Limitations of the Research Design

The primary limitation of the research design was the use of purposive sampling for the selection of the TCM schools used for the study. Although this is a selective and judgmental non-probability sampling technique that does not produce a sample representative of a larger population, it is efficacious for the study of a particular group under investigation (Daniel, 2012). In addition, this sampling method may lead to sampling biases. For the purposes of this research study, it is useful for studying 6th grade low-income minority boys attending publicly-funded middle schools. However, in general, the sampling method limits external validity (generalizability) of results.

The second limitation of the research design was that of employing a causal-

comparative research strategy. According to BCPS (2015), because of the non-experimental nature of this approach, when conducting analyses and drawing conclusions based upon this type of study, “determining causes must be done carefully, as other variables, both known and unknown, could still affect the outcome”. Exercising this caution helps to ensure that relationships drawn between variables are credible. However, the internal validity of this research design is still limited.

Chapter 3 Summary

This research study was designed to compare STAAR achievement scores in math and reading between 6th grade low-income minority boys attending a publicly-funded SGM school and 6th grade low-income minority boys attending two TCM schools. Research suggests that education of low-income minority boy students in SGM schools can be effective for improving their educational outcomes because it provides more opportunities to tailor the learning environment to the unique needs of this population. The first research hypothesis was that the students attending the SGM school would have higher reading scores than the math scores of students attending the TCM schools. The second research hypothesis was that the students attending the SGM school would have higher math scores than the math scores of students attending the TCM schools. To test these hypotheses, the researcher used purposive sampling to identify one SGM school and two TCM middle schools that met the criteria for the research study. G-Power analysis estimated that the targeted minimum sample size was 390 boys. The school district forwarded archival, raw reading and math STAAR achievement scores to the researcher for 6th grade boys at each selected school as measured at the end of the 2012, 2013, and 2014 school years. The researcher conducted analysis on the data set

using factorial ANOVA, and the Bonferroni post-hoc test to determine what differences existed between the two types of learning environments in the subject areas of reading and math and to what extent those differences existed? If the SGM learning environment produced higher STAAR scores than the TCM learning environments, this would suggest that the SGM might play a role in improving the educational outcomes of low-income minority boys and allow for the rejection of the null hypothesis.

Chapter Four

Results

The sample consisted of $n = 812$ different boy students who attended the 6th grade at three different schools over a three-year period between 2011 and 2014. The data were obtained from the school district by filing an open records request. The entire 6th grade boy population from the SGM school, the TCM1 school, and the TCM2 school were included in the sample. SGM was a single-gender boys' school primarily comprised of low-income minority students, TCM1 was a co-gender school primarily comprised of low-income African American students, and TCM2 was a co-gender school primarily comprised of low-income Hispanic students.

From the total of 812 available observations, 12 were discarded because values for one or more variables were missing. The resulting sample size that was available for the analysis consisted of $n = 800$ students. African-American (47.8%) and Hispanic (46.4%) were the largest demographic categories represented in the sample. No students in the sample were classified as special education students. The total of $n = 722$ (90.1 %) students came from a disadvantaged, or low-income economic background.

Results for Hypothesis 1: Analysis of STAAR Reading Scores

H1. Sixth-grade boys attending single-gender model middle schools have higher STAAR achievement scores in reading, on average, than boys attending co-gender model middle schools.

The descriptive statistics for STAAR reading scores are presented in Table 1. Visual inspections of this table and of **Error! Reference source not found.1** indicates

that scores for the TCM2 school were not stationary over the three years and declined for some reason. It is also clear that the SGM school had the highest mean scores in the subject of reading.

Table 1
Descriptive Statistics for Reading Scores

Table 1. i

Descriptive statistics for reading scores

	<i>n</i>	<i>Mean</i>	<i>Std Dev.</i>
SGM			
2011-2012	85.00	1618.41	111.15
2012-2013	100.00	1637.92	114.87
2013-2014	86.00	1630.01	117.19
Total	271.00	1629.29	114.33
TCM1			
2011-2012	75	1533.88	107.07
2012-2013	62	1518.42	111.16
2013-2014	71	1479.01	92.07
Total	208	1510.54	105.65
TCM2			
2011-2012	110	1565.95	95.40
2012-2013	101	1571.57	120.74
2013-2014	110	1571.88	97.61
Total	321	1569.76	104.50

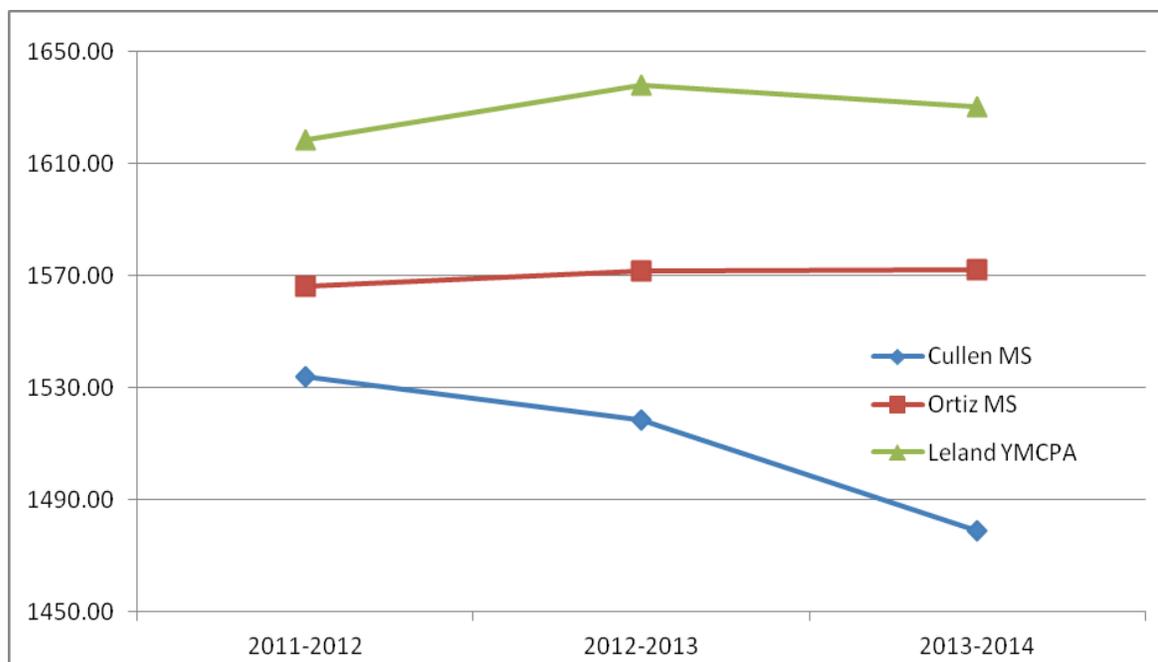


Figure 1. Means of Sample Reading Score for Schools by Year

To test the null hypothesis regarding the effect of school gender composition on STAAR reading achievement scores, the following factorial 3x3 ANOVA model was fitted (Howell, 2013):

$$\mu_{ij} = \mu_0 + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ij}$$

Here μ_{ij} represents group means, α_i is the effect due to school (either the SGM school, the TCM1 school, or the TCM2 school), β_j is the effect due to school year, $(\alpha\beta)_{ij}$ is the interaction effect, and ϵ_{ij} is a normally distributed error (Howell, 2013).

The model was selected to separate the effects due to school model from the effects due to school year.

The results of fitting this factorial ANOVA model are presented in Figure 1. The data suggest that the main effect due to the school model variable was statistically significant, while the main effect due to school year and the interaction effect between

school model and school year were not statistically significant. The model's R^2 was $R^2 = 0.164$. The model explained 16.4% of the total variance. The effect size due to school model was small, $\eta^2 = 0.15$. For this model, Levene's test was not statistically significant: $F(8,792) = 0.88, p = 0.54$. This suggests that the requirement of equality of variances for the model was not violated and that it was appropriate to utilize factorial ANOVA for the analysis (Howell, 2013). Examination of histograms indicated that there were no major departures from normality. According to Howell (2013), ANOVA is robust with respect to departures from normality. For this reason, it was assumed that potential violations of normality were inconsequential.

Table 2. Factorial ANOVA analysis for reading scores

	<i>df</i>	<i>F</i>	<i>p-value</i>	<i>Partial Eta Squared</i>
School	2	70.92	0.00	0.15
Year	2	1.51	0.22	0.00
School * Year	4	2.40	0.05	0.01
Error	791			
Total	800			

Because the effect due to school was statistically significant, the Bonferroni post-hoc test was used to identify differences between individual schools. The results of post-hoc comparisons are presented in Table 3. Average reading scores for all three schools were significantly different. That is, the difference between average reading scores for any pair of schools was statistically significant.

The SGM had the highest score among all three schools. The Bonferroni post-hoc test suggests that, on average, SGM students scored higher than students at TCM1 by

118.75 ($p < 0.01$) and higher than the TCM2 school by 59.53 ($p < 0.01$). Scores at TCM1 were the lowest among the three schools. In comparison to TCM2, the TCM1 scores were, on average, lower by 59.21 points ($p < 0.01$) and by 118.75 points ($p < 0.01$) lower than the average SGM scores. TCM2 scores were higher than TCM1 scores by 59.21 ($p < 0.01$) points and lower than scores at SGM by 59.53 ($p < 0.01$) points. Overall, the Bonferroni post-hoc test suggests that average reading scores were the highest for SGM and the lowest for TCM1 with the TCM2 scores being between the two.

Table 3.
Post-hoc analysis for reading scores

<i>(I) School</i>	<i>(J) School</i>	<i>Mean Difference (I-J)</i>	<i>p-value</i>
SGM	TCM1	118.75	p<0.01
	TCM2	59.53	p<0.01
TCM1	TCM2	-59.21	p<0.01
	SGM	-118.75	p<0.01
TCM2	TCM1	59.21	p<0.01
	SGM	-59.53	p<0.01

This suggests that the null hypothesis can be rejected for main effect associated with school model. The originally-stated hypothesis can be supported. Indeed, average STAAR reading scores for the single-gender school were significantly higher than scores for the co-gender schools.

Results for Hypothesis 2: Analysis of STAAR Math Scores

H2. Sixth-grade boys attending single-gender model middle schools have higher STAAR achievement scores in math, on average, than boys attending co-

gender model middle schools.

The descriptive statistics for math scores at the three schools are presented in Table 4. Visual inspections of this table suggest that scores for TCM2 were not stationary over the years. Table 4 suggests that math scores did not change over the three years for SGM and TCM1. However, there was an apparent increase in math scores for TCM2.

Table 4.
Descriptive statistics for math scores

	<i>n</i>	<i>Mean</i>	<i>Std Dev.</i>
SGM			
2011-2012	85.00	1654.71	135.31
2012-2013	100.00	1679.29	131.22
2013-2014	86.00	1646.20	130.84
Total	271.00	1661.08	132.69
TCM1			
2011-2012	75	1555.83	125.16
2012-2013	62	1550.53	122.02
2013-2014	71	1533.08	130.43
Total	208	1546.49	125.85
TCM2			
2011-2012	110	1579.19	137.82
2012-2013	101	1600.37	128.80
2013-2014	110	1650.72	148.78
Total	321	1610.36	141.84

Figure 2 depicts means plots. Although mean math scores for the SGM school were higher for the first two periods, the average scores for the TCM2 school exceeded average scores for the SGM school in the last period (2013-2014). This figure is strongly suggestive, that in general, the statement that single-gender schools result in academic performance may not be universally true.

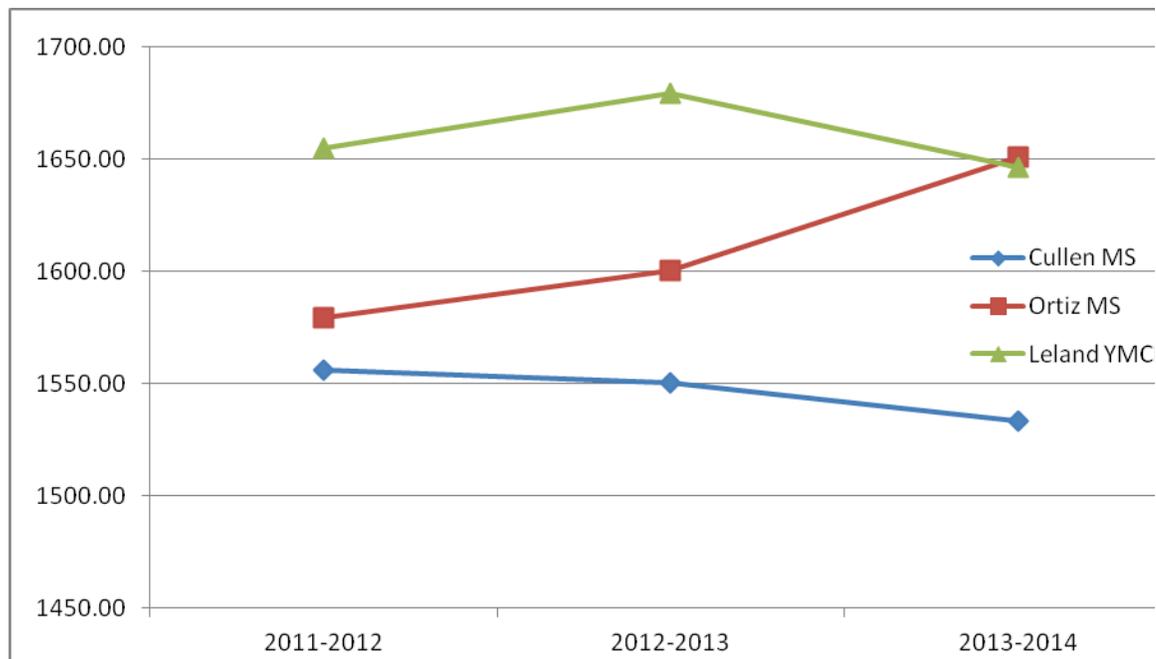


Figure 2. Means for Sample Math Score for Schools by Year

To test the null hypothesis regarding the effect of school type on STAAR math achievement scores, the following factorial 3x3 ANOVA model was fitted (Howell, 2013).

$$\mu_{ij} = \mu_0 + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \epsilon_{ij}$$

Here μ_{ij} represents group means, α_i is the effect due to school (either the SGM school, the TCM1 school, or the TCM2 school), β_j is the effect due to school year, $(\alpha\beta)_{ij}$ is the interaction effect, and ϵ_{ij} is a normally distributed error. The model was selected to separate the effects due to school model from effects due to school year.

The results of fitting this model are presented in Table 5. The data suggest that the main effect due to school model and the interaction effect between the school model and school year variables were statistically significant, while the main effect due to school year was not. The presence of the interaction effect suggests that the difference in math scores between schools was time dependent. The model's R^2 was $R^2 = 0.12$. The model explained 12.0% of the total variance. The effect size due to school model was small, $\eta^2 = 0.10$. For this model, Levene's test was not statistically significant: $F(8, 791) = 0.75, p = 0.64$. This suggests that the requirement of equality of variances for the model was not violated and that it was appropriate to utilize factorial ANOVA for the analysis (Howell, 2013). Examination of histograms indicated that there were no major departures from normality. According to Howell (2013), ANOVA is robust with respect to departures from normality. For this reason, it was assumed that potential violations of normality were inconsequential.

Table 5.
Factorial ANOVA analysis for math scores

	<i>df</i>	<i>F</i>	<i>p-value</i>	<i>Partial Eta Squared</i>
School	2	42.34	0.00	0.10
Year	2	0.88	0.41	0.00
School * Year	4	4.35	0.00	0.02
Error	791			
Total	800			

Because the effect due to school was statistically significant, the Bonferroni post-hoc test was used to identify differences between individual schools. The results of post-hoc comparisons are presented in Table 6. Average math scores for all three schools

were significantly different. That is, the difference between average math scores for any pair of schools was statistically significant.

The SGM school had the highest math scores among all three schools. On average, the SGM students scored higher than students of the TCM1 school and the TCM2 school by 114.59 ($p < 0.01$) and 50.71 ($p < 0.01$), respectively. Scores at TCM1 were the lowest among the three schools. In comparison to TCM2, the TCM1 scores were on average lower by 63.88 points ($p < 0.01$) and by 114.59 points ($p < 0.01$) lower than the average SGM scores. TCM2 scores were high than TCM1 scores by 63.88 ($p < 0.01$) points and lower than scores at SGM by 50.71 ($p < 0.01$) points. Overall, the Bonferroni post-hoc test suggests that average math scores were the highest for SGM and the lowest for TCM1 with the TCM2 scores being between the two.

Table 6.
Post-hoc analysis for math scores

<i>(I) School</i>	<i>(J) School</i>	<i>Mean Difference (I-J)</i>	<i>p-value</i>
SGM	TCM1	114.59	p<0.01
	TCM2	50.71	p<0.01
TCM1	TCM2	-63.88	p<0.01
	SGM	-114.59	p<0.01
TCM2	TCM1	63.88	p<0.01
	SGM	-50.71	p<0.01

To summarize, the null hypotheses for the main effect associated with school model and school model can be rejected. There is no statistically significant evidence to reject the null hypothesis associated with school year. The hypothesis stated in the beginning of this section cannot be supported because in the 2013-2014 school year, there

was no statistically significant difference between the SGM school and the TCM2 school, as $t(194) = 0.222, p = 0.824$.

Discussion

The above analysis suggests that for STAAR reading scores, the single-gender school outperformed the two co-gender schools. For STAAR math scores, the situation is more complicated. If taken as a whole over the three years, the single-gender school produced students who scored higher than the co-gender schools. However, when individual years were analyzed, the single-gender school did not always produce greater math achievement as compared to the co-gender schools (the TCM2 school).

The analysis also suggests that even if single gender schools result in better academic performance, the effect may not be practically large. The differences in scores observed between single-gender schools and co-gender schools were relatively small – typically no more than 10%. There was also a statistically significant difference between the two co-gender schools, and this difference was comparable in magnitude to the difference between the higher performing co-gender school and the single-gender school. This is indicative that factors other than school gender composition may explain differences in academic performance as measured by STAAR reading and math scores.

Even if the assumption that single-gender schools may improve academic performance is true, it is possible that the effect of a similar magnitude could be achieved by other means. Over the years examined, the TCM2 school's performance on math scores improved, while math scores for the TCM1 school stayed relatively the same. The magnitude of the improvement on math scores at the TCM2 school was approximately equal to the initial difference in math score between the TCM2 school and the SGM

school. It was not clear why math scores went up in the TCM2 school, but this increase suggests the possibility that there was some other unknown factor that caused this increase. Further investigation of what changes at the TCM2 school resulted in higher scores may be warranted.

To summarize, there were unexplained differences in STAAR reading and math scores over time and between schools. It seems likely that there were some other factors impacting the academic performance that were not investigated due to the limitations of this dataset. These factors are likely to exert non-negligible impact on educational outcomes, and the magnitude of this impact is likely to be comparable or even larger than the effect of a school's gender composition.

Chapter Five

Discussion and Conclusion

The purpose of this research study was to compare two educational models to investigate whether differences exist in academic achievement among 6th grade boys in single-gender model (SGM) schools and those in traditional co-gender model (TCM) schools. Research was conducted using a quantitative retrospective research design to analyze archival reading and math data from the State of Texas Assessment of Academic Readiness (STAAR) for three years: 2012, 2013, and 2014. This chapter provides a review and discussion of the results from the analysis and their implications for practice, policy, and research. Further, the chapter provides the researcher's reflections on the results and offers the researcher's recommendations for future research.

Summary of the Results

The research question that guided this study was: Are single-gender schools better than co-gender schools at producing high STAAR achievement scores in reading and math among low-income minority 6th grade boys? The first research hypothesis was that the boys in the SGM school would attain higher reading scores than students attending the TCM schools. The second research hypothesis was that the students attending the SGM school would attain higher math scores than students attending the TCM schools. In the subject area of reading, an analysis of the scores suggested that the SGM school outperformed the two TCM schools, both overall and year to year. In the subject area of math, an analysis of the scores suggested that overall, the SGM scored higher than the

TCM schools, but when analyzed year to year, the SGM did not always produce higher match scores than the TCM schools. Thus, while the researcher was able to reject the null hypothesis for the reading scores, the null hypothesis could not be rejected for the math scores.

Discussion of Results

Hypothesis 1. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in reading, than boys attending co-gender model middle schools.

In the subject of reading, students attending the SGM schools scored significantly higher on STAAR tests than their TCM counterparts in both an overall analysis and a year-by-year analysis, which supported the originally-stated hypothesis. The SGM school had the highest scores among all three schools; on average, SGM students scored higher than students of the TCM1 school and the TCM2 school by 118.75 and 59.53, respectively.

This result supports the research of several researchers. First, it supports the research of Terry (2014), who conducted a qualitative study examining the impact of single-sex education on high school students. Terry's (2014) research found that when males are separated into single-sex learning environments, because they are no longer distracted by members of the other gender (among other factors), they are able to re-engage, or actively participate in the learning process, resulting in more favorable academic outcomes in areas like reading. While it is unclear what role of the lack of distraction from the other gender played in increasing the academic performance of their peers who attended TCM schools, it is clear that there was some effect present in the

SGM that consistently resulted in the overall higher academic performance in their STAAR reading scores over and above their TCM peers.

Next, the findings support the Journal of Educational Psychology's (2002) report that children from single-sex schools and classrooms outperform students from co-educational schools. Then, the research results also back Iverson and Murphy's (2007) position that single-sex learning environments tend to encourage boys to engage in areas of study that are typically not within their realm of interest, like reading, an area in which typically girls tend to excel over and above their male counterparts. Thus, the inability to reject the null hypothesis for reading is consistent with published research literature.

Hypothesis 2. Sixth-grade boys attending single-gender model middle schools on average have higher STAAR achievement scores in math than boys attending co-gender model middle schools.

In the subject of math, overall, students attending the SGM schools scored higher than their TCM counterparts, allowing for the rejection of the null hypothesis. On average, the SGM students scored higher than students of the TCM1 school and the TCM2 school by 114.59 and 50.71, respectively. However, in the year-by-year analysis, the null hypothesis could not be rejected, because in the 2013-2014 school year, there was no statistically significant difference between the SGM school and the TCM2 school, as $t(194) = 0.222, p = 0.824$.

The overall results for math scores also serve to affirm the findings of previous researchers. First, the research results corroborate the claims of many proponents of single-sex learning environments, who promote its benefits in fostering better academic achievement overall among students (Sikhora, 2014). Then, the research supports the

findings of Terry (2014) who hypothesized that male minority students attending a single-gender publicly-funded middle school would experience greater levels of improvement in their math scores as a result of being shielded from the marginalizing effects of urban schooling (among other factors), thus re-engaging them in school at a level that will result in better academic performance. Again, it is unclear how certain intervening factors, like being shielded from the marginalizing effects of urban schooling, contributed to the increase in academic performance of the SGM students. What is clear is that there was some effect present in the SGM that consistently resulted in the overall higher academic performance in their STAAR math scores over and above their TCM peers.

The research outcomes of this study also support evidence in the literature that boys tend to have a greater affinity for math than for reading (U.S. Department of Education, 2008; Doris et al., 2013). For each year of the STAAR math scores that were examined, the average score was higher than the STAAR reading scores for each of the schools in the study. The yearly average means for reading scores among the SGM, TCM1, and TCM2 schools were 1629.29, 1510.54, and 1569.76, respectively, while the yearly average means for reading scores for the same schools were 1661.08, 1546.49, and 1610.36, respectively.

An additional aspect of the results that should be highlighted is that the TCM2 school's STAAR math scores improved over the three-year period examined for the study while the TCM1 school's STAAR math scores remained relatively the same from year to year. This suggests that there was some factor at work in the TCM2 school that was not present in the TCM1 school, and this factor remains unknown.

Discussion of Results in Relation to the Literature

The results of the research study support the single-sex alternative education theory, which suggests that educating low-income minority boys in single-sex learning environments can improve their educational experiences and academic performance relative to those educated in traditional co-gender schools (Hubbard & Datnow, 2005; Klein, 2012; Goodkind et al., 2013). Study results suggest that even though SGM schools resulted in better academic performance overall, the effect might not have been a practically large one. The differences in scores between the SGM and the TCM schools were relatively small, as there was no more than a 10 percent difference in scores between them. However, although the overall effect between the SGM school and the TCM schools was not robust, the effect was present and significant nonetheless, allowing for the null hypothesis to be rejected. Thus, it is the researcher's position that the results of this study support the body of research that affirms single-sex education as a beneficial alternative to traditional co-gender model schools to increase the academic performance of 6th grade low-income minority boys.

The study results, which affirm that students attending a single-sex school fared better academically than their peers educated in co-gender learning environments, are consistent with the research of Brown (2008), which evaluated the academic outcomes of a specific group of students after they were separated into single-sex classes, although in the same school, and compared their academic performance with their peers that remained in co-gender classes. The result: students in the single-sex classes excelled over their peers that remained in the co-gender classes, even to the extent that students who had been academically unsuccessful in the past became very successful in the single-sex

environment and test scores showed drastic improvement. In contrast, the results of this research study oppose the research findings of Schachter (2003), who investigated a Seattle elementary school that was 95 percent minority and low-income. Schachter (2003) reported that although single-sex learning environments make a positive difference in the academic performance in students overall, the benefits were especially visible in schools serving minorities in low-income demographics. The results of the study also showed impressive and significant increases in state standardized achievement test scores for the students in the single-sex schools relative to their peers in co-gender schools. However, while the differences in scores for students in Schachter's (2003) research were robust after separating the genders, the results for this research study did not show a practically large or vigorous effect in score differences after placing boys into a single-sex school.

Although there was a difference in the overall analysis, albeit a small one, between the SGM and the TCM schools, there was also a difference between the two TCM schools themselves – a larger and statistically significant one. This difference was comparable to the difference between TCM2, which is the TCM school that performed the highest of the two TCM schools in both reading and math, and the SGM school. The notion that the same magnitude of differences in math and reading scores that was produced between the SGM and TCM schools (taken together) was also produced between the TCM1 school and the TCM2 school suggests that there are potentially other factors at work in producing the differences measured by STAAR reading and math scores – factors other than the gender composition of the schools.

The aspect of the results of this research study is similar to the results of the research of Hayes et al. (2011), who conducted quantitative research (the only other known quantitative research study on low-income minorities attending publicly-funded middle school in the U.S.) to examine how single-sex education impacted low-income minority girls attending a single-sex school relative to girls attending a public magnet school. Although the girls in the single-sex school showed signs of improvement in academic achievement, they were not robust enough to conclude that the effect was due to the gender composition of the school. Instead, the Hayes et al. (2011) attributed the academic improvement to overall levels of prior achievement among the body of girls that attended the single-sex school. Like this study, although there were academic improvements among those attending the single-sex school, it could not be concluded that the improvements resulted as a direct consequence of the gender composition of the school.

This conclusion is also consistent with Goodkind et al., (2013), who reported that there are some who believe that the benefits that are realized from single-sex education environments might not be directly related to the fact that they have separated the genders from one another in the learning environment and that they are instead attributable to other factors, like the investment of additional resources into schools of this nature and the fact that many teachers who instruct students in single-sex educational settings are held to higher teaching standards. Other potential factors to which the higher academic performance realized in single-sex schools might be attributed could be similar to those found in the research of Hubbard and Datnow (2005), which concluded that such environments were successful, not because the school was single-sex, but because of the

“interrelated contributions of the schools’ organizational characteristics, positive student-teacher relationships, and ample resources” (p. 115). Finally, Noguera (2012) posited that the reason that single-sex schools are successful because of the culture of success and resources that are deliberately infused into the school environment rather than to the fact that the boys of color are separated from their female and non-minority peers.

Implications of Study Results

Implications for Practice

Research generally promotes that educating students in single-sex learning environments is the best way to meet the individual needs of children and provide whatever is necessary for each child to become academically successful (Schachter, 2003). This research study supports this general scholarly position; although its results are not robust, they are significant, so they do allow for the rejection of the null hypothesis overall. Thus, the research study’s implications for practice is to advocate for the separation of boys and girls, particularly those of a low-income minority demographic, into separate learning environments so that their individual needs can be met, their gender-specific needs can be addressed, and they can be placed into a context in which they can become academically successful. If practitioners do not have the educational resources to create separate schools, an alternative is to separate genders within schools; boys can be educated on one floor of the school while girls are educated on another floor, or boys can be educated in one wing of the school while girls are educated in an opposite wing of the school.

Ultimately, practitioners should endeavor to create single-sex schools as an alternative means of educating and increasing the academic performance of low-income

minority middle school boys, as this is the context under which the results of this study were produced; however, in the transitional time until these schools are created, the separation of genders into their own areas is a good temporary option. Establishing a single-gender environment requires time for planning, training for teachers, and a thorough review of best practices. For example, Datnow, Hubbard, and Woody (2001) found schools had insufficient time to plan, gain the support of their constituencies, and to recruit to train teachers.

Salomone (2003) discusses another less-than-successful implementation of a single-sex program. Although test scores improved, there were also findings that the needs of boys and girls were not fully addressed because of, “inadequate staff development, inexperienced teachers, and a school mission that was more focused on raising standardized test scores than consciously addressing the specific educational needs of girls and boys.” School districts seeking to create single- gender schools will need assists with each of these areas and be provided with ongoing technical assistance through a statewide coordinator whose sole function is to support schools in creating, implementing, and sustaining single-gender programs.

Implications for Policy

This research study was designed to address the problem of differing positions that exist in education surrounding whether single-sex learning environments can have a greater impact on the outcomes of minority students or whether these students can realize the same desired educational outcomes in traditional co-gender environments. The results of this research study suggest that three different cohorts of 6th grade minority boys attending publicly-funded middle schools experienced better educational outcomes than

their peers of the same demographic attending traditional co-gender publicly-funded middle schools in the same district.

The policy implications of the study's outcome point to the need for school districts to create single-sex schools as an alternative method of education and to create policies that allow parents who fall within certain income-restricted guidelines to choose whether they will place their boys in single-sex schools or in traditional co-gender schools, all of which are publicly funded so that parents are not faced with paying any out-of-pocket costs to exercise this option. This parental selection policy is a particularly critical one to implement when their children are transitioning from elementary to middle school, because boys can experience considerable challenges, specifically in reading, as they advance from the fifth to the sixth grade, the age around which large achievement gaps tend to appear (Fryer and Levitt, 2010). Because of Title IX regulations, which allow districts greater flexibility to provide single-sex education in order to eliminate race and gender based discrimination in schools (Doris et al., 2013), this is both a justifiable and feasible policy to implement.

Ultimately a body of research will exist from which to draw conclusive policy recommendations for single sex schooling. But unfortunately this issue is now at the nexus of educational politics as well as policy, where research findings are often picked over by advocates to support existing political claims (Datnow & Hubbard, 2008). Many supporters of single sex public education are making policy recommendations regarding how to best educate our children by irresponsibly picking and choosing neuroscience research to fit their political agenda. While NCLB established single sex schooling for academically failing schools and amendments to the regulations of Title IX thereafter

established legality for all public schools to provide single sex education, scholars have asked, even before NCLB, if single sex schooling in the public sector is sustainable (Hubbard & Datnow, 2002). Perhaps this might be, in part, because the policy of public single sex schooling was seemingly formulated before addressing the questions: what is the purpose of education in single sex schools? For whom? And, for what goals?

Implications for Research

Although research literature supports that single-sex learning environments can serve to improve the academic performance of low-income minority students overall, little to no research has been conducted about how single-sex learning environments can increase the educational outcomes 6th grade low-income minority boys. This research study has advanced the knowledge of how single-sex learning environments can impact the educational outcomes of this target population that during the critical period in which they are transitioning from elementary school into middle school, the period when wide achievement gaps appear (Fryer and Levitt, 2010).

Additionally, this research has filled a void in the literature by examining single-sex middle schools. According to Doris and colleagues (2013), nearly all of the previous studies in research literature examine the topic from the context of schools at the high school level or the university level. Thus, many researchers do not consider them credible sources of support to justify single-sex education as a means of improving the academic outcomes of younger students such as those in middle or elementary school.

Then, the research has addressed an issue of the socioeconomic context under which studies of single-sex education most commonly take place. Goodkind et al. (2013) reported that most research surrounding single-sex education in the U.S. has been

conducted by studying more privileged students whose parents have the resources to attend private and parochial schools and whose socioeconomic status is directly related to better quality education, and consequently, better academic performance in relation to their low-SES counterparts. This research study examined single-sex education by studying low-income minority students in publicly-funded schools, thus filling a socioeconomic contextual gap that was previously absent or unknown in the literature and providing greater context-based support for the use of single-sex education in low-income communities as a means of increasing academic achievement among minority boys.

Finally, the research implications of this study center on the nature of the study: prior to conducting this study, there was only one rigorous quantitative research study that examined the impact of single-sex education on low-income minority youth in a publicly-funded middle school, and it focused on comparing the performance low-income minority girls attending a public school with girls in a public magnet school (Hayes et al., 2011). Goodkind et al. (2013) also highlighted the need for empirical research, criticizing the fact that most advocates for single-sex education do not ground their confidence in quantitative studies (in large part, because such studies surrounding this topic are scarce in the literature) but rather promote the alternative means of education based on theory and assumption. Thus, this study has groundbreaking implications, as it is the first known study of its kind to engage rigorous quantitative research examining the impact of single-sex education on low-income minority boys attending publicly-funded middle schools.

Researcher Reflections

When Fergus and Noguera (2010) conducted their three-year study on single sex schools for the purpose of identifying strategies targeted towards increasing the academic performance of minority males, they executed their research guided by two theoretical precepts: 1) it was necessary to understand the social and emotional needs of Black and Latino boys; and 2) it was necessary to understand how the academic needs of Black and Latino boys surface and how to target strategies and interventions to address those specific needs. The researcher for the current study operated under similar premises: 1) the social and emotional needs of low-income minority boys are different than those of their white peers, and this needed to be taken into account when providing educational instruction to them; and 2) when the unique needs of the low-income minority male middle school demographic are taken into consideration, interventions are necessary to address them.

As a middle school educator, the researcher deems single-sex education as a key intervention and educational alternative in the lives of low-income minority boys, particularly at the early middle school level when boys are transitioning from the lower academic and social demands of elementary school to the more rigorous academic and social demands of middle school. Providing a context for them that focuses on their unique social, emotional, and academic needs so that they can focus on increasing their academic performance without judgment, without the distractions of the opposite gender, without the marginalizing culture that tends to exist in many traditional co-gender urban schools, without the fear of being placed into special education, and without the

disciplinary biases that tend to exist towards boys of color is essential in helping them to succeed. However, consistent with Goodkind et al. (2013), the researcher recognizes that many advocates for single-sex education rely upon anecdotal data, theory, and assumptions to promote the cause. Thus, the researcher found it necessary to develop a study created around rigorous quantitative analysis to serve as a foundation for his advocacy of single-sex education, particularly for this demographic.

The researcher anticipated stronger differences between the STAAR reading and math scores of the boys attending the SGM and the boys attending the two TCM schools. A long-term supporter of single-sex education, he has observed numerous low-income middle school boys (many of whom had only been attain dismal results in traditional co-gender schools) excel academically in single-sex learning environments, relative to their peers of the same demographic attending traditional co-gender model schools. Therefore, while the researcher anticipated the results showing that the STAAR reading and math scores for the SGM were higher overall than the scores for the TCM schools, he did not anticipate the results that the findings, on a practical level, were no more than 10 percent – quite small relative to what was expected based upon his previous professional observations. According to his professional observations, the differences between the two school models were expected to be of a much greater magnitude. In light of these unanticipated study results, the researcher recognizes that additional research is necessary to understand the dynamics that might be at work in producing such unexpected empirical results.

Recommendations for Future Research

Researchers generally contend that single-sex schools can play an integral part in empowering both teachers and students to achieve academic proficiencies at greater levels and increase the academic performance of male students overall. While this research study did not examine what factors affected the increased academic proficiencies of the males involved in the research study, it produced results that are consistent with the body research: the males in single-gender middle schools had higher academic performance overall than their peers in traditional co-gender middle schools. Further, the year-to-year research results produced some questions as to what factors were at work within and between the schools to produce the results that were produced from the study. Thus, the factors to which the academic improvements were attributable, outside of the gender composition of the school, are unknown. Considering this, one recommendation for future research is to expand upon this research study by examining the factors that contribute to the increased academic performance of low-income minority male 6th graders who attend single-gender middle schools.

Another recommendation for future research is to examine the STAAR reading and math scores of 6th grade minority boys in relation to not only their 6th grade minority male peers in the same district, but to their female minority counterparts attending traditional co-gender schools in the same district. Because girls, who traditionally have higher levels of academic achievement in areas like reading (Sikhora, 2014), were not included in this research study, it is unknown whether the overall STAAR scores of the boys in the single-gender school, although higher than their male peers in the traditional

co-gender model school, would be higher than the scores of girls in traditional co-gender model schools. Including girls in the study will advance scholarly understanding of how low-income minority boys' 6th grade STAAR reading and math scores compare to two important reference groups in efforts to further validate single-sex education as a beneficial alternative to traditional co-gender schooling.

Then, the researcher recommends that further research triangulate quantitative with qualitative data when examining the impact of single-sex education on 6th grade low-income minority boys. As Goodkind and colleagues (2013) explained, "Obviously, it is important to hear from youth themselves, as without their buy-in and support, single-sex public schools are unlikely to succeed" (p. 1176). Thus, it is recommended that future research utilize not only STAAR reading and math scores for quantitative analysis of academic improvement, but this quantitative analysis should be complemented by a qualitative analysis that will allow for deeper, richer insights into the perceptions of the low-income minority boys as to how and why they feel their academics improve as a result of gender separation in the 6th grade.

Conclusion

Overall, the SGM school outperformed the TCM schools, although not in a way that was practically large enough to conclude that SGM schools universally produce greater reading and math achievement than their TCM counterparts simply as a result of the single-sex gender composition of the school. The overall higher performance of the SGM school was minor at best, and in the year-to-year performance in the subject of math, the TCM2 school actually outperformed the SGM school in the final year of analysis. This suggests that there are other unknown factors at work influencing the

scores within and between the schools that are not attributable to gender composition. Thus, even if the assumption that SGM schools may improve overall academic performance is true, it is also possible that the effect of a similar magnitude could be achieved by other means. Further research is necessary to discover the unknown factors that are at work producing the differences in academic achievement between low-income minority middle school boys in publicly-funded single-sex schools and their peers attending traditional co-gender model schools.

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