Gender Segregated Learning Environments: An Analysis Of The Perceived Impact Of Single-sex Classrooms In South Carolina

2011

Paul Gleason
University of Central Florida

Find similar works at: http://stars.library.ucf.edu/etd

University of Central Florida Libraries http://library.ucf.edu

STARS Citation

http://stars.library.ucf.edu/etd/2039

This Doctoral Dissertation (Open Access) is brought to you for free and open access by STARS. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of STARS. For more information, please contact lee.dotson@ucf.edu.
GENDER SEGREGATED LEARNING ENVIRONMENTS
AN ANALYSIS OF THE PERCEIVED IMPACT OF SINGLE-SEX CLASSROOMS IN SOUTH CAROLINA

by

PAUL GLEASON
M.B.A. Stetson University, 2004
B.B.A. Stetson University, 1997

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the College of Health and Public Affairs
at the University of Central Florida
Orlando, Florida

Spring Term
2011

Major Professor
Lawrence Martin
ABSTRACT

Educating male and female students in separate learning environments has been a common practice since the early inception of educational programs. However, this practice was heavily debated in the 20th century for its perceived inequalities in the treatment of students based on their gender resulting in today’s coeducational classroom structure. Recently, interest in single-sex classrooms returned as an alternative for educating America’s youth. Political support for this educational approach was evident in modifications to the 2006, No Child Left Behind Act which in turn led to increased availability and popularity of this educational venue. Despite same-sex classrooms’ acceptance, research results on the effectiveness of single-sex classrooms have been mixed contributing to inconclusive findings that do little to support the use of public funds for such initiatives. The purpose of this research is the analysis of data to clarify the outcomes of single-sex classroom environments and their effects on students. South Carolina Department of Education survey results (2008) were examined using ANOVA analysis to identify differences in the group means between the male and female students and regression analysis was used to test the influence of the control (independent) variables on the dependent variables. The statistical analysis did not find significant differences in how the single-sex classrooms impact males and females in terms of academic achievement. However, motivation and self-esteem were found to have significant differences for male and female students in single-sex classrooms. Notably the analysis results
indicated 4th, 5th, and 6th grade levels demonstrated the greatest disparities between the genders. Regression results highlighted the inability of the independent (control) variables of grade level, gender, or ethnicity in explaining the variation in any of the dependent variables, failing to confirm the model used in analysis. Likewise, grade level was generally found to have a greater impact than gender or ethnicity on the academic achievement, motivation and self-esteem dependent variables. It is recommended that additional research be conducted to further consider these variables and their effects on students utilizing a wider range of control (independent) variables.
ACKNOWLEDGMENTS

I owe my deepest gratitude to my committee chair, Dr. Lawrence Martin, whose guidance and persistent helped bring both character and academic rigor to my research. I would also like to thank my committee members, Dr. Ronnie Korosec and Dr. John Bricout, whose insight and feedback were instrumental to the development of my study and the formulation of my results. A special thank you is extended to my final committee member, Dr. Kathy Piechura-Couture, whose mentorship provided both the basis for my research as well as the platform for which additional research on single-sex education can be built upon.

None of this would have been possible without the unfettered support of my family and in particular my wife, Heather Gleason. Life is full of change and my wife consistently stood by my side throughout this whole process. The biggest change of all, the birth of my son Keegan Gleason, took place while formulating my dissertation. My wife’s fortitude ran strong to not only raise a newborn but allow me the opportunity to complete my research. With her support as well as the support of my family and friends, I am proud to present the results of my dissertation.
# TABLE OF CONTENTS

LIST OF FIGURES ................................................................................................................................. ix

LIST OF TABLES ........................................................................................................................................ x

LIST OF ACRONYMS / ABBREVIATIONS ................................................................................................. xii

CHAPTER ONE: INTRODUCTION ........................................................................................................... 1

  Problem Statement ............................................................................................................................... 4
  Need for Research ............................................................................................................................... 5
  Significance of Problem ....................................................................................................................... 7
  Study Scope ........................................................................................................................................ 11
  Study Purpose .................................................................................................................................... 12
  Implications of Study .......................................................................................................................... 14

CHAPTER TWO: LITERATURE REVIEW ................................................................................................. 18

  Impact of Gender on Self-Esteem ....................................................................................................... 18
  Impact of Gender on Academic Achievement .................................................................................... 20
  Impact of a Teacher’s Gender on Instructional Style .......................................................................... 28
  Learning Abilities Based on Course Subject ...................................................................................... 35
  Impact of Gender on Long-Term Career Achievement ...................................................................... 39
  Summary ............................................................................................................................................ 44

CHAPTER THREE: METHODOLOGY ...................................................................................................... 49
LIST OF FIGURES

Figure 1: Boys Reading Results at Woodward Avenue Elementary ......................................... 6
Figure 2: Single-sex School Choice Option ........................................................................... 26
Figure 3: Single-sex School Choice Option by Grade ......................................................... 27
Figure 4: How Girls are Rejecting Science ........................................................................... 39
Figure 5: Histogram for Academic Achievement ................................................................. 70
Figure 6: Histogram for Motivation ....................................................................................... 72
Figure 7: Histogram for Self-Esteem ...................................................................................... 74
Figure 8: BLMSIS Theory of Change ...................................................................................... 113
# LIST OF TABLES

Table 1: South Carolina Survey Variables ................................................................. 63

Table 2: Study Variables ............................................................................................ 64

Table 3: Descriptive Statistics for the South Carolina Survey Variables .................. 67

Table 4: Descriptive Statistics for Academic Achievement ....................................... 71

Table 5: Descriptive Statistics for Motivation ............................................................ 73

Table 6: Descriptive Statistics for Self-Esteem ......................................................... 75

Table 7: Descriptive Statistics for the Dependent Variables .................................... 76

Table 8: ANOVA Results for Academic Achievement ............................................. 79

Table 9: ANOVA Results for Motivation ................................................................. 80

Table 10: ANOVA Results for Self-Esteem ............................................................. 81

Table 11: Regression Results for Academic Achievement ....................................... 83

Table 12: Regression Results for Motivation ......................................................... 84

Table 13: Regression Results for Self-Esteem ......................................................... 85

Table 14: ANOVA Results for Academic Achievement by Grade Level .................. 88

Table 15: Regression Coefficients for 4th & 5th Grade Academic Achievement .......... 89

Table 16: ANOVA Results for Motivation by Grade Level ....................................... 91

Table 17: Regression Coefficients for 5th & 6th Grade Motivation ............................ 92

Table 18: ANOVA Results for Self-Esteem by Grade Level ...................................... 93
Table 19: Regression Coefficients for 5th & 6th Grade Self-Esteem

Table 20: Comparison of 5th Grade Mean Values
## LIST OF ACRONYMS / ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAUW</td>
<td>American Association of University Women</td>
</tr>
<tr>
<td>ATI</td>
<td>Aptitude-Treatment Interaction</td>
</tr>
<tr>
<td>BLMSIS</td>
<td>Black and Latino Male School Intervention Study</td>
</tr>
<tr>
<td>CE</td>
<td>Coeducational</td>
</tr>
<tr>
<td>NASSPE</td>
<td>National Association for Single-Sex Public Education</td>
</tr>
<tr>
<td>NOW</td>
<td>National Organization of Women</td>
</tr>
<tr>
<td>SS</td>
<td>Single-Sex Education</td>
</tr>
</tbody>
</table>
CHAPTER ONE: INTRODUCTION

Early educational systems were built upon gender segregation where male students were taught a different curriculum than female students in separate learning environments (Cocklin 1982). These early classroom settings drew a clear separation between methods for teaching boys and girls. Instruction for boys was based on the societal norm that boys would become the income producers and providers for society, wives and family. On the other hand, the curriculum for girls was based on a need to develop skills which would assist them with gender related duties involving the household and the raising of children (Watson, Quatman and Edler 2002). Research conducted in the United Kingdom during the late sixties and early seventies, found coeducational environments to be more appropriate in meeting the social and educational needs of students (Dale 1969; Dale 1971; Dale 1974). This research along with social pressure for cross gender socialization led to a shift within most western educational systems, moving from segregated classrooms to coeducational environments where male and female students interact with each other and are required to learn by means of the same curriculum (Woodward, Fergusson and Horwood 1999).

In the late 1970s, interest in single-sex education was revived due to changes within many educational systems in response to social demands. Additionally, the United Kingdom’s research findings that supported coeducational learning environments came under scrutiny re the findings of validity and reliability (Cocklin 1982; Lee and Bryk 1986; Schneider, Coutts and
Starr 1988; Marsh 1989). Increasing concern over gender fairness of the coeducational system occurred when researchers uncovered obvious gender bias affecting K-12 females in coeducational schools (Jenkins 2006). This bias included course subject preference based on gender where math and science have come to be known as masculine subjects while English, arts and foreign languages were coined female domains. Past research indicated that girls were not as comfortable as boys when speaking in class and that across the board, boys received more attention in the classroom (Jenkins 2006).

Along with these classroom gender inconsistencies, teachers were found to give more feedback to boys beginning in middle school. Jenkins (2006) commented that this type of preferential treatment could instill more self confidence in boys than girls especially related to math and science curricula. How Schools Shortchange Girls, a published 1992 study by the American Association of University Women (AAUW), highlighted some alarming findings involving girls in coeducational schools. Perhaps one of the most troubling gender findings in the AAUW study was the fact that “Girls often are not expected or encouraged to pursue higher-level mathematics and science courses” (AAUW 1992, p.147).

In response to these concerns with coeducational environments, educators began to experiment with single-sex educational environments where boys and girls were instructed in separate classrooms. Gaining legal backing on October 25, 2006, single-sex education in public schools was sanctioned by the United States Department of Education which modified sections 5131(a)(23) and 5131(c) of the No Child Left Behind Act to include a provision for this
educational strategy (NASSPE 2006). These new regulations allowed elementary and secondary public schools to offer single-sex classrooms if they could justify the use of single-gender classes, offered equivalent coeducational classes on the same subject within the same geographic region and reviewed the programs every two years to determine if single-sex classes were still warranted.

According to the former Department of Education Secretary Margaret Spellings, “Research shows that some students may learn better in single-sex education environments,” (McLane, Colby, Yodof and Bradshaw 2006, p.1) and “The Department of Education is committed to giving communities more choices in how they go about offering varied learning environments to these students. These final regulations permit communities to establish single-sex schools and classes as another means of meeting the needs of students” (McLane et al. 2006, p.1). Since these new regulations were adopted, the number of schools offering the single-sex option has grown exponentially. According to Weil (2008), it is estimated that in the fall of 2002, only about a dozen public schools in the United States offered any kind of single-sex educational alternative (excluding schools which offered single-sex classrooms only in health or physical education). The National Association of Single Sex Public Schools (2008) stated that by the fall of 2008 that number had soared to more than 440 classrooms. In South Carolina alone, over 200 schools offered single-sex classrooms.
Problem Statement

Around the world, educational providers are continually asked to strive to higher standards, setting new benchmarks in achievement while balancing a diminishing resource base. Often, the drivers behind the scenes steering these educational efforts are politically motivated, backed by conventional wisdom, common folklore, or just wishful thinking in attempt to reach the broad needs and interests of employers, business, the economy, civil society, law and order, parental choice and at the very least those students who are part of the learning community (Bowles and Gintis 1976; Apple 1982; Weiss 1982; Apple and Weis 1983; Giroux 1983; Ball 1990; Giroux 1992; Ball 1993). All too often, these educational efforts are not backed by sound empirical evidence questioning the value received by society for such public services.

Past studies have produced conflicting results on the effectiveness of single-sex classrooms, questioning the use of public funds for such initiatives that are not supported by sound empirical evidence. With the scarcity of public resources, now more than ever it is important that all public policies are backed by research supporting the use of public funds. By justifying policy decisions with proven data supporting the implementation of that policy, the accountability of the government will improve while integrating more transparency in the legislative process. In doing so, society will be more supportive of policy decisions, reducing the amount of skepticism that exists within the public about the proposed uses of public funds. In
the end, the use of empirical evidence in policy making will improve the level of trust that is currently missing between the government and society.

Need for Research

With the scarcity of public funds and the detrimental effects of the current economy, it is vital that any funds allotted for educating our youth are put to best use. The offering of single-sex educational choices has been heavily contested since revisions to the No Child Left Behind Act calling for more empirical evidence supporting the theoretical benefits generated by teaching male and female students in separate classrooms. In January 2008, NBC Nightly News documented a pilot study assessing FCAT (Florida Comprehensive Assessment Test) results at Woodward Avenue Elementary School in DeLand, Florida. Starting back in 2004, both male and female students were separated into single-sex or coeducational classrooms, attempting to match demographics, class sizes and teaching techniques. Both single-sex and coeducational classrooms utilized the same teaching curriculum to boost the internal validity of the research with the most recent FCAT results finding 86% and 75% passing proficiencies for boys and girls respectively in single-sex classrooms. In stark contrast, boys and girls in coeducational classrooms in the same school yielded passing proficiencies of 37% and 59% respectively (Sax 2006). Figure 1 documents the improvements in reading proficiency of boys showing that almost 80% of boys in single-sex classrooms passed the FCAT reading achievement test while only just over 40% of boys in coeducational classrooms passed (NBC 2008).
The Woodward Avenue Elementary school study has been coordinated by the Nina B. Hollis Institute for Educational Reform at Stetson University. This institute has been recognized on several occasions for leading the charge within higher education on research involving the use of single-sex public education. Although initial results testing academic achievement have been positive, the need for supporting research utilizing larger sample sizes is great. The institute has also tracked the growth of public classrooms in South Carolina offering single-sex alternatives and would be interested in the results of any study that gauges the impact on students.

Both the Office of Public School Choice in South Carolina and the Nina B. Hollis Institute at Stetson University have expressed interest in the results which would come out of this proposed study. By further analyzing the results of a South Carolina survey administered to
students in single-sex classrooms, I believe that significant difference will be identified in the perceived improvements to self-esteem, motivation or academic achievement of male versus female students. However, this research will test the perception of single-sex programs by students enrolled in single-sex classrooms. For this reason, it is feasible that female students will show more perceived benefits obtained by single-sex classrooms due to their already higher level of educational optimism.

**Significance of Problem**

Single-sex schooling has been controversial and research results have been mixed. Many researchers and educators have debated the effectiveness of single-sex classrooms leading to a variety of research studies aimed at gauging the impact of single-sex educational opportunities on both males and females (Miller and Dale 1974; Astin 1977; Riordan 1985; Lee and Bryk 1986; Marsh, Smith, Marsh and Owens 1988; Marsh 1989). Research by Jenkins (2006) found that single-sex educational programs were attempted based on four specific objectives including: improving the educational outcomes for all students, offering students and parents a diverse array of educational options, compensating students for past or present gender discrimination, and conducting an educational experiment examining the different types of systems. The implementation of a single-sex educational system has faced many obstacles pertaining to the legal and ethical barriers associated with any type of segregation based on gender.
Past research assessing the impact of single-sex and coeducational environments has commonly been hampered with selection bias issues since students selected for study have rarely been a random sample (Haag 2003). Therefore, in the past it was difficult to draw any cause and effect conclusions associating school type with scholarly outcomes and attainment (Bracey 2007). Additionally, Woodward, Fergusson, and Horwood (1999) emphasized that research selection bias may have led to skewed research findings since many students attending single-sex or private schools were from higher socioeconomic statuses and were possibly brighter, more motivated students to begin with. To address the selection bias design flaw, many researchers focused their efforts on the development of improved research methodology and instrumentation designed to measure the difference between single-sex and coeducational classrooms as well as the gender interaction amongst teachers, students and classmates (Irving 1976; Lee and Bryk 1986; Marsh 1989). Studies utilizing longitudinal designs were found to have the best structure to combat selection bias issues and produce statistically more significant research results (Bracey 2006; Riordan, Faddis, Beam, Seager, Tanney, DiBiase, Ruffin and Valentine 2008).

The Policy and Program Studies Service, which is part of the United States Department of Education, published a “review” of research on single-sex education in October 2005. This review was funded and commissioned by the Department of Education and was conducted by five scholars at the American Institutes of Research (AIR). Conclusions drawn in this “review” shed an unfavorable light on the benefits of single-sex education (Bracey 2007). However, this
review has come under attack by proponents of single-sex education who contend that there were serious design flaws in the study. The categorization of the examined research studies into effective single-sex, non-effective single-sex studies, and null did not take into consideration the number of participants in each study and no weight was given to studies with a larger sample size (Sax 2005), thus suggesting that a study with 30 participants had the same weight as another with 300 participants. As a result, the power of individual studies was ignored questioning the efficacy of AIRs research and conclusions drawn.

Bracey (2006) reviewed the issues and data relating to single-sex education. In his extensive review, he concludes that most single-sex schools that exist in the public sector in the United States are quite new and that planning for research or evaluation from the outset appears not to have happened. Bracey states,

“Thus, any conclusions about the efficacy in the United States of single-sex public schools or classes depend on the extent to which one feels confident generalizing from research in the public sector in other countries, or from research in this country comparing public and private, usually religious, schools, or comparing single-sex religious schools with coeducational religious schools.” (Bracey 2006, p.17)

Opponents of single-sex education argue that the separation of the sexes would have negative social impacts including a loss in adaptation and socialization skills propagating further inequities amongst genders and continue to deteriorate gender self-confidence, particularly in the case of females (Whitney and Hoffman 1998). The National Organization of Women (NOW) expressed opposition against single-sex education as it was viewed to drive males and females
further apart. NOW believes that single-sex education would continue to perpetuate the socialization of America’s youth according to gender related role expectations ultimately leading to adverse outcomes for both sexes (NOW 2008). Although the American Association of University Women (AAUW) conducted considerable research highlighting gender inequities in coeducational classrooms, the AAUW also took a stance against the use of single-sex education claiming it reinforced problematic gender stereotypes, increased gender discrimination and restricted the educational opportunities available to both boys and girls (AAUW 2008).

Gender stereotyping was found to remain an issue even in single-sex educational environments according to a California pilot study. Recognized at the time as the nation’s largest experiment with single-sex education in public schools, California’s research study involved twelve public single-sex schools consisting of 300 middle and high-school students. The pilot study only lasted from 1998 to 2000 and was quickly disbanded as the schools were found to lack equity driven agendas and did not emphasize empowerment (Zwerling 2001). However, this study did identify some benefits of single-sex education such as a reduction in social distractions which allowed for more open dialogue between the teacher and students as well as provide a better environment for students to concentrate on academics (Zwerling 2001).
Study Scope

As proposed, this study was designed to investigate the effectiveness of single-sex educational environments in terms of a student’s motivation, academic achievement, and self-esteem. Conclusions were drawn from secondary data gathered from second through ninth grade students in South Carolina who have enrolled in single-sex classrooms. This study was aimed at providing evidence based research to support policies surrounding the use of public funds for single-sex educational environments. The purpose of my research was to study the impact of gender segregated educational environments as reported by students enrolled in single-sex settings.

Utilizing the results of the South Carolina survey, this study first looked at the relationship between survey answers in attempt to identify major factors which contribute to the success of single-sex classrooms. These factors were verified with relational analysis testing for a Cronbach Alpha score greater than or equal to 0.7. These dependent variables were further tested with ANOVA analysis to identify differences between male and female students, while controlling for both grade level and ethnicity. The results of the ANOVA analysis helped methodically test the hypotheses and answer the research questions.

A review of literature shows that the ethnicity of the student has been largely ignored as a confounding variable which could potentially alter the results of studies on single-sex education. However, ethnicity stereotyping has been well documented as an issue prevalent in most educational environments. Minority groups are often seen to lack language skills which
greatly hamper students from interacting with the teacher as well as other students. Research has shown that Latino and Black males are much more likely to receive low grades and test scores, less likely to attend college, more likely to drop out of school, be documented as learning disabled, absent from gifted and honors programs and over-represented amongst pupils who are expelled or suspended from school (Gregory, Skiba and Noguera 2010). In September 2007, the Equal Opportunity Commission (EOC) stated that in order to bridge the attainment gap between those students that “have” the resources to explore educational alternatives as opposed to the “have not’s” which lack the resources, educators must understand the interplay between ethnicity and gender (Commission 2007). This study reviewed the statistical variations between different ethnic groups in attempt to identify the characteristics of students who benefit most from single-sex educational environments.

**Study Purpose**

By analyzing survey data collected on part of the South Carolina Department of Education, I built upon past research conducted by a state entity, identifying trends which were not initially revealed. The research methods I used on this dataset have not been performed in this manner on this data source, lending to the cumulative educational research effort needed to assess the effectiveness of single-sex education. This survey was administered by David Chadwell, Coordinator for Single-Gender Initiatives overseeing the Office of Public School Choice within the South Carolina Department of Education, in April and May 2008 to students, parents and teachers in single-sex classrooms. Participation in the survey was voluntary and
yielded over 2200 student responses as well as 178 parent and 181 teacher replies from 41 different elementary, middle and high schools in the state of South Carolina (Chadwell 2008). “The purpose of the survey was to be a tool for schools to learn more about student, parent, and teacher perception of their single-gender program as well as the overall perception of single-gender education in the state. It was designed with the intent of helping schools and the state learn what was working and what needed attention in terms of student, parent, and teacher perception and the impact that the program was having on its student” (Chadwell 2008, p.1). Initial conclusions made by Chadwell when assessing the student responses included (Chadwell 2008):

1) Two-thirds of the student participants agreed that single-sex education is a factor in improving each of the categories tested.

2) Female students agreed with the benefits of single-gender education greater than male student (60 to 80% versus 50 to 70%).

3) African-American students agreed with the benefits of single-gender classrooms greater than Caucasian students.

4) Middle school students maintained the lowest agreement compared to elementary and high school students.

These finding have been posted on the South Carolina Department of Education website (see appendix) but they have not been published by any other source. The level of analysis
conducted by Chadwell was rudimentary calling for additional exploration of the survey results to identify significant findings which would hold up to peer review.

**Implications of Study**

Although there is a sense that educational research is not used by policymakers or does not even reach them, policy research seems to be frequently acknowledged and cited within the policymaking process (Greenberg, Mandell and Onstott 2000; Pelton 2000). Unlike research in the hard sciences where most if not all variables can be controlled and accounted for, educational policy research is less predictable and adhering to strict research methodologies is much more difficult to achieve. Because of this, educational research tends to only identify “probable outcomes and general principles that seem to apply in various settings, so policymakers face the task of taking general social science information and applying it to specific contexts. For example, policymakers confronting an education finance problem rely on general principles to analyze the relationship between revenues and various combinations of tax rates, tax bases and grant-in-aid formulas” (Kirst 2000, p.379-380).

As part of her social research work, Carol Weiss (1988) contends that conclusions drawn from a single study or a group of related studies do not directly impact policy. However, she proposes that the concepts, findings and theoretical perspectives developed through research slowly permeate into the policymaking processes. She terms this effect as an ‘enlightenment function’ where research findings creep into the legislative process, shaping the means by which politicians think about educational issues (Weiss 1988). Nobody is going to dispute the
fact that research has and deserves a place in the policymaking process, nor is there any debate over the negligible impact individual studies have. However, there is also a strong agreement among many that more evidence-based, cumulative research is needed in order to justify educational policies as well as satisfy the public need for accountability in the struggling U.S. education system.

Despite the recent attacks on educational research, broad support exists for ongoing and active studies that are based on sound research methods which can provide impartial empirical evidence in support of educational policies and practices. Many researchers support the ‘engineering model’ which attempts to link outcomes with pedagogical techniques similar to practices in the medical field (Hargreaves 1996; Oakley 2000). Some researchers saw this model as inappropriate for social sciences (Janowitz 1972; Weiss 1977; Weiss 1988), instead supporting the ‘enlightenment model’ which “treats research as providing resources that practitioners can use to make sense both of the situations they face and of their own behavior, rather than telling them what it is best to do. Thus, where the engineering model implies that research finding have inherent and determinate practical implications, or should have, the enlightenment model treats the effects of research on practice as rather more uncertain and unpredictable, and as by no means necessarily immediate; though this does not imply that they will be negligible” (Hammersley 2000, p.393-394).

Unlike the medical field where hard scientific facts are the aim of most research efforts, educational research is much more complex and is greatly impacted by many unforeseen and
uncontrollable variables. This level of complexity promotes insecurity with the findings of research results due to the lack of generalization and the threat that results may be isolated to a limited number of social settings, alienating policymakers who would like to replicate the finding in different but specific contexts (Kirst 2000). Because of these concerns, the use and acceptance of research against qualitative data sources is greater in the social sciences as opposed to the natural or physical sciences which prefer and almost demand quantitative research. A substantial amount of British research work in education over the past 50 years has been a product of qualitative research in an attempt to document students perspectives, and particularly those considered troubled or from a lower class (Werthman 1963; Hargreaves 1967; Willis 1977; Hammersley and Woods 1984). This commitment to qualitative research focusing on a child’s perspective has been broadened further as documented by James and Prout (1997) and some researchers have even suggested that work along these same lines can guide policymaking involving education and finally bridge the gap to evidence based educational policies and practices (James and Prout 1997; Pollard and Filer 1999; Hammersley 2000).

In support of recent and ongoing research in education, this study will help shed light on the effectiveness of single-sex education by providing sound evidence on the matter. It is the goal of David Chadwell to conduct similar surveys in the future to show a history of support for single-sex educational environments. With the results of this study, Chadwell has expressed a desire to modify the survey instrument to refine the tool to become a solid and standard
instrument to gauging student feedback on the effectiveness of single-sex education.

Ultimately, the output of this study will provide sound empirical evidence on the effectiveness of single-gender education along with structured research methodology from which future researchers can conduct additional studies.
CHAPTER TWO: LITERATURE REVIEW

Many arguments have been identified pertaining to gender interaction in education in both coeducation and single-sex educational environments. These arguments are classified below into five sections encompassing: the impact of gender on self-esteem; the academic achievement of boys and girls who are instructed in separate learning environments; the impact of a teacher’s gender on their instructional style; the learning abilities of male versus female students within different course subjects; and the impact of gender on long-term career achievement.

Impact of Gender on Self-Esteem

Many factors affect the academic achievement of students including the perception of the self along with personal expectations (Harter 1992). Many studies have found lower self-perceptions among women compared to men especially within historically masculine domains (Fredricks and Eccles 2002; Jacobs, Lanza, Osgood, Eccles and Wigfield 2002; Kurman 2004). Other studies analyzed adolescent developmental stages and related tasks noting that girls experienced a steep decline in confidence when they came in contact with a real or perceived failure during their adolescent years (Pipher 1994). Even girls with a strong sense of self-confidence often renounced and devalued their feelings, thoughts and perceptions during adolescence (Stern 1991). Boys entering adolescence were characterized as seeking
acceptance by conforming to male gender stereotypes of being strong and acting independently. These gender norms were based on the concept that males often use force, fear, exclusion and peer-pressure in social relationships resulting in their hurting and devaluing other males, females and even themselves (Koegel 1994). Unfortunately these gender related behaviors (both male and female) were often found to be reinforced in the educational setting with teachers treating male students different than female students.

Single-sex environments were found to promote high levels of self-esteem empowering girls to explore more leadership roles. Research conducted by Cairns (1990) investigated self-esteem for students in secondary schools in Northern Ireland and concluded that single-sex schools provided benefits which improved self-esteem. Cairns, however, listed as a limitation of his study that self-esteem improvements might have been related to an improved cognitive self-concept which only equates to part of the self-esteem equation (Cairns 1990; Woodward et al. 1999). Another similar study in Northern Ireland conducted by Granleese and Joseph (1993) utilized a domain-specific, self-concept measured at one coeducational and one single-sex secondary school. Girls in the single-sex schools were found to be less critical of their own behavioral conduct more so than girls in coeducational schools. According to the researchers, this proved to be the single best predictor of overall self-worth in the girls-only schools. In contrast, girls in the coeducational schools perceived physical appearance to be the single-best predictor of their overall self-worth (Granleese and Joseph 1993).
In studying sixth-grade boys and girls in Belgian elementary schools, Brutsaert and Bracke (1994) found self-esteem of girls to be unaffected by the gender organization of the school while boys showed a much lower sense of well-being when placed in single-sex classrooms. According to the researchers, the negative impact on males may have been related to the high number of female teachers on staff thus raising the possibility that the teachers’ gender may have affected the educational experience of students in this study (Brutsaert and Bracke 1994).

A ten year longitudinal study conducted by Smith (1996) assessed the attitudes and achievements of one girls-only and one boys-only high school in Australia that had just transitioned from coeducational to single-sex classrooms. Smith found that both boys’ and girls’ self-concept declined during the first five years of the study but after that time their self-concept improved to levels which exceeded those measured before the transition to single-sex schooling (Smith 1996). As being one of the few longitudinal studies on single-sex education, this research could prove valuable for others attempting to test for similar results in a different culture and geographic location.

Impact of Gender on Academic Achievement

Single-sex education research based on the separation of boys and girls into independent learning environments examined teaching styles that are more conducive to higher levels of academic achievement. This research was completed under the assumption that the learning characteristics of male and female students differ. Research has shown that
boys prefer flexibility and visual learning techniques in an atmosphere that is high in movement and energy. On the other hand, girls prefer a more structured learning environment where lessons and student activities are clearly defined and articulated with minimal noise and other distractions (Pollack 1998; Thompson and Ungerleider 2004; Froschol and Sprung 2005). Single-sex education generally has been based on the premise that gender separated educational environments benefit both male and female students. Results of recent studies comparing the academic achievement of students at single-sex institutions and coeducational schools found relatively inconsistent results. Some dated studies provided support for coeducation (Marsh et al. 1988; Marsh 1989), others supported single-sex education (Astin 1977; Riordan 1985; Lee and Bryk 1986) and yet other studies found no difference between male and female students’ outcomes when attending either coeducational or single-sex schools (Rutter, Tizard and Whitmore 1970; Miller and Dale 1974). More recent research conducted by the National Association for the Advancement of Single Sex Public Education (NASSPE) shows overwhelming support for single-sex environments (Sax 2002; NASSPE 2006; Sax 2006). Much research has been conducted on the effects of single-sex education with the over-riding objective to determine the overall impact on academic performance, effect on an individual’s self-esteem and the long-term impact on career achievement.

The National Association for the Advancement of Single Sex Public Education (NASSPE) was founded by Dr. Leonard Sax as a nonprofit organization dedicated to the advancement of single-sex public education for both boys and girls. Sax has since been recognized for his
leading role in single-sex education research as well as his advocacy for the use of this system within public education. Working through the NASSPE, Sax has influenced 366 public schools in the United States to establish single-sex educational opportunities, most of which offered single-sex classrooms while retaining some coeducational activities (NASSPE 2006). Sax’s work focused on the academic improvements offered by single-sex environments, both at the school and classroom level.

One of Sax’s earliest examples of single-sex education was documented at Shenfield High School, Essex, England in 1994 when this school began separating boys and girls into different classrooms. Results from this research study indicated that single-sex classroom environments improved academic achievement on standardized test scores with a 26 percent increase in academic achievement for boys and 22 percent for girls (Sax 2002). Sax (2002) includes a discussion of further research from Manchester University that attempted to replicate the Shenfield High School study. As part of this study, five diverse public schools established both single-sex and coeducational classrooms assigning the students to one of these classrooms. “Sixty-eight percent of boys in single-sex classes subsequently passed a standardized test of language skills, versus 33 percent of the boys in coed classes. Among the girls, 89 percent assigned to single-sex classes passed the test, versus 48 percent of girls in coed classes” (Sax 2002, p.257). These results supported Sax’s initial findings of a significant educational advantage in the single-sex classrooms for both male and female students. However, the published results reviewed from this study made no mention of how the
participants were assigned to a particular classroom, questioning the validity of the study based on possible selection bias.

In Sax’s (2007) book, *Boys Adrift: the five factors driving the growing epidemic of unmotivated boys and underachieving young men*, Sax focused the discussion on the academic achievement of boys as it related to the impact of single-sex education. He noted several studies which addressed the gap in educational motivation between boys and girls. One study in particular by Gentry, Gable, & Rizza (2002) confirmed previous research findings that boys at every age in coeducational schools are much less enthusiastic about school than girls. These results held true regardless of school location (urban or rural) and student socioeconomic demographic information. The gap in academic motivation widened as the boys grew older with research findings indicating that adolescent males were more likely to associate outstanding school performance with being a “geek” as they matured. Additionally, males perceived coeducational institutions to be run primarily by women according to female rules which hampered expression. Boys viewed top students in their school to be either girls or geeks indicating the majority of male students didn’t value academic excellence (Gentry, Gable and Rizza 2002).

This current trend where the scholastic achievements of girls far exceed those of boys has led to challenges in the admissions process for many universities. According to Sax (2007), the decreased academic achievement of males in the present coeducational system has resulted in a new concern involving college admission rates. As of 2006, women made up 58%
of students at two and four-year institutions creating problems for colleges which strive to maintain gender equity in its student population (Lewin 2006). The University of Richmond has struggled to maintain a gender balance which is stipulated by the availability of on-campus housing. As a result of this predicament, the admission rate of males has been 13% higher than that of females (Kingsbury 2007). This gender inequality trend in university admissions was acknowledged by Kingsbury (2007) in *U.S. News* when he commented that many colleges have maintained their student population gender balance over the past 10 years by admitting women and men at drastically different rates based on differing academic standards (Kingsbury 2007).

Sax (2007) outlines the advantages related to single-sex education for both males and females but noted greater improvements in academic achievement of boys was evident when placed in single-sex educational settings. Important supporting research included in Sax’s discussion was conducted by Graham Able (1999). Able analyzed the academic performance of boys and girls in 30 coeducational and single-sex schools throughout England and found that single-sex classrooms and schools provided more academic benefits for boys than for girls. These research findings were contradictory to the previously believed concept that males would behave better in class if females were present to act as good role models. Through an in depth analysis of the empirical evidence generated in this study, it is feasible that one could come to the conclusion that both girls and boys are academically hampered in coeducational environments however the disadvantage is greatest for the males (Sax 2007). From this
research, Sax concluded that the single-sex educational format could very well modify a boy’s attitude toward school from sullen resentment and apathy to enthusiasm and energy for the academic process. For the single-sex educational format to be successful, teachers of necessity would require training to identify effective teaching styles and strategies per gender needs (Sax 2007).

In his book *Why Gender Matters: What Parent and Teachers Need to Know About the Emerging Science of Sex Differences*, Sax (2005) explored the educational advantages afforded to girls in single-sex environments. These advantages included: expanded educational opportunities, custom-tailored learning and instruction, as well as a much greater degree of autonomy especially related to heterosexual relations (Sax 2005). The opportunity and encouragement girls are afforded to explore non-traditional subject areas such as math and sciences is regarded as the single greatest benefit of single-sex education. Girls across every age bracket from kindergarten through college regardless of geographic location are much more likely to explore these non-traditional subjects in girls-only classrooms (Sax 2005).

However, as of yet, parents have been skeptical of single-sex educational programs, not completely sold on the benefits proposed. Figure 2 shows that 37% of parents in the U.S. support single-sex schooling as an educational option compared to 24% who oppose this educational alternative (Howell, West and Peterson 2008).
In spite of this apparent support, only 42% of parents said they would probably or definitely consider single-sex schooling as an option for their own child while 58% said they probably or definitely would not consider the option (Howell et al. 2008). Figure 3 shows that parents would prefer to enroll their children in single-sex classroom during secondary education but have little desire for their children to be enrolled in primary education single-sex classrooms (Thinkquest 2006).
Inzlicht and Ben-Zeev (2000) researched the academic advantages of different educational environments on women’s academic success. They examined the custom-tailored learning and instruction offered when male and female students are separated. Through the application of mixed-gender and single-gender instructional environments, the researchers found that academic performance of girls diminished as the number of males in the classroom increased (Inzlicht and Ben-Zeev 2000). These results were similar to those of Underwood and Underwood (1997) noted by Sax (2005) in his discussion of research studies supporting female academic improvements when custom-tailored instructional techniques were utilized in single-sex learning environments.
Impact of a Teacher’s Gender on Instructional Style

Presently in the United States, there exists an expectation that male and female students receive equal attention in school preparing them equally for their future career paths. However, studies indicate that teachers interact with male students differently than female students in elementary education (Bailey 1993; Holden 1993; Hopf and Hatzichristou 1999), junior high education (Heller and Parsons 1981; Sadker, Sadker and Bauchner 1984; Sadker 1986; Worrall and Tsarna 1987) and high school education (Omvig 1989; Smith 1991; Smith 1992). In general, female students don’t receive as much attention as male students in the classroom (Brophy 1985; Sadker 1986; Bailey 1993). Some of the research found that the difference in teacher-student interaction varied based on the gender of the instructor (Worrall and Tsarna 1987; Omvig 1989; Hopf and Hatzichristou 1999) as well as the course subject (Sadker 1986; Holden 1993; Hopf and Hatzichristou 1999).

Research was also conducted to identify the impact of a teacher’s gender on a student’s progression. At the elementary school level, male and female teachers differed in the quality of teaching but not necessarily the quantity of material taught (Brophy 1985). A study in Greece, found female elementary teachers more sensitive to their students’ needs while giving more warnings of behavioral problems than their male counterparts. Additionally, male teachers were found to be more instrumental and authoritative in their classroom approach as opposed to female teachers who were more expressive and supportive (Meece 1987).
In junior high school science classes in the United States, male teachers were found to interact with male students two-thirds of the time and the remaining one-third of the time with female students. In contrast, female teachers were found to interact with male students 51% of the time and female students 49% (Bellamy 1994). However, these results were questioned for their reliability and validity since inferential statistics were not applied to confirm that the difference in the interaction of male and female teachers with their students was statistically significant.

At the high school level, the patterns of student teacher interaction appeared to differ from those at the elementary and junior high level. Female vocational teachers in American high schools were found to direct more praise, acceptance, remediation and criticism toward male students than female students (Omvig 1989). Other studies by Omvig (1989) and Smith (1992) found male teachers interacted equally with male and female students in all areas except in the application of criticism. Commonly, research has found that more criticism was directed towards male students rather than female students regardless of the gender of the teacher (Omvig 1989; Smith 1992).

In a university setting, there has been much speculation as to the role male and female professors play in the success of their students and in particular, how female professors serve as role models for female students (Rice 1991; Maher and Tetreault 1994). Early research by Adler and Iverson (1974; 1975) at Smith College, a women’s only college, concluded that female students felt closer to female professors as opposed to male professors (Adler and Iverson
1974; Adler 1975). Other studies indicated students gave more positive feedback ratings to instructors of the same gender rather than opposite-gender instructors (Behling, Curtis and Foster 1982). However, it is important to note that some research found both male and female students felt closer to female professors who engaged in significantly more personalized interaction as opposed to male professors (Crawford and MacLeod 1990; Sears and Hennessey 1996).

More research at the post-secondary education level found faculty behaviors and attitudes to have a profound effect on students’ intellectual development, especially for women students (El-Khawas 1980). Although the stated purpose of many university faculty members was to treat female and male students equitably (Hall 1982), many researchers found bias towards male and female students in college level American classrooms (Wilkinson and Marrett 1985; Sadker 1989; Brophy and Good 1990; Tannen 1991; Sadker 1992; Yepez 1994). Faculty members at the college level were found to ask male students higher order questions demanding critical thought more often than female students (Sadker and Sadker 1982); made eye contact more frequently with male students than with female students (Thorne 1979); called on males more often (Thorne 1979); were more tolerant when males interrupted females (Hall 1982); and responded to females with diffidence and males with attention (Hall 1982). This research supported evidence that American teachers in higher education, regardless of gender, gave male students significantly more interaction time (Spaulding 1963;
Sadker 1992) and initiated more contact with male students in relation to female students (Jones 1971).

The work of Sadker, Sadker and Bauchner (1984) led to the development of an observational instrument, INTERSECT, designed to measure the sex equity interactions in classroom teaching. The application of this tool assisted researchers with converting everyday classroom interactions into organized and measurable elements (Sadker et al. 1984). Findings using the INTERSECT research instrument in a junior high school setting revealed that male students received more praise, conduct, remedial and criticism interactions (Sadker et al. 1984; D'Ambrosio and Hammer 1996). Additionally when examining individual student to teacher interaction, female students were called on less than male students particularly during intellectual interactions (Sadker et al. 1984). Application of the INTERSECT tool in a high school vocational programs found that male students received more praise and acceptance as well as more criticism than did female students (Omvig 1989). The Omvig (1989) study proved to be statistically significant but neither study (Sadker et al 1984 or Omvig 1989) was published in a peer reviewed journal resulting in a lack of wide acceptance of their finding by the educational research community (Duffy, Warren and Walsh 2001).

One of the few studies to use the INTERSECT tool and to be published in a peer reviewed journal assessed interactions in business classes in high schools. The results of this study were similar to the conclusions made by Omvig (1989) finding female teachers interacted more with male students than female students (Smith 1992). However, male teachers were
found to be more equitable in their interactions except for the application of criticism which was targeted more at male students versus female students (Smith 1991). The results of these studies are of particular interest due to the sound research methods utilized including the use of large sample sizes and the application of inferential statistics. Overall, the results of the studies using the INTERSECT tool supported the view that female students were overlooked in some situations which might have led to a reduction in their self-esteem and academic performance.

The level of student to teacher interaction was also explained by researchers examining the behaviors of male versus female students. Studies consistently found male students were more likely to respond to or initiate interaction with a teacher than female students (Brophy 1985; Meece 1987). In both junior high and elementary schools, research has shown that male students would call out the answer or talk in class regardless of whether the teacher addressed them (Bailey 1993; Altermatt, Jovanovic and Perry 1998). To counter this disruptive behavior, elementary teachers sometimes developed visual examples and themes to attract the interest of males in an effort to help them focus (Lee 1980). The results of these studies suggested that extroverted behaviors were commonly displayed by male students as opposed to introverted behaviors by female students thus affecting the overall level of student to teacher interaction.

Government agencies have taken notice of this research and are beginning to take steps to ensure male and female role models exist in the classroom. A recent media release by the U.S. Attorney General’s Department reported the government to be extremely concerned with
the dwindling number of male teachers and male role models at all educational levels and highlighted the possible effects on the development of both boys and girls (Ruddock 2004). Leading up to the 2004 federal election, the Australian Labor Party released a policy document stating that “now, more than ever, young boys need contact with men who can offer positive role models and mentor them in the right direction ... Labor wants to see many more male teachers teaching and making a difference to the lives of young boys in our schools” (Party 2004, p.14). However, it is unclear whether these government entities are interested in the academic achievement of students or merely providing role models to influence the behaviors of students. Ultimately, positive role models should enhance the educational experience for all students but empirical evidence to support this connection is in short supply and needs further development.

Recent studies on the impact of the gender of the teacher have actually contradicted earlier studies noting the teacher’s gender has little to no effect at all on a student’s experience. The work of Martin and Marsh (2005) attempted to test the impact of the teacher’s gender on academic engagement and motivation comparing two competing models. The first model, referred to as the gender-stereotypic model, is based on early studies that suggested girls fared better in classes taught by females and boys fared better in classes taught by males. The second model, referred to as the gender-invariant model, proposes that the engagement and motivation of girls and boys does not vary significantly as a function of the gender of the teacher. In testing these two models using confirmatory factor analysis and
multilevel modeling, the researchers found there to be no significant interaction between the teacher’s gender and the student’s gender (Martin and Marsh 2005). These findings back similar studies which noted that the nature of the pedagogical techniques which each individual teacher follows has a much greater impact on academic outcomes than does the gender of the teacher.

However, this study did note that when differences occurred, they favored the academic achievement of girls. Females scored higher on a number of adaptive dimensions but also ranked higher in terms of academic anxiety (Martin and Marsh 2005). These results counter the government concerns of a shortage in male role models as male teachers have less impact on male students than is the case with female teachers and students. These findings support and extend upon previous work documenting gender differences on similar lines (Martin 2001; Martin 2002; Martin 2005) but went on to account for variations at the class, school and student levels (Martin and Marsh 2005).

Bias towards male students is not only demonstrated in the behavior of teachers, but also in the academic tools such as books, media resources and technology. Traditional picture books and classic stories such as Alice in Wonderland and Cinderella present contrasting gender related behaviors between males and females (Whitney and Hoffman 1998). Often females play limited roles in these stories, with 85% of the main characters in children’s stories being male (Fox 1993). These gender stereotypes have been reinforced through the application of technology with clip-art images frequently depicting males in leadership roles whereas females
have been portrayed in subordinate roles (Knupfer 1997). By the time children reach the sixth
grade, they have learned that maleness signifies opportunity while femininity implies constraint
regardless of the gender of the student (Orenstein 1994).

Learning Abilities Based on Course Subject

The concept that educational course subject matter may warrant different teaching
styles and methods according to gender differences has remained an active topic for debate.
Research has found that teachers commonly hold higher expectations of males in science
classes and of females in language classes (Worrall and Tsarna 1987; Leedy, LaLonde and Runk
2003; Van de gaer, Pustjens, Van Damme and De Munter 2006). Additionally, praise by
teachers was affected by the teacher’s own gender. Research found at the junior high level
that male teachers gave more praise to all students in science and math classes whereas female
teachers gave more praise in language classes (Worrall and Tsarna 1987). An Austrian study
qualitatively assessed student to teacher interaction in junior and senior high schools
concluding that teachers in mathematic classes downplayed the success of female students
while concealing the failures of male students (Jungwirth 1991). A similar study completed in
Greek secondary schools found female mathematic teachers believed there were more
behavioral problems from all students regardless of gender as opposed to the perception of
fewer behavioral problems noted by male and female teachers in language arts (Hopf and
Hatzichristou 1999). However, these studies were based on qualitative instruments, such as
questionnaires, which only weakly support the hypothetical argument that the course subject
in combination with the gender of the teacher impacted the level of student to teacher interaction (Duffy et al. 2001).

Student course subject preference was found to be largely driven by gender stereotypes in coeducational environments which encouraged girls toward subjects such as reading and language arts and boys toward mathematics and science. However, several studies revealed that single-sex classrooms and schools could reverse this stereotypical course emphasis especially in the case of girls who were more likely to take interest in mathematics and science curriculum (Haag 2003). By analyzing girls in single-sex Nigerian schools as well as Nigerian public boarding schools, Mallam (1993) found girls in the single-sex environment were more inclined toward mathematics particularly when the subject was taught by female teachers. Colley, Comber and Hargreaves (1994) conducted similar research using British students in both single-sex and coeducational settings. The researchers asked both boys and girls to rank their course subject preferences. The girls from single-sex schools, particular those younger in age, indicated a stronger preferences for masculine subjects such as mathematics and sciences as opposed to their coeducational peers (Colley, Comber and Hargreaves 1994). On the other hand, boys from single-sex environments displayed a stronger preference for stereotypical feminine subjects such as music and art.

A study conducted by Lee and Lockheed (1990) assessed the mathematic achievements and the stereotypical view of mathematics by 1,012 ninth-grade students in Nigerian public schools. Utilizing data obtained from the Second International Association for the Evaluation of
Educational Achievement, these researchers found no difference in mathematic scores between boys and girls in coeducational settings. However, girls in single-sex schools outperformed their counterparts in coeducational schools while boys in single-sex schools did worse than their coeducational counterparts (Lee and Lockheed 1990). This study maintained strong external validity due to its ability to account for the confounding variables including differences in school resources, student background and teacher attitudes.

More current research confirms these gender stereotypes still exist where masculine subjects are thought to be science and mathematics where as feminine subjects include reading and literature arts. The use of single-sex educational environments is assumed to combat these stereotypes and provide opportunities for both males and females to explore academic arenas which have been traditionally off limits. A three year longitudinal study of two single-sex secondary school physic classes in a school in England found girls to obtain a higher confidence level in their studies over coeducational environments. The benefits of the single-sex environment led to better academic achievement and increased the likelihood of the girls going on to further study physics and other scientific areas (Gillibrand, Robinson, Brawn and Osborn 1999).

Title IX of the Educational Amendments of 1972 was drafted to promote equity in coeducational physical education classes by ensuring that equal resources were available to both males and females in athletics. However, gender stereotypes concerning physical activity have long impacted the treatment of female students in coeducational physical education
(Dunbar and O'Sullivan 1986; O'Sullivan, Bush and Gehring 2002). Boys typically have more sports and physical activities outside of the school environment than girls (Sallis, Prochaska and Taylor 2000). When studying a females preference in relation to physical education classes, researchers found that most females preferred to be involved in single-sex physical education classes (Lirgg 1993; Lirgg 1994; Treanor, Graber, Housner and Wiegand 1998) because these classes focused more on skills development as opposed to game play made up of team games preferred when males are involved (McKenzie, Prochaska, Sallis and LaMaster 2004).

Course subject bias is still as concern in regards to gender equity and stands in the way of the ultimate goal of ensuring equal opportunities in the future for both males and females. Figure 4 highlights the disparity that still exists within the field of science where females continue to lag behind males in their pursuit of this subject matter.
Figure 4: How Girls are Rejecting Science

A 2008 study by the Joint Council for Qualifications found males far outpace females in their pursuit of different science course subjects (Garner 2008). The use of single-sex education has been found to counter this course subject stereotyping, however further research needs to be conducted to fully understand the impact to long-term career aspirations.

Impact of Gender on Long-Term Career Achievement

Many researchers have analyzed the impact of single-sex education and coeducational environments on the career aspirations and achievements of girls. One study in the early seventies found career decisions made by females were largely influenced by what females
believed to be appropriate female behavior or occupational opportunities. The researchers commented that these career decisions were based on the females perception that intellect or achievement was not expected nor rewarded by their peers and teachers (Hawley 1971). Gottfredson’s Theory of Circumscription and Compromise (1981) provided a model of career development which indicated that by adolescence, a youth’s career choices were narrowed down to those that were viewed to be appropriate according to gender with decisions concerning career options being reinforced by the actions of others as the student matured and time passed (Gottfredson 1981; Watson et al. 2002). The work of Grotevant and Thorbecke (1982) found that male and female adolescents obtained their vocational or career identities according to different gender related developmental tasks. For example, by the completion of high school, males were more accustomed to the concept of occupational identity whereas females were more familiar with their relational identity (Grotevant and Thorbecke 1982). Danziger (1983) continued research in this area concluding that ability, academic achievement, and opportunity strongly influenced the career expectation of adolescent males differing dramatically from the factors of class background and parental expectations that influenced adolescent girls (Danziger 1983).

Females historically have been faced with the conflict between a commitment to marriage and family or to their future careers (Card, Steel and Abeles 1980; Archer 1985). Corder and Stephan (1984) studied this gender role expectation finding that females made career decisions only after they determined how they would combine family and work (Corder
and Stephan 1984). These research findings partly explain why adolescent females often aspire to lower prestigious and stereotypically feminine careers than males (Shapiro and Crowley 1982; Danziger 1983; Eccles 1985). As proof, Shapiro and Crowley (1982) reported that women were under-represented in the most prestigious careers while Reis (1987) confirmed that males far surpassed females in both professional accomplishments and financial reward (Reis 1987).

More recent research has documented a trend which supports an increasing equalization of career aspirations for adolescent boys and girls. Some studies have indicated that girls’ aspirations now actually exceed boys (Stevens, Puchtell, Ryu and Mortimer 1992). Farmer’s (1983) research in the early eighties of ninth and twelfth graders found that females aspired to higher levels of career aspirations and surprisingly indicated that these females believed their career roles would be the core of their future adult lives, much more so than did the males in this study (Farmer 1983). Research by Dunnell and Bakken (1991) supported the previously mentioned findings while concluding that females are seeking careers less traditional or gender-stereotypical than those of the males (Dunnell and Bakken 1991). One research study during this time period disputed these findings, indicating there were no difference in the career aspirations of adolescent males and females (Stevens et al. 1992) but an overwhelming amount of research currently shows the career aspirations of females surpasses that of males.

An Australian study examined the goals and reputations of adolescent females in single-sex and coeducational schools by segregating study participants into focus groups based on their at-risk rating, calculated based on behavioral and situational checklists completed by the
students’ teachers and/or school psychologists. The results presented by Carroll (2002) found females in the single-sex environments maintained higher career aspirations, strived for greater academic achievement and were more likely to set educational goals. On the other hand, girls in coeducational classrooms were found to be more interested in their personal appearance as well as social image and focused less on educational goals (Carroll 2002). In separating the participants by their at-risk status, this study provided insight into possible educational motivators for at-risk youth. Along this line, the study found at-risk adolescent as a whole desired a better life style and a fun learning environment which they equated more so with single-sex classrooms (Carroll 2002).

Single-sex women’s colleges were found to be two to three times more likely than their coeducational counterpart institutions to graduate successful women as defined by the Who’s Who of American Women (Tidball 1980). These statistics held true even when the size of the college, the selectivity of students, and the amount of academic expenditures were taken into consideration. Tidball’s (1980) research found that the elite women’s colleges, commonly referred to as members of the Seven Sisters, produced significantly more successful women than less selective women’s colleges. Additionally these single-sex women’s colleges produced two times as many women achievers as their counterpart coeducational selective institutions. Notably, even less selective all female colleges produced three times as many successful graduates as their coeducational counterparts while incurring less academic expenses (Tidball 1980). This research suggests that single-sex institutions may be most beneficial to women of
lower socioeconomic classes as well as academically average women who have not had the same opportunities that have been afforded to the upper and middle classes (Duncan, Wentworth, Owen-Smith and Lafavor 2002).

Tidball (1980) also concluded that women’s college’s produced more graduates who obtained doctorate degrees in nontraditional fields which pay higher than doctorate degrees attained by female graduates of coeducational institutions. This finding was supported by several researchers who found graduates of coeducational colleges more likely to obtain a doctorate degree in fewer fields with a concentration in education (Riordan 1994; Wolf-Wendel 1998; Tidball, Smith, Tidball and Wolf-Wendel 1999). The success of female college graduates was attributed to a number of factors including: a large female faculty to total faculty ratio providing ample female role models; scarcity of male students since the number of successful women decreases as the percentage of male students increases in coeducational colleges; small college size; and supportive demeanors of male and female faculty towards women’s education compared to counterpart coeducational institutions (Tidball 1980). Single-sex educational environments were claimed to be beneficial providing women with opportunities to excel in nontraditional fields such as math and science; pursue leadership roles that were historically dominated by males; and aspire for traditionally masculine careers that are more prestigious and offer better pay (Tidball and Kistiakowsky 1976; Astin 1977; Brown 1982; Giele 1987; Smith 1990; Miller-Bernal 1993; Duncan et al. 2002).
Tidball’s (1980) research was soundly criticized based on the limitations of the statistical analysis used to correlate the relationship between single-sex education and achievement. Critics noted Tidball’s failures to accurately account for the socio-economic privileges shared by students attending women’s colleges as well as the errors that occurred in drawing cause and effect conclusions when correlation analysis was utilized (Kaminer 1998). Researchers additionally questioned Tidball’s findings that women colleges produced more females successful in the fields of math and science. The empirical evidence, when examined, indicated the study’s methodology and statistical analysis were questionable and therefore women colleges were no more likely to produce female mathematicians and scientists than coeducational institutions (Kaminer 1998).

**Summary**

By and large, research results on the impact of gender on learning have been hampered by confounding effects making it difficult to narrow in on the root of the cause. As a result, many studies drew conclusions based on assumptions and lacked the support of sound empirical evidence. However, a common theme revealed itself within the literature review pertaining to the ethnicity of the student along with other socio-demographic statistics. Underprivileged students have long lagged behind students from middle and upper classes which are afforded the opportunity to broaden their educational outlook through external sources such as the use of training materials, private tutors and better access to technology. It is these underprivileged students who stand to benefit the most through the use of customized
instructional methods that hone in on a student’s abilities and utilizes techniques to maximize a student’s potential. Single-sex educational environments are seen as a means to combat socio-economic disparities and forge new opportunities for those students who lack the resources to seek non-public educational tools.

Past research shows that on average, girls perform better in school than boys, receiving higher grades and completing their high school education at higher rates (Jacobs et al. 2002). A review of standardized achievement tests shows that females are better spellers and outperform males on tests of writing, literacy, and general knowledge (Statistics 2003). However, this success may be limited to certain subject areas. Fourth graders in 35 countries were given the same international aptitude test showing that females outperformed males on reading literacy in every country. Although no differences were identified between males and females in fourth grade mathematic scores, boys began to outperform females on science tests at this point (Achievement 2007). These course subject gender differences in science and math achievement have severe implications on the career aspirations of women and are a great source of concern for most educators.

The AAUW led the charge in the 1980’s and 90’s trying to determine why this gender disparity exists within math, science, engineering and technical careers (AAUW 1992). The National Science Board (1997) noted in 1997 that only 22% of engineers and scientists in the United States were women, whereas half of social scientists were females. Those women who did pursue careers in mathematics, engineering and science often sought out fields in the
biological sciences, where they accounted for 40% of the workforce (Bae and Smith 1997). On the other hand, women only comprised 33% of the workforce in mathematics or computer science, 22% in physical sciences and 9% in engineering (Bae and Smith 1997).

Gender differences have been noted in the cognitive abilities of middle school students which can partially explain the disparity between males and females in science and engineering careers. Hedges and Nowell documented in 1995 that females exceeded males in late elementary school on several verbal skills tasks: verbal fluency, comprehension, verbal reasoning, and understanding logical relations (Hedges and Nowell 1995). Likewise, males outperformed females in terms of spatial skills involving tasks such as spatial perception, mental rotation, and spatial visualization (Voyer, Voyer and Bryden 1995). For the most part, males perform better than females on mathematical achievement tests; however differences were not noted in all mathematic skills. Males and females are on par in terms of basic math knowledge and females actually have better computational skills. Males far out-paced females in regards to geometry and mathematic reasoning, highlighting the greatest disparity between the genders (Fennema, Sowder and Carpenter 1999). Males have also been noted to have a higher level of confidence in their mathematic abilities which has been found to correlate directly with math performance (Casey, Nuttall and Pezaris 2001).

The impact of poor mathematical reasoning skills possessed by females has several educational implications. Starting at age 12, adolescent females begin to like social studies and language arts as well as dislike math and science in comparison to males (Sadker and Sadker
This results in lower academic achievement expectations by females in math and science courses who attribute their poor performance to a lack of ability (Eccles, Barber, Jozefowicz, Malanchuk and Vida 1999). As a result, females opt-out of higher level math and science courses which may be pre-requisites to pursue certain majors in college (i.e. computer science, engineering). Consequently, the number of females who seek advanced degrees in these fields is dramatically reduced (Halpern 2004).

Differing in their view, other researchers contend that the achievement gender gap in science and mathematics is biologically driven. Past research has found that male and female fetuses develop differently as an effect of the prenatal hormones that are circulating in the brain (Berenbaum, Korman and Leveroni 1995) whereas; other researchers have found links between genetics and intelligence (Plomin 2000). However, there is overwhelming evidence that shows that girls’ attitudes towards science and math are greatly influenced by sociocultural factors. For example, parents have been found to encourage their sons more so than daughters to take advanced high school courses of mathematics, physics and chemistry and hold higher expectations of their success (Wigfield, Battle, Keller and Eccles 2002). Parents also tend to view social studies and language arts as more important for their daughters and math and science as more important for their sons (Andre, Whigham, Hendrickson and Chambers 1999).

As of recent, this trend seems to be reversing itself as the differences in mathematical reasoning between males and females has begun to decline, leading to higher enrollment rates of females in science and math courses (Campbell, Hombo and Mazzeo 2000; Freeman 2004).
This change can be attributed to the multiple school choice options available which allow males and females to explore subject matters in an environment where they feel more comfortable. One of these options, single-sex classrooms, is designed to structure the presentation of course material based on the needs of the student which varies between males and females. Male students yearn for a flexible learning environment that promotes a great deal of interaction between the teacher and other students. On the other hand, females desire a more methodical structure where course material is presented in an orderly fashion with minimal distractions. These learning differences must be recognized and addressed to customize the learning environment to yield the most promising educational outcomes.
CHAPTER THREE: METHODOLOGY

This chapter reviews items related to the design of this research project providing an understanding of what information will be tested, how data analysis will be conducted and the theoretical framework supporting this research method, a review of the data source including transformation and imputation methods, and ultimately the research questions which will be attempted to be answered along with the hypothesis’ which will be tested. Instrumentation presented for use in this section provide sound methods by which the hypotheses were tested leading to the presentation of valid/reliable results which would hold up to peer review.

Theoretical Framework

Human beings are unique in nature, creating a variety of characteristics that impact their ability to learn and comprehend educational material when presented with it. Educators are faced with the daunting task of not only identifying and recognizing these unique characteristics within each student, but to also develop teaching methods and instruments which maximize the potential in each student. Aptitude-Treatment Interaction (ATI) was first presented by Cronbach and Snow in 1977 as a theoretical concept that proposed that some instructional strategies or treatments (ie. single-sex educational environments) are more or less effective for particular individuals depending on their specific abilities. ATI hypothesizes that
when the instruction is exactly matched with the aptitudes of the learner, optimal learning results will prevail (Cronbach and Snow 1977).

As first defined by Cronbach and Snow, the aptitude-treatment interaction theory pertains to the educational development of students, encompassing a broad range of instructional and aptitude variables. As suggested by ATI, the effectiveness of instructional strategies differs depending on the specific abilities of each individual. ATI is based upon the following principles:

1) Aptitudes and instructional treatments interact in complex patterns and are influenced by task and situation variables.

2) Highly structured instructional environments tend to be most successful with students of lower ability; conversely, low structure environments may result in better learning for high ability students.

3) Anxious or conforming students tend to learn better in highly structured instructional environments; non-anxious or independent students tend to prefer low structure (Cronbach and Snow 1977; Kearsley 2008).

Aptitude, in relation to ATI research, is defined by Snow (1991) as any “measurable person characteristic hypothesized to be (needed for successful) goal achievement in the treatment(s) studied” (Snow 1991, p.205). Working within this definition, aptitude can be seen as any personal characteristic, such as differential abilities or intelligence, which would impact the learning experience of a person. Aptitude also includes “personality and motivational
differences along with styles, attitudes, and beliefs” (Snow 1991, p.206) and can be measured through the review of personal characteristics including those listed above as well as other variables such as ethnicity, gender, social class, or prior educational history (Cronbach and Snow 1977).

Treatment in ATI, as defined by Cronbach and Snow (1977), encompasses any variable or element that is present in the learning environment, most commonly manipulable variables. As such, treatments can include variations in the pace of delivery, the delivery method, the instructional material used or the style of instruction. Treatment can also include environmental elements which cannot be easily manipulated. For example, characteristics of the teacher such as their race or gender as well as characteristics of the learning environment in which the treatment is delivered can be considered environmental elements which cannot be manipulated (Snow 1991). It is this last part involving the characteristics of the learning environment that best defines the attempts of single-sex classrooms to improve the aptitudes of male and female students.

Cronbach and Snow (1977) defined interaction to take into account the variation of the effect of the treatment on different people. Interaction (or variation) is said to exist when one situation has a particular effect on one person but a different effect on another (Cronbach and Snow 1977). With male and female students in different classrooms, the possibility exists that single-sex classrooms have differing effects on male versus female students contributing to a high-level of interaction in the use of single-sex education as a treatment.
When considered together, ATI’s mandate is to “try to design enough treatments so that everyone will be able to succeed in one of them, and route that person into a treatment he fits” (Cronbach and Snow 1977, p.1). As a result, the goal of ATI is to establish an environment for learning where the treatments (instructional delivery methods) match the aptitude (abilities) of the person attempting to learn on a case-by-case basis (Cronbach and Snow 1977). Even more important, “ATI methodology is designed to take individual differences among treated persons into account systematically in treatment evaluation – to assess the degree to which alternative treatments have different effects as a function of person characteristics and thus determine whether particular treatments can be chosen or adapted to fit particular persons optimally” (Snow 1991, p.208). In this context, ATI could be used as a mechanism to promote knowledge interaction as a means to extend the abilities of educators to establish even more individually customized learning environments.

The implementation of single-sex educational programs is an attempt to customize the instructional methods utilized for students in public education. Single-sex environments fit under the theoretical framework of ATI which promotes that optimal learning results are achieved when the aptitudes of the learner are exactly matched with the instructional methods utilized. ATI is commonly applied within the bounds of education but the complexity in identifying the interaction of all of the variables associated with a learning environment may be difficult to predict and understand. For example, segregating males and females in separate classrooms is only one aspect of the learning environments. Other influential factors include
the teaching methods used by the instructor, availability of teaching materials and other resources, and the behaviors of fellow classmates and the instructor.

ATI has been extensively researched in effort to better understand the interactions of the multiple variables that exist within a learning environment but also to dispel the embedded principles set within it. Many critics claim that the effect of ATI is too difficult to understand to be the basis for the development of instructional practices. Even Snow admits that “Learning style differences can be linked to relatively stable person or aptitude variables, but they also vary within individuals as a function of task and situation variables” (Snow 1989, p.343). Despite these concerns, ATI has been adopted as a common tool for exploring new instructional strategies and curriculum design, particularly in the areas of reading and mathematics (Astleitner 2006; Koran and Koran Jr. 2006; Yeh 2007).

Research Questions

Gender differences have commonly been overlooked when developing education systems and program curriculum for public schools. However, the interaction of males and females in the classroom has been found to substantially impact the motivation, academic achievement and self-esteem of students at times, altering their career aspirations accordingly. Classroom interactions including student to teacher and student to student interactions have been researched with varying results.
To shed some additional light on the effectiveness of single-sex classrooms, I studied the impact of single-sex classrooms on male versus female students in South Carolina. In doing so, I addressed the following research questions:

1) Do single-sex classrooms improve the perceived academic achievement of female and male students equally?

2) Do single-sex classrooms improve the perceived motivation of female and male students equally?

3) Do single-sex classrooms improve the perceived self-esteem of female and male students equally?

Prior research has shown that male students as opposed to female students generate different but distinct benefits from single-sex classroom leading to the following hypotheses:

- H1A: Male and female students in single-sex classrooms have statistically significant (p<.05) differences in their perceived academic achievement.
- H10: Male and female students in single-sex classrooms have no statistically significant differences in their perceived academic achievement.
- H2A: Male and female students in single-sex classrooms have statistically significant (p<.05) differences in their perceived motivation.
- H20: Male and female students in single-sex classrooms have no statistically significant differences in their perceived motivation.
• H3A: Male and female students in single-sex classrooms have statistically significant (p<.05) differences in their perceived self-esteem.

• H30: Male and female students in single-sex classrooms have no statistically significant differences in their perceived self-esteem.

Research Design

The design of this research project is centered on the analysis of a survey data set obtained from the South Carolina Department of Education. This research design section will include a review of this data set, an assessment of the validity and reliability of the survey instrument used, an explanation of how item non-response was handled, and finally a discussion of the statistical methods used to analyze this data set. During data analysis, research methods were rigorously followed in attempt to insure the highest level of validity and reliability while minimizing the many biases present in single-sex educational research. By methodically following the research methods proposed, the outcomes from this research project will contribute sound empirical evidence to the field of single-sex educational research to help clarify the many issues that presently exist pertaining to its use in public schools.

Data

The South Carolina Department of Education has experimented with single-sex classrooms in public schools since 2007 and currently offers over 300 single-sex classrooms throughout the state (Chadwell 2008). South Carolina’s Office of Public School Choice run by
David Chadwell conducted a survey online in the spring of 2008 which was administered to students, their parents and teachers in single-sex classrooms as a means to gauge their impressions of single-gender education. The survey yielded 2,233 student responses that ranked their experiences within single-sex classrooms in regards to 20 survey questions of which 15 were identified for further analysis. Responses were ranked on a Likert scale ranging from strongly agree (value = 7), somewhat agree (value = 6), agree (value = 5), neutral (value = 4), disagree (value = 3), somewhat disagree (value = 2), and strongly disagree (value = 1).

Participation in the South Carolina survey was offered to students in public single-sex classrooms to which participation was optional and the identity of participants was kept anonymous. The South Carolina Office of Public School Choice designed and promoted the survey in an effort to garner a better understanding of the benefits of single-sex learning environments. However, based on the survey limitations, a random sampling of all students in single-sex classrooms in South Carolina would be difficult if not impossible to obtain. The survey was posted on the website of the South Carolina Department of Education and a “link to the surveys was sent to schools with single gender classes, and teachers were encouraged to ask their students and parents to complete the survey as well as complete their own survey” (Chadwell 2008, p.1). The secondary data analysis conducted as part of this study only evaluated the student responses in an attempt to gain insight into the success of single-gender classrooms from the prospective of current students.
This data set also includes identifying information for gender, school attended, grade level, ethnicity and free text comments. Some of these control (independent) variables were used as part of the initial analysis conducted by David Chadwell. Although administered by a reputable source, this secondary data set lacked control (independent) variables and as a result, further research utilizing this data set will only be able to control for grade level and ethnicity, limiting the conclusions which can be drawn. The initial conclusions drawn by Chadwell can be seen in the appendix and were made available for public viewing on the South Carolina Department of Education website for the Office of Public School Choice.

Validity and Reliability

The validity of a survey instrument entails the question of whether a survey is measuring what it says it is measuring. On the other hand, the reliability of a survey instrument attempts to determine if a survey is measuring things consistently. Despite efforts to fortify validity and reliability, survey instruments tend to be strong on reliability but weak when it comes to validity (Barribeau, Butler, Corney, Doney, Gault, Gordon, Fetzer, Klein, Rogers, Stein, Steiner, Urschel, Waggoner and Palmquist 2005). Surveys are commonly laden with proximal indicators forcing participants to pin their feelings to such dichotomies as support/oppose, agree/disagree or like/dislike and thus lack the flexibility to allow participants to express their true feelings. This artificiality inherent in most survey instruments puts a strain on validity. The validity of the South Carolina data set centers on the ability of administrators of the South
Carolina Department of Education to formulate surveys which best describe the feelings of students in single-sex classrooms.

Two types of validity which should be addressed when using surveys as a data source are face and content validity. Face validity refers to the ability of the survey questions to measure a student’s feeling about participation in single-sex classrooms and is determined through a judgment call as opposed to some statistical method (Marzano 2004). Considering the extensive experience of the South Carolina administrators in working with students in single-sex classroom, the face validity of this data set has been assumed to be fairly strong. Content validity relates to the extent to which survey questions measure the complete range of feelings that students have about single-sex environments (Marzano 2004). Content validity in relation to this study is supported by the literature review which highlights important and critical impacts of single-sex classrooms on student development. Much of the literature which has been reviewed discusses the impact that single-sex environments have on students’ motivation, academic achievement and self-esteem highlighting the relevance of these latent constructs.

Reliability is much more straightforward but can only be tested in relation to each construct. For the purposes of this study, I was most interested in the type of reliability relating to internal consistency that tests the correlation of the variables or survey questions which make up the dependent variables. Internal consistency was confirmed with the use of reliability analysis testing for Cronbach’s Alpha of each index and is discussed in more detail as
part of the selection of method section. It is important to note that a survey can be reliable but not valid. However, a survey cannot be valid without being reliable (Barribeau et al. 2005). High quality surveys are made up of uni-dimensional indexes that have relatively high validity and reliability for the population being surveyed.

Item Non-response

A review of the descriptive statistics identified a number of missing records as a result of individual questions not being responded to by survey participants, creating the need to address item non-response. “Item non-response refers to the fact that due to fatigue, sensitivity, lack of knowledge, or other factors, participants not infrequently leave particular items blank on mail questionnaires or decline to give any response during interviews” (Garson 2006, p.1). To rectify item non-responses, several actions can be taken. First, the data can be imputed replacing missing records with the mean or some other factor. Another alternative is to leave the data as it stands making no modifications for missing records. The final suggested method is to drop records missing values which feed into the indexes however still utilizing those records where the data is complete for other indexes (Garson 2006).

Unfortunately, there is no simple decision rule which can lead a researcher to choose to leave the missing values as they are, to impute missing values or to drop cases with missing values. “When the number of cases with missing data is small (ex., <5% in larger samples), it is common simply to drop these cases from analysis” (Garson 2006, p. 1). According to Kalton and Kaspryzk (1982), even when the number of missing cases is larger than 5%, the research
may opt for dropping missing cases as opposed to imputing values when conducting multivariate analysis. Imputation has been found to distort coefficients of association as well as correlation relating variables (Kalton and Kasprzyk 1982).

Analysis of the South Carolina data set shows a base count of records to equal 2,233 students. The latent construct of academic achievement has a base count of 2,127 records indicating that 4.7% of the records are missing one or more values. The construct of motivation maintains a base count of 2,062 students signifying that 7.7% of records are missing data points. The final construct of self-esteem has a base count of 2,150 students indicating that 3.7% of records are missing values. Since the number of missing records is relatively low and in most cases less than 5% of total records, I am opting to drop all cases which contain missing values in agreement with the philosophy of Kalton and Kasprzyk. As a result, the dependent variable of academic achievement maintained 2,127 cases where as motivation had a sample size of 2,062 and the variable self-esteem ended up with 2,150 cases which were analyzed as part of this study.

Selection of Method

It is important to understand the impact of single-sex classrooms on students so that future education policies promoting such practices can be backed by sound research. Utilizing the South Carolina survey results, I attempted to test the impact of single-sex classrooms on a student’s motivation, academic achievement and self-esteem. Through the use of reliability analysis, survey questions were matched with the three proposed dependent variables. These
indexes were tested for internal consistency within the matched survey questions through the inspection of the *Cronbach Alpha* score which can be used to assess the inter-item consistency and the alpha coefficient in each domain. Based on the results of this analysis, additional tweaking had to be performed in the mapping of survey questions with the dependent variables until an acceptable alpha score was achieved.

This method of research against a survey instrument is a common method of analysis because of its ability to isolate the effect of the survey variables available in a large sample size. Indexes as well as scales can be used as data reduction tools against survey data sets and “are ordinal level measures that are composites of two or more questionnaire items” (Israel 1992, p.5). Scales are defined by identifying patterns in the survey responses linking questions which have been answered similarly by survey participants (Weisbert, Krosnick and Bowen 1996). On the other hand, the development of indexes involves the cumulation of the scores which have been assigned to the different response categories for a group of survey questions (Babbie 1973). To validate the indices defined in this proposal, uni-dimensionality was tested to ensure that the indexes measured a single concept or dimension. To test the internal consistency of the questions included in an index, removing any threat that one of the dependent variables measures more than one effect, the statistical measure of *Cronbach’s Alpha* is commonly used (Carmines and Zeller 1979).

Much debate exists on what are acceptable alpha scores. The classic citation of Nunnally originally developed in 1978, reports that a valid index should have an alpha value
greater than 0.70 but not much higher than 0.90 (Nunnally and Bernstein 1994). Garson (1998) asserts that 0.70 is widely-accepted as the cut-off in social science however, notes that some have been more strict adopting 0.75 or 0.80 as the standard while others have been more lenient allowing alpha scores as low as 0.6 (Garson 1998). The alpha of 0.70 “is as low as one may wish to go is reflected in the fact that when alpha is 0.70, the standard error of measurement will be over half (0.55) a standard deviation” (Garson 1998, p.1). Isreal (1992) proposes that an alpha score of 0.60 is considered acceptable for exploratory research common in behavioral sciences while a benchmark of 0.80 is considered an indicator of good internal consistency within the physical sciences (Israel 1992). In following Garson’s methodology, 0.70 will be used as an acceptable alpha score in determining the validity of an index for the purpose of this study.

Results of the reliability analysis confirmed the creation of three dependent variables for further study. The dependent variable of academic achievement was identified relating to survey questions of ABILITY_TO_SUCCEED, GRADES, HOMEWORK, and CLASSWORK maintaining an alpha score of 0.852. When testing the dependent variable of motivation against survey questions of DESIRE_TO_SUCCEED, INTEREST, PARTICIPATION, ATTITUDE, BEHAVIOR, DETERMINED, ENJOY and FOCUS, an alpha score of 0.906 was generated. The final dependent variable of self-esteem was represented by the survey questions of SELF-CONFIDENCE, INDEPENDENCE and FRIENDS, holding an alpha score of 0.721. The mapping of the survey questions to the dependent variables is displayed in table 1.
Table 1: South Carolina Survey Variables

<table>
<thead>
<tr>
<th>Academic Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABILITY TO SUCCEED: This year, by being in a single-gender program, my ability to succeed has increased.</td>
</tr>
<tr>
<td>GRADES: This year, by being in a single-gender program, my grades have improved.</td>
</tr>
<tr>
<td>HOMEWORK: This year, by being in a single-gender program, my completion of homework has increased.</td>
</tr>
<tr>
<td>CLASSWORK: This year, by being in a single-gender program, my completion of classwork has increased.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIRE TO SUCCEED: This year, by being in a single-gender program, my desire to succeed has increased.</td>
</tr>
<tr>
<td>INTEREST: This year, by being in a single-gender program, my interest in trying new things has increased.</td>
</tr>
<tr>
<td>PARTICIPATION: This year, by being in a single-gender program, my participation in class has increased.</td>
</tr>
<tr>
<td>ATTITUDE: This year, by being in a single-gender program, my attitude toward school has improved.</td>
</tr>
<tr>
<td>BEHAVIOR: This year, by being in a single-gender program, my behavior as improved.</td>
</tr>
<tr>
<td>DETERMINED: This year, by being in a single-gender program, my determination to accomplish my goals has increased.</td>
</tr>
<tr>
<td>ENJOY: This year, by being in a single-gender program, I enjoy attending school more.</td>
</tr>
<tr>
<td>FOCUS: This year, by being in a single-gender program, my ability to focus has improved.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-Esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF-CONFIDENCE: This year, by being in a single-gender program, my self-confidence has improved.</td>
</tr>
<tr>
<td>INDEPENDENCE: This year, by being in a single-gender program, my independence has increased.</td>
</tr>
<tr>
<td>FRIENDS: This year, by being in a single-gender program, my ability to make friends has improved.</td>
</tr>
</tbody>
</table>

This study utilized several control (independent) variables to assist with data analysis.

Table 2 reviews of the dependent and control (independent) variables used for hypothesis testing as well as additional statistical analysis.
Table 2: Study Variables

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Achievement</strong></td>
<td>ABILITY_TO_SUCCEED, GRADES, HOMEWORK, CLASSWORK</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>DESIRE_TO_SUCCEED, INTEREST, PARTICIPATION, ATTITUDE, BEHAVIOR, DETERMINED, ENJOY, FOCUS</td>
</tr>
<tr>
<td><strong>Self-Esteem</strong></td>
<td>SELF-CONFIDENCE, INDEPENDENCE, FRIENDS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control (Independent) Variables</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>Male or Female</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>African American, Caucasian, Hispanic</td>
</tr>
<tr>
<td><strong>Grade Level</strong></td>
<td>4th, 5th, 6th, 7th, 8th</td>
</tr>
</tbody>
</table>

ANOVA analysis was used to identify differences in the group means between the male and female students (Handbook 2008), testing whether significant statistical differences exist within the perceived academic achievement, motivation and self-esteem of male and female students in single-sex classrooms. ANOVA analysis, as proposed by Snedecor and Cochran (1989), will test the validity of the data set while identifying underlying variables which are representative of the effectiveness of single-sex education (Snedecor and Cochran 1989).

ANOVA analysis is considered a special case of the t-test and will typically yield similar results when testing the same data set. However, ANOVA is a more commonly used tool of analysis “because the technique is much more powerful in complex experimental designs” (Stockburger 1996, p.1).

To conclude the research, multiple linear regression analysis was used to determine the impact of the control (independent) variables of ethnicity and grade level on the motivation, academic achievement and self-esteem of male and female students and provide a better
understanding of whether the dependent variables are influenced by the instruction taking place in single-sex classrooms as opposed to other environmental variables. Multiple linear regression was used to test the strength of the relationship of the dependent variables of motivation, academic achievement and self-esteem with the control (independent) variables of ethnicity and grade level. Multiple regression is a statistical method used to model the relationship between two or more control (independent) variables with an outcome or dependent variable (Chromy and Abeyasekera 2005). This predictive analysis will identify variations in the effect of single-sex classrooms on different student characteristics in attempt to identify those students who stand to benefit the most from a single-sex learning environment. It is a goal of this study to determine if significant differences exist in the perceived effectiveness of single-sex educational programs between male and female students in South Carolina public schools controlling for ethnic and grade level variations.
CHAPTER FOUR: FINDINGS

Utilizing SPSS, survey responses were transformed and compiled for analysis in an attempt to test the three study variables of academic achievement, motivation and self-esteem. The results of this analysis are presented below beginning with a review of the distribution of the data, a discussion of the descriptive statistics resulting from the survey questions focusing on the confirmed indexes, an assessment of the hypothesis testing as well as the influence of the control (independent) variables, and concluding with a review of the supplemental analysis conducted by grade level in an attempt to better understand its statistical significance.

Distribution

The South Carolina survey yielded 2,233 student responses that ranked their experiences within single-sex classrooms in regards to 20 survey questions of which 15 were identified for further analysis. The descriptive statistics for the 15 survey questions used in this study are displayed in table 3 noting the mean values for the sample as a whole as well as the mean for each gender, ethnic group and grade level.
Table 3: Descriptive Statistics for the South Carolina Survey Variables

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Grade Level</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Male</td>
<td>Female</td>
<td>African American</td>
<td>Caucasian</td>
<td>Hispanic</td>
<td>4th</td>
<td>5th</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>SELF-CONFIDENCE</td>
<td>5.096</td>
<td>4.98</td>
<td>5.2</td>
<td>5.2</td>
<td>4.92</td>
<td>5.25</td>
<td>6.1</td>
<td>5.37</td>
</tr>
<tr>
<td>DESIRE TO SUCCEED</td>
<td>5.729</td>
<td>5.16</td>
<td>5.39</td>
<td>5.47</td>
<td>4.96</td>
<td>5.28</td>
<td>6.09</td>
<td>5.57</td>
</tr>
<tr>
<td>INTEREST</td>
<td>5.135</td>
<td>5.06</td>
<td>5.21</td>
<td>5.23</td>
<td>4.91</td>
<td>5.43</td>
<td>6.01</td>
<td>5.48</td>
</tr>
<tr>
<td>INDEPENDENCE</td>
<td>5.218</td>
<td>5.04</td>
<td>5.39</td>
<td>5.39</td>
<td>4.95</td>
<td>4.83</td>
<td>5.97</td>
<td>5.32</td>
</tr>
<tr>
<td>PARTICIPATION</td>
<td>5.307</td>
<td>5.23</td>
<td>5.38</td>
<td>5.42</td>
<td>5.15</td>
<td>5.32</td>
<td>6.21</td>
<td>5.51</td>
</tr>
<tr>
<td>ABILITY TO SUCCEED</td>
<td>5.378</td>
<td>5.31</td>
<td>5.45</td>
<td>5.55</td>
<td>5.05</td>
<td>5.34</td>
<td>6.15</td>
<td>5.55</td>
</tr>
<tr>
<td>ATTITUDE</td>
<td>4.770</td>
<td>4.68</td>
<td>4.85</td>
<td>4.86</td>
<td>4.5</td>
<td>5.39</td>
<td>5.9</td>
<td>5.05</td>
</tr>
<tr>
<td>BEHAVIOR</td>
<td>4.860</td>
<td>4.8</td>
<td>4.92</td>
<td>4.96</td>
<td>4.62</td>
<td>5.35</td>
<td>5.95</td>
<td>5.3</td>
</tr>
<tr>
<td>GRADES</td>
<td>5.143</td>
<td>5.15</td>
<td>5.14</td>
<td>5.31</td>
<td>4.83</td>
<td>5.14</td>
<td>5.65</td>
<td>5.42</td>
</tr>
<tr>
<td>DETERMINED</td>
<td>5.374</td>
<td>5.27</td>
<td>5.47</td>
<td>5.55</td>
<td>5.06</td>
<td>5.34</td>
<td>6.08</td>
<td>5.60</td>
</tr>
<tr>
<td>MAKE FRIENDS</td>
<td>5.261</td>
<td>5.26</td>
<td>5.27</td>
<td>5.66</td>
<td>5.02</td>
<td>5.54</td>
<td>6.36</td>
<td>5.52</td>
</tr>
<tr>
<td>HOMEWORK</td>
<td>4.918</td>
<td>4.85</td>
<td>4.98</td>
<td>5.07</td>
<td>4.62</td>
<td>5.13</td>
<td>5.99</td>
<td>5.41</td>
</tr>
<tr>
<td>CLASSWORK</td>
<td>5.272</td>
<td>5.25</td>
<td>5.3</td>
<td>5.44</td>
<td>4.97</td>
<td>5.4</td>
<td>5.92</td>
<td>5.55</td>
</tr>
<tr>
<td>FOCUS</td>
<td>5.054</td>
<td>4.95</td>
<td>5.15</td>
<td>5.18</td>
<td>4.82</td>
<td>5.02</td>
<td>5.74</td>
<td>5.09</td>
</tr>
<tr>
<td>N</td>
<td>2215</td>
<td>1032</td>
<td>1178</td>
<td>1317</td>
<td>671</td>
<td>99</td>
<td>145</td>
<td>390</td>
</tr>
<tr>
<td>N</td>
<td>2219</td>
<td>1034</td>
<td>1180</td>
<td>1321</td>
<td>673</td>
<td>99</td>
<td>143</td>
<td>391</td>
</tr>
<tr>
<td>N</td>
<td>2213</td>
<td>1035</td>
<td>1173</td>
<td>1314</td>
<td>673</td>
<td>98</td>
<td>147</td>
<td>391</td>
</tr>
<tr>
<td>N</td>
<td>2206</td>
<td>1031</td>
<td>1170</td>
<td>1313</td>
<td>670</td>
<td>98</td>
<td>146</td>
<td>386</td>
</tr>
<tr>
<td>N</td>
<td>2204</td>
<td>1027</td>
<td>1172</td>
<td>1315</td>
<td>672</td>
<td>95</td>
<td>145</td>
<td>386</td>
</tr>
<tr>
<td>N</td>
<td>2193</td>
<td>1023</td>
<td>1165</td>
<td>1302</td>
<td>667</td>
<td>97</td>
<td>143</td>
<td>389</td>
</tr>
<tr>
<td>Dimension</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>ATTITUDE</td>
<td>2210</td>
<td>1027</td>
<td>1178</td>
<td>1316</td>
<td>673</td>
<td>97</td>
<td>143</td>
<td>387</td>
</tr>
<tr>
<td>BEHAVIOR</td>
<td>2206</td>
<td>1025</td>
<td>1176</td>
<td>1313</td>
<td>668</td>
<td>98</td>
<td>146</td>
<td>387</td>
</tr>
<tr>
<td>GRADES</td>
<td>2216</td>
<td>1028</td>
<td>1183</td>
<td>1317</td>
<td>672</td>
<td>99</td>
<td>147</td>
<td>390</td>
</tr>
<tr>
<td>DETERMINED</td>
<td>2212</td>
<td>1030</td>
<td>1177</td>
<td>1318</td>
<td>671</td>
<td>98</td>
<td>145</td>
<td>388</td>
</tr>
<tr>
<td>MAKE FRIENDS</td>
<td>2206</td>
<td>1022</td>
<td>1179</td>
<td>1310</td>
<td>669</td>
<td>99</td>
<td>147</td>
<td>388</td>
</tr>
<tr>
<td>ENJOY</td>
<td>2210</td>
<td>1029</td>
<td>1176</td>
<td>1318</td>
<td>668</td>
<td>99</td>
<td>147</td>
<td>388</td>
</tr>
<tr>
<td>HOMEWORK</td>
<td>2215</td>
<td>1027</td>
<td>1183</td>
<td>1320</td>
<td>670</td>
<td>99</td>
<td>147</td>
<td>388</td>
</tr>
<tr>
<td>CLASSWORK</td>
<td>2212</td>
<td>1028</td>
<td>1179</td>
<td>1317</td>
<td>671</td>
<td>97</td>
<td>147</td>
<td>384</td>
</tr>
<tr>
<td>FOCUS</td>
<td>2210</td>
<td>1030</td>
<td>1175</td>
<td>1315</td>
<td>670</td>
<td>98</td>
<td>145</td>
<td>388</td>
</tr>
</tbody>
</table>

Valid N (listwise) 1891
The descriptive statistics for each survey question displayed in table 3 are broken down by gender, ethnicity (Caucasian, African American and Hispanic only) and grade level (4th, 5th, 6th, 7th and 8th grades). The statistics for ethnicity and grade level are limited due to small sample sizes for grade levels 1st, 2nd, 3rd, and 9th and ethnicity variables Asian American and Other. These statistics show that Hispanics are accurately represented in the sampling accounting for 4.5% of student participants while African American are over-represented making up 60.9% of the total student participants. The population statistics for South Carolina for 2008 show that 4.1% and 28.5% of the residents are of Hispanic or African American origin (Bureau 2008). Consequently, the sample contains sufficient responses from minorities to support the generalizability of the research findings across this population. However, Caucasians comprised 68.7% of the population in South Carolina in 2008 (Bureau 2008) but only accounted for 30.3% of the sample leading to their under-representation. In regards to gender, the sample is split relatively even with 46.7% male and 53.3% female student respondents and compares to South Carolina population statistics of 48.7% and 51.3% respectively (Bureau 2008).

The results of the reliability analysis confirmed three dependent variables for further study. The latent construct of academic achievement had a base count of 2,127 pupils; motivation had a base count of 2,062 students and self-esteem had a base count of 2,150 records. The scores for the survey responses were aggregated based on the survey question mapping previously presented. As a result of this computation, the dependent variable of
academic achievement had a score range of 4 to 28, while motivation had a range of 8 to 72 and self-esteem had a range of 3 to 21 for each survey participant.

**Academic Achievement**

Figure 5 is a histogram that represents the distribution of the dependent variable of academic achievement highlighting the group mean, the standard deviation and the sample size along with a normality curve.

Figure 5 shows that the data for academic achievement is negatively skewed to the left promoting the need for further analysis on the normality of the data. It is important that the data maintain a normal distribution as ANOVA analysis, which will be conducted next, is a
parametric test. In response, additional tests were conducted to determine if the data was normalized and if so, to what degree. Table 4 highlights the skewness and kurtosis values which were evaluated as part of the determination of the extent to which the data is normalized for the dependent variable of academic achievement.

Table 4: Descriptive Statistics for Academic Achievement

<table>
<thead>
<tr>
<th></th>
<th>N Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Deviation Statistic</th>
<th>Skewness Statistic</th>
<th>Kurtosis Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC</td>
<td>2127</td>
<td>4</td>
<td>28</td>
<td>20.73</td>
<td>5.659</td>
<td>-.866</td>
<td>.053</td>
</tr>
<tr>
<td>ACHIEVEMENT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valid N</td>
<td>2127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(listwise)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The variable academic achievement has a skewness statistic of -0.866 which is a negative value and indicates the distribution has an asymmetric tail extending towards more negative values. The skewness statistic demonstrates that the students are showing an overall high level of perceived academic achievement. Brown (1997) suggests that a skewness value in the range of -0.8944 and +0.8944 is “within the expected range of chance fluctuations in that statistic, which would further indicate a distribution with no significant skewness problem” (p.2). Based on this methodology, the variable of academic achievement maintained an acceptable skewness value supporting the conclusion that the data is normalized.

The kurtosis statistic describes the peakedness or flatness of a distribution compared to the normal distribution. A positive kurtosis value represents a relatively peaked distribution where as a negative kurtosis value is indicative of a flat distribution. The closer the kurtosis value is to zero, the more normalized the data. After analysis, the variable of academic
achievement showed a kurtosis value of 0.176. According to Brown, a kurtosis value that falls within the range of -1.7888 and +1.7888 is within the expected range of chance fluctuations (Brown 1997). When considered in conjunction with the skewness value, the sample data for academic achievement can be considered normalized.

Motivation

Figure 6 is a histogram that represents the distribution of the dependent variable of motivation highlighting the group mean, the standard deviation and the sample size along with a normality curve.

Figure 6: Histogram for Motivation
Figure 6 shows that the data for the motivation variable is negatively skewed to the left, similar to that for academic achievement. Table 5 highlights the skewness and kurtosis values which were evaluated as part of the determination of the extent to which the data distribution is normalized for the dependent variable of motivation.

Table 5: Descriptive Statistics for Motivation

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Deviation Statistic</th>
<th>Skewness Statistic</th>
<th>Kurtosis Statistic</th>
<th>Std. Error Statistic</th>
<th>Std. Error Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTIVATION</td>
<td>2062</td>
<td>8</td>
<td>56</td>
<td>40.25</td>
<td>11.001</td>
<td>-.739</td>
<td>.054</td>
<td>.019</td>
<td>.108</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>2062</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The variable motivation has a skewness statistic of -0.739 which is a negative value and indicates the distribution has an asymmetric tail extending towards more negative values. The skewness distribution demonstrates that both male and female students are showing a high level of perceived motivation. Following Brown’s (1997) methodology presented earlier, the variable of motivation maintains an acceptable skewness value supporting the conclusion that the data distribution is normal. The variable of motivation also resulted in a kurtosis value of 0.019 which represents a distribution which is fairly normal. When considered in conjunction with the skewness value, the distribution of the sample data for motivation can be considered normalized.
Self-Esteem

Figure 7 is a histogram that represents the distribution of the dependent variable of self-esteem highlighting the group mean, the standard deviation and the sample size along with a normality curve.

![Histogram for Self-Esteem](image)

**Figure 7: Histogram for Self-Esteem**

Figure 7 shows that the data for the self-esteem variable is negatively skewed to the left as is the case with the other dependent variables. Table 6 highlights the skewness and kurtosis values which were evaluated as part of the determination of the extent to which the data is normalized for the dependent variable of self-esteem.
Table 6: Descriptive Statistics for Self-Esteem

<table>
<thead>
<tr>
<th></th>
<th>N Statistic</th>
<th>Minimum Statistic</th>
<th>Maximum Statistic</th>
<th>Mean Statistic</th>
<th>Std. Deviation Statistic</th>
<th>Skewness Statistic</th>
<th>Kurtosis Statistic</th>
<th>Std. Error Statistic</th>
<th>Std. Error Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF_ESTEEM</td>
<td>2150</td>
<td>3</td>
<td>21</td>
<td>15.58</td>
<td>4.205</td>
<td>-.890</td>
<td>.332</td>
<td>.053</td>
<td>.106</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>2150</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The variable self-esteem has a skewness statistic of -0.890 which is a negative skewness value and indicates the distribution has an asymmetric tail extending towards more negative values. The skewness distribution demonstrates that the students are showing a high level of perceived self-esteem. Following Brown’s (1997) methodology, the variable of self-esteem is just within the acceptable boundaries for a skewness value supporting the conclusion that the data distribution is normal. The variable of self-esteem also resulted in a kurtosis value of 0.332 which represents a distribution which is fairly normal. When considered in conjunction with the skewness value, the distribution of the sample data for self-esteem can be considered normal and does not require further manipulation.

Descriptive Statistics

The descriptive statistics for each of the three dependent variables are displayed in Table 7 cross tabulated by the control (independent) variables of gender, ethnicity and grade level. Categories with a small number of cases are omitted.
Table 7: Descriptive Statistics for the Dependent Variables

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th></th>
<th></th>
<th>Ethnicity</th>
<th></th>
<th></th>
<th></th>
<th>Grade Level</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
<td>Mean</td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td>40.25</td>
<td>39.46</td>
<td>40.93</td>
<td>41.26</td>
<td>38.21</td>
<td>42.05</td>
<td>48.17</td>
<td>42.39</td>
<td>42.48</td>
<td>37.13</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td></td>
<td>15.58</td>
<td>15.26</td>
<td>15.87</td>
<td>15.95</td>
<td>14.91</td>
<td>15.59</td>
<td>18.44</td>
<td>16.23</td>
<td>16.17</td>
<td>14.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Academic Achievement</td>
<td></td>
<td>2127</td>
<td>986</td>
<td>1141</td>
<td>1263</td>
<td>653</td>
<td>92</td>
<td>143</td>
<td>372</td>
<td>567</td>
<td>363</td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td>2062</td>
<td>959</td>
<td>1103</td>
<td>1225</td>
<td>641</td>
<td>88</td>
<td>134</td>
<td>360</td>
<td>539</td>
<td>357</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td></td>
<td>2150</td>
<td>1002</td>
<td>1148</td>
<td>1277</td>
<td>657</td>
<td>96</td>
<td>144</td>
<td>376</td>
<td>571</td>
<td>373</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td></td>
<td>1891</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


In cross tabulating the three dependent variables with the control (independent) variables, some interesting trends appear to be present. In relation to gender, each of the mean values is higher for females (20.88, 40.93, and 15.87) than males (20.56, 39.46, and 15.26). From this information, it is possible to infer that females perceive more benefits from single-sex classrooms than do males. Also, the mean values for each of the ethnic groups of African American (21.4, 41.26, and 15.95) and Hispanic (21.26, 42.05, and 15.59) are higher than those for Caucasian (19.45, 38.21, and 14.91). In assessing who stands to benefit most from single-sex education, this data suggests that African American and Hispanic females stand to benefit the most. In terms of grade level, 4th (23.74, 48.17, and 18.44), 5th (21.99, 42.39, and 16.23) and 6th (21.75, 42.48, and 16.17) grade students perceive higher benefits than 7th (19.02, 37.13, and 14.64) and 8th (18.72, 35.71, and 14.11) grade students. The data on 4th grade students shows means significantly higher than 5th and 6th grade students but the sample size for the 4th grade students is less than half of that for 5th grade students and a quarter of that for 6th grade students. This data also suggests that there may be a diminishing effect taking place as students in single-sex classrooms mature.

**Hypothesis Testing**

Three hypotheses were tested using ANOVA analysis in an attempt to identify differences between males and females enrolled in single-sex public classrooms in South Carolina. In each case, the null hypothesis denotes no differences between male and female students. As stated previously, the hypotheses for this study are:
• H1a: Male and female students in single-sex classrooms have statistically significant 
(p<.05) differences in their perceived academic achievement.

• H10: Male and female students in single-sex classrooms have no statistically significant 
differences in their perceived academic achievement.

• H2a: Male and female students in single-sex classrooms have statistically significant 
(p<.05) differences in their perceived motivation.

• H20: Male and female students in single-sex classrooms have no statistically significant 
differences in their perceived motivation.

• H3a: Male and female students in single-sex classrooms have statistically significant 
(p<.05) differences in their perceived self-esteem.

• H30: Male and female students in single-sex classrooms have no statistically significant 
differences in their perceived self-esteem.

**Academic Achievement**

ANOVA analysis was conducted to test for differences in the group means between male 
and female students on the dependent variable academic achievement. ANOVA analysis 
calculated the group mean of male students to be 20.56 compared to a mean of 20.88 for 
female students and an overall mean of 20.73 for all students for the variable of academic 
achievement. Based on a 95% confidence interval, differences will be identified when the 
results of the ANOVA analysis produce a p value which is equal to or less than 0.05. Utilizing
this criterion, the analysis did not identify a statistically significant difference between males and females in single-sex classrooms in terms of their perceived academic achievement (see table 8). This conclusion is drawn from a resulting p value of 0.19 which is greater than the 0.05 threshold.

Table 8: ANOVA Results for Academic Achievement

<table>
<thead>
<tr>
<th>Source of Variances</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Achievement</td>
<td>1</td>
<td>55.087</td>
<td>55.087</td>
<td>1.721</td>
<td>0.19</td>
</tr>
<tr>
<td>Error</td>
<td>2125</td>
<td>68017.233</td>
<td>32.008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2126</td>
<td>982375.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>STD Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>986</td>
<td>20.56</td>
<td>5.650</td>
</tr>
<tr>
<td>Female</td>
<td>1141</td>
<td>20.88</td>
<td>5.664</td>
</tr>
<tr>
<td>Total</td>
<td>2127</td>
<td>20.73</td>
<td>5.659</td>
</tr>
</tbody>
</table>

With a mean difference of 0.32 (1.6%) between female and male participants, the result of this ANOVA analysis fails to reject the null hypothesis of no differences between males and females in terms of perceived academic achievement (H1). This analysis shows that the hypothesis was not supported by the data concluding that there does not appear to be any statistically significant differences between male and female students in terms of their perceived academic achievement while enrolled in public single-sex classrooms in South Carolina.
Motivation

In regards to the dependent variable motivation, ANOVA analysis calculated the group mean of male students to be 39.46 compared to a mean of 40.93 for female students and an overall mean of 40.25 for all students combined. Utilizing the criterion of a 95% confidence interval, ANOVA analysis identified a statistically significant difference between males and females in single-sex classrooms in terms of their perceived motivation (see table 9). This conclusion is drawn from a resulting p value of 0.002 which is less than the 0.05 criterion.

Table 9: ANOVA Results for Motivation

<table>
<thead>
<tr>
<th>Source of Variances</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>1</td>
<td>1110.387</td>
<td>1110.387</td>
<td>9.212</td>
<td>0.002</td>
</tr>
<tr>
<td>Error</td>
<td>2060</td>
<td>248302.968</td>
<td>120.535</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2061</td>
<td>249413.355</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>STD Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>959</td>
<td>39.46</td>
<td>11.196</td>
</tr>
<tr>
<td>Female</td>
<td>1103</td>
<td>40.93</td>
<td>10.786</td>
</tr>
<tr>
<td>Total</td>
<td>2062</td>
<td>40.25</td>
<td>11.001</td>
</tr>
</tbody>
</table>

With a mean difference of 1.47 (3.7%) between female and male participants, the result of this ANOVA analysis leads to the rejection of the null hypothesis relating to the perceived motivation of students (H2) finding statistically significant differences between males and females. This analysis shows that the hypothesis was supported by this data concluding that there does appear to be statistically significant differences between male and female students.
in terms of their perceived motivation while enrolled in public single-sex classrooms in South Carolina.

Self-Esteem

In regards to the dependent variable self-esteem, ANOVA analysis calculated the group mean of male students to be 15.26 compared to a mean of 15.87 for female students and a mean of 15.58 for all students combined. The difference in the results for male and female students is larger for this dependent variable than any other variable tested. Utilizing the criterion of a 95% confidence interval, ANOVA analysis identified a statistically significant difference between males and females in single-sex classrooms in terms of their perceived self-esteem (see table 10). This conclusion is drawn from a resulting p value of 0.001 which is less than the 0.05 criterion.

Table 10: ANOVA Results for Self-Esteem

<table>
<thead>
<tr>
<th>Source of Variances</th>
<th>Degrees of Freedom</th>
<th>Sums of Squares</th>
<th>Mean Squares</th>
<th>F Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Esteem</td>
<td>1</td>
<td>197.204</td>
<td>197.204</td>
<td>11.208</td>
<td>0.001</td>
</tr>
<tr>
<td>Error</td>
<td>2148</td>
<td>37794.89</td>
<td>17.595</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2149</td>
<td>37992.093</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>STD Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1002</td>
<td>15.26</td>
<td>4.311</td>
</tr>
<tr>
<td>Female</td>
<td>1148</td>
<td>15.87</td>
<td>4.091</td>
</tr>
<tr>
<td>Total</td>
<td>2150</td>
<td>15.58</td>
<td>4.205</td>
</tr>
</tbody>
</table>
With a mean difference of 0.61 (4.0%) between female and male participants, the result of this ANOVA analysis leads to a **rejection of the null hypothesis relating to the perceived self-esteem of students (H3)** finding statistically significant differences between males and **females**. This analysis shows that the hypothesis was supported by the data concluding that there does appear to be a statistically significant difference between male and female students in terms of their perceived self-esteem while enrolled in public single-sex classrooms in South Carolina.

**Influence of Control (Independent) Variables**

Each of the dependent variables (academic achievement, motivation and self-esteem) was regressed against the control (independent) variables (grade level, gender and ethnicity). Listwise regression analysis was conducted in an attempt to measure the relative influence of the control (independent) variables on the dependent variables. The result of this analysis confirmed the conclusions drawn as part of the hypothesis testing.

Before conducting this analysis, some of the control (independent) variables were transformed to facilitate the input requirements of SPSS. The values for the categorical variable of gender were converted from male and female to the nominal measures of 0 for males and 1 for females. Likewise, the categorical variable of ethnicity was split into separate variables for each of the ethnicities represented in the data. A variable was established for the ethnicity of Caucasian with a value of 1 given to those participants who were of the ethnic race of Caucasian whereas all other participants were coded with a 0. Other nominal variables of...
African American, Hispanic, Asian American and Other were created following this same logic. However, to minimize issues of multicollinearity, at least one ethnic group was excluded from each regression calculation.

**Academic Achievement**

The results of the regression analysis conducted for academic achievement are displayed in Table 11 and highlight the significance of grade level along with the ethnicities of African American and Hispanic.

**Table 11: Regression Results for Academic Achievement**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Achievement</td>
<td>0.325</td>
<td>0.105</td>
<td>0.104</td>
<td>5.351</td>
<td>2008</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Achievement</td>
<td>(Constant)</td>
<td>25.864</td>
<td>0.546</td>
<td>47.354</td>
</tr>
<tr>
<td></td>
<td>GRADE_LEVEL</td>
<td>-1.056</td>
<td>0.079</td>
<td>-0.283</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>0.218</td>
<td>0.24</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>1.651</td>
<td>0.596</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>2.32</td>
<td>0.26</td>
<td>0.198</td>
</tr>
</tbody>
</table>

These statistics show that grade level and the ethnicities of Hispanic and African American are statistically significant in the perceived academic achievement of all students with p values of 0.000, 0.006 and 0.000 respectively. Gender was again found not to be significant.
(p = 0.364) in terms of the dependent variable academic achievement. With a beta weight of -0.283, grade level has the greatest influence of any of the control (independent) variables. As grade level increases, the perceived academic achievement declines. The resulting R square value of 0.105 indicates that only a small percentage of the variation in academic achievement is explained by the model.

Motivation

The results of the regression analysis conducted for motivation are displayed in table 12.

Table 12: Regression Results for Motivation

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>0.350²</td>
<td>0.122</td>
<td>0.12</td>
<td>10.328</td>
<td>1954</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients B</th>
<th>Standardized Coefficients Beta</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>55.965</td>
<td>1.105</td>
<td>50.665</td>
<td>0</td>
</tr>
<tr>
<td>GENDER</td>
<td>1.315</td>
<td>0.47</td>
<td>0.06</td>
<td>2.8</td>
</tr>
<tr>
<td>CAUCASIAN</td>
<td>-3.849</td>
<td>0.508</td>
<td>-0.164</td>
<td>-7.571</td>
</tr>
<tr>
<td>GRADE_LEVEL</td>
<td>-2.35</td>
<td>0.157</td>
<td>-0.32</td>
<td>-14.971</td>
</tr>
<tr>
<td>HISPANIC</td>
<td>-0.39</td>
<td>1.143</td>
<td>-0.007</td>
<td>-0.341</td>
</tr>
</tbody>
</table>

In regards to the dependent variable of motivation, results show that grade level, gender and the ethnicity of Caucasian are all statistically significant with p values of 0.000, 0.005 and 0.000 respectively. Grade level has the greatest influence of any of the control (independent) variables with a beta weight of -0.32. As was the case with academic achievement, an increase
in grade level results in a decline in the perceived motivation of students. The resulting R square value of 0.122 indicates that only a small percentage of the variation in motivation is explained by the model.

Self-Esteem

The results of the regression analysis conducted for self-esteem are displayed in table 13.

Table 13: Regression Results for Self-Esteem

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Esteem</td>
<td>0.292 (\uparrow)</td>
<td>0.085</td>
<td>0.084</td>
<td>4.013</td>
<td>2030</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Esteem</td>
<td>(Constant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19.137</td>
<td>0.41</td>
<td>46.626</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>GRADE_LEVEL</td>
<td>-0.731</td>
<td>-0.262</td>
<td>-12.234</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>0.596</td>
<td>0.071</td>
<td>3.335</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>0.562</td>
<td>0.028</td>
<td>1.28</td>
</tr>
<tr>
<td>African American</td>
<td>1.266</td>
<td>0.194</td>
<td>0.146</td>
<td>6.522</td>
</tr>
</tbody>
</table>

In regards to the dependent variable of self-esteem, results show that grade level, gender and the ethnicity of African American are all statistically significant with \( p \) values of 0.000, 0.001 and 0.000 respectively. Grade level carries the greatest influence with a beta weight of -0.262. This statistic again indicates that as grade level increases, the perceived self-esteem of
students decline. The resulting R square value of 0.085 indicates that only a small percentage of the variation in self-esteem is explained by the model.

Summary

In the case of each dependent variable, grade level is seen to have the greatest influence and in each instance has a negative beta weight indicating that as students move up in class, the benefits of single-sex environments are less evident. These results support the conclusion that a diminishing effect might be taking place in single-sex classrooms where as students’ age and mature, some of the benefits of these environments decrease. This analysis found that grade level has a greater impact than either the gender or ethnicity of students.

The South Carolina data set included minimal variables that could be used as control (independent) variables thus limiting the analysis to only gender, ethnicity and grade level. Going into this study, the impact of ethnicity was thought to be of particular importance and could be a major contributing factor to identifying differences between male and female students. This idea was based on the reasoning that Caucasian male and female pupils are often afforded educational opportunities which are not available to African American or Hispanic students. Access to tutors or private schooling is only available to those who have the means to afford such services. It is this logic that promoted changes to the No Child Left Behind act to permit public single-sex schooling. This alternative is viewed by many to be a school choice option that had only been available to those fortunate enough to be able to send their children to private schooling which commonly constructs classrooms in a single-sex fashion.
Results of this analysis show that ethnicity is a confounding factor in some instances, however overall ethnicity does not have the impact that gender or grade level does. The resulting R square values of 0.105 for academic achievement, 0.122 for motivation and 0.085 for self-esteem indicate that the control (independent) variables explain only a small percentage of the variation in the three dependent variables. The data does show that the impact of grade level is far greater than anticipated or reported in previous studies. In response, additional analysis was conducted as part of this study to identify the impact of gender and ethnicity in relation to the different grade levels represented in this survey.

Analysis by Grade Level

Results from the ANOVA and regression analysis show that there seems to be some grade level effect take place in the South Carolina data. To extend this research, supplementary analysis was conducted to further explore the impact of grade level on the dependent variables.

Academic Achievement

When testing all grade levels independently, there were found to be statistically significant differences in 4th and 5th grade male and female students in regards to their perceived academic achievement in single-sex classroom. Results of this analysis are displayed in table 14.
Table 14: ANOVA Results for Academic Achievement by Grade Level

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Male (N)</th>
<th>Female (N)</th>
<th>Male Mean</th>
<th>Female Mean</th>
<th>F Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Grade</td>
<td>12</td>
<td>7</td>
<td>24.42</td>
<td>23.57</td>
<td>0.311</td>
<td>0.584</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>26</td>
<td>9</td>
<td>22</td>
<td>24.56</td>
<td>0.119</td>
<td>0.733</td>
</tr>
<tr>
<td>3rd Grade</td>
<td>0</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>4th Grade</td>
<td>81</td>
<td>62</td>
<td>21.32</td>
<td>22.98</td>
<td>4.288</td>
<td>0.04</td>
</tr>
<tr>
<td>5th Grade</td>
<td>134</td>
<td>238</td>
<td>20.61</td>
<td>22.77</td>
<td>14.48</td>
<td>0.00</td>
</tr>
<tr>
<td>6th Grade</td>
<td>274</td>
<td>293</td>
<td>21.52</td>
<td>21.97</td>
<td>1.105</td>
<td>0.294</td>
</tr>
<tr>
<td>7th Grade</td>
<td>137</td>
<td>226</td>
<td>19.3</td>
<td>18.86</td>
<td>0.465</td>
<td>0.496</td>
</tr>
<tr>
<td>8th Grade</td>
<td>282</td>
<td>267</td>
<td>18.48</td>
<td>18.98</td>
<td>0.991</td>
<td>0.32</td>
</tr>
<tr>
<td>9th Grade</td>
<td>40</td>
<td>38</td>
<td>21.8</td>
<td>21.24</td>
<td>0.302</td>
<td>0.584</td>
</tr>
</tbody>
</table>

ANOVA analysis generated the respective p values of 0.04 for 4th graders and 0.00 for 5th graders highlighting an effect taking place at these grade levels that is not present in all others.

In both 4th and 5th grades, females have higher mean scores than males reporting 22.98 and 22.77 for 4th and 5th grade females while only 21.32 and 20.61 for 4th and 5th grade males. The 10.5% difference between the group means of male and female 5th grade students is far greater than any other grade level indicating some confounding effect taking place which warrants further exploration. A discussion of the significance of the effect taking place amongst 5th graders will be covered in the summary section after each dependent variable has been reviewed.

Multiple regression analysis was conducted in an attempt to further explore the significance of the ANOVA analysis results and identify the relative influence of the control
(independent) variables on the dependent variables. The results of this regression analysis are displayed in table 15.

Table 15: Regression Coefficients for 4th & 5th Grade Academic Achievement

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th Grade</td>
<td>.301</td>
<td>.090</td>
<td>.057</td>
<td>3.758</td>
<td>143</td>
</tr>
<tr>
<td>5th Grade</td>
<td>.250</td>
<td>.063</td>
<td>.050</td>
<td>5.218</td>
<td>372</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>4th Grade</td>
<td>(Constant)</td>
<td>24.476</td>
<td>.487</td>
<td>50.214</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>-1.445</td>
<td>.643</td>
<td>-.186</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-.157</td>
<td>.730</td>
<td>-.018</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>.813</td>
<td>1.734</td>
<td>.039</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>2.480</td>
<td>1.744</td>
<td>.118</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-3.714</td>
<td>1.476</td>
<td>-.208</td>
</tr>
<tr>
<td>5th Grade</td>
<td>(Constant)</td>
<td>21.278</td>
<td>.544</td>
<td>39.088</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>2.125</td>
<td>.567</td>
<td>.191</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-1.628</td>
<td>.603</td>
<td>-.145</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>.113</td>
<td>1.029</td>
<td>.006</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>1.347</td>
<td>2.174</td>
<td>.032</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-1.629</td>
<td>1.094</td>
<td>-.078</td>
</tr>
</tbody>
</table>

This regression analysis shows that gender is a statistically significant factor in the perceived academic achievement of 4th and 5th grade students with p values of .026 and .000 backing the ANOVA analysis results. In terms of 4th grade students, the ethnicity of Other was found to have the greatest influence with a beta weight of -0.208, even greater than the -0.186 beta for gender. Since no other ethnicity variable was found to be significant, these findings
have little bearing on any conclusions involving ethnicity. Amongst 5th grade students, gender is found to have the greatest influence with a beta weight of 0.191. It is interesting to note the influence of gender in the 4th grade is negative as opposed to a positive influence in the 5th grade pointing to possible differences in the implementation of the 4th grade versus 5th grade single-sex educational programs. However, the relative influence the control (independent) variables is minimal as evidenced by the R square values of 0.090 for 4th and 0.063 for 5th graders.

Motivation

When all grade levels were tested independently, statistically significant differences were present in the perceived motivation of 5th and 6th grade males and females in single-sex classroom. Results of this analysis are displayed in table 16.
Table 16: ANOVA Results for Motivation by Grade Level

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Male (N)</th>
<th>Female (N)</th>
<th>Male Mean</th>
<th>Female Mean</th>
<th>F</th>
<th>Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Grade</td>
<td>11</td>
<td>6</td>
<td>49</td>
<td>49.33</td>
<td>0.011</td>
<td>0.918</td>
<td></td>
</tr>
<tr>
<td>2nd Grade</td>
<td>25</td>
<td>7</td>
<td>48.96</td>
<td>49</td>
<td>0</td>
<td>0.992</td>
<td></td>
</tr>
<tr>
<td>3rd Grade</td>
<td>0</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>4th Grade</td>
<td>75</td>
<td>59</td>
<td>47.87</td>
<td>48.56</td>
<td>0.319</td>
<td>0.573</td>
<td></td>
</tr>
<tr>
<td>5th Grade</td>
<td>137</td>
<td>223</td>
<td>39.66</td>
<td>44.06</td>
<td>16.526</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>6th Grade</td>
<td>253</td>
<td>286</td>
<td>41.44</td>
<td>43.4</td>
<td>5.368</td>
<td>0.021</td>
<td></td>
</tr>
<tr>
<td>7th Grade</td>
<td>135</td>
<td>222</td>
<td>36.54</td>
<td>37.5</td>
<td>0.567</td>
<td>0.452</td>
<td></td>
</tr>
<tr>
<td>8th Grade</td>
<td>285</td>
<td>262</td>
<td>35.08</td>
<td>36.4</td>
<td>1.981</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>9th Grade</td>
<td>38</td>
<td>37</td>
<td>43.13</td>
<td>40.78</td>
<td>1.446</td>
<td>0.233</td>
<td></td>
</tr>
</tbody>
</table>

This conclusion is confirmed by ANOVA analysis which generated the respective p values of 0.00 for 5th graders and 0.021 for 6th graders. In both 5th and 6th grades, females have higher mean scores than males reporting 44.06 and 43.4 for 5th and 6th grade females while only 39.66 and 41.44 for 5th and 6th grade males. Again, the 11.1% difference between the group means of male and female 5th grade pupils is far greater than any other grade level indicating some confounding effect taking place which warrants further exploration. A discussion of the significance of the effect taking place amongst 5th graders will be covered in the summary section after each dependent variable has been reviewed.

Multiple regression analysis was conducted in an attempt to further explore the significance of the ANOVA analysis results and identify the relative influence of the control (independent) variables on the dependent variables. The results of this regression analysis are displayed in table 17.
Table 17: Regression Coefficients for 5th & 6th Grade Motivation

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th Grade</td>
<td>.241&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.058</td>
<td>.045</td>
<td>9.949</td>
<td>360</td>
</tr>
<tr>
<td>6th Grade</td>
<td>.201&lt;sup&gt;b&lt;/sup&gt;</td>
<td>.041</td>
<td>.027</td>
<td>9.979</td>
<td>539</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>5th Grade</td>
<td>(Constant)</td>
<td>40.250</td>
<td>1.037</td>
<td>816</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>4.411</td>
<td>1.087</td>
<td>.211</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-1.713</td>
<td>1.169</td>
<td>-.080</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>1.316</td>
<td>1.996</td>
<td>.035</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>3.613</td>
<td>4.145</td>
<td>.045</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-2.615</td>
<td>2.165</td>
<td>-.064</td>
</tr>
<tr>
<td>6th Grade</td>
<td>(Constant)</td>
<td>42.490</td>
<td>.932</td>
<td>45.605</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>3.055</td>
<td>1.066</td>
<td>.151</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-2.261</td>
<td>1.121</td>
<td>-.108</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>.020</td>
<td>3.090</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>.482</td>
<td>5.039</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-3.236</td>
<td>3.836</td>
<td>-.044</td>
</tr>
</tbody>
</table>

This regression analysis shows that gender is a statistically significant factor in the perceived motivation of 5<sup>th</sup> and 6<sup>th</sup> grade students with p values of 0.000 and 0.004, backing the ANOVA analysis results. In terms of 5<sup>th</sup> grade students, gender was found to have the greatest influence with a beta weight of 0.211. Amongst 6<sup>th</sup> grade students, gender again maintained the greatest influence with a beta weight of 0.151. It is interesting to note the influence of gender at both 5<sup>th</sup> and 6<sup>th</sup> grade levels is positive and different than the findings related to academic achievement. However, the relative influence of the control (independent) variables is minimal as evidenced by the R square values of 0.058 for 5th and 0.041 for 6th graders.
Self-Esteem

When all grade levels were tested independently, statistically significant differences still existed in the perceived self-esteem of 5th and 6th grade males and females in single-sex classrooms. Results of this analysis are displayed in table 18.

Table 18: ANOVA Results for Self-Esteem by Grade Level

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Male (N)</th>
<th>Female (N)</th>
<th>Male Mean</th>
<th>Female Mean</th>
<th>F Ratio</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Grade</td>
<td>11</td>
<td>7</td>
<td>17.73</td>
<td>19.43</td>
<td>1.907</td>
<td>0.186</td>
</tr>
<tr>
<td>2nd Grade</td>
<td>25</td>
<td>9</td>
<td>17.64</td>
<td>17.89</td>
<td>0.025</td>
<td>0.876</td>
</tr>
<tr>
<td>3rd Grade</td>
<td>0</td>
<td>1</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>4th Grade</td>
<td>83</td>
<td>61</td>
<td>18.4</td>
<td>18.49</td>
<td>0.045</td>
<td>0.832</td>
</tr>
<tr>
<td>5th Grade</td>
<td>142</td>
<td>234</td>
<td>15.31</td>
<td>16.79</td>
<td>12.707</td>
<td>0.00</td>
</tr>
<tr>
<td>6th Grade</td>
<td>273</td>
<td>298</td>
<td>15.73</td>
<td>16.57</td>
<td>6.605</td>
<td>0.01</td>
</tr>
<tr>
<td>7th Grade</td>
<td>142</td>
<td>231</td>
<td>14.21</td>
<td>14.9</td>
<td>2.247</td>
<td>0.135</td>
</tr>
<tr>
<td>8th Grade</td>
<td>287</td>
<td>270</td>
<td>13.92</td>
<td>14.32</td>
<td>1.231</td>
<td>0.268</td>
</tr>
<tr>
<td>9th Grade</td>
<td>39</td>
<td>37</td>
<td>16.64</td>
<td>16.3</td>
<td>0.239</td>
<td>0.626</td>
</tr>
</tbody>
</table>

This conclusion is confirmed by ANOVA analysis which generated the respective p values of 0.00 for 5th graders and 0.01 for 6th graders. In both 5th and 6th grades, females have higher mean scores than males reporting 16.79 and 16.57 for 5th and 6th grade females while only 15.31 and 15.73 for 5th and 6th grade males. As is the case with the other two dependent variables, the 9.7% difference between the group means of male and female 5th grade students is strong indicating that some confounding effect is taking place which warrants further exploration. A discussion of the significance of the effect taking place amongst 5th graders will be covered in the summary section after each dependent variable has been reviewed.
Multiple regression analysis was conducted in an attempt to further uncover the significance of the ANOVA analysis results and identify the relative influence of the control (independent) variables on the dependent variables. The results of this regression analysis are displayed in Table 19.

Table 19: Regression Coefficients for 5th & 6th Grade Self-Esteem

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th Grade</td>
<td>.195&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.038</td>
<td>.025</td>
<td>3.916</td>
<td>376</td>
</tr>
<tr>
<td>6th Grade</td>
<td>.151&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.023</td>
<td>.014</td>
<td>3.932</td>
<td>571</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th Grade</td>
<td>(Constant)</td>
<td>15.407</td>
<td>.397</td>
<td>38.782</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>1.508</td>
<td>.418</td>
<td>.185</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-.299</td>
<td>.451</td>
<td>-.036</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>.120</td>
<td>.751</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>1.424</td>
<td>1.630</td>
<td>.045</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-.616</td>
<td>.808</td>
<td>-.040</td>
</tr>
<tr>
<td>6th Grade</td>
<td>(Constant)</td>
<td>15.988</td>
<td>.276</td>
<td>57.835</td>
</tr>
<tr>
<td></td>
<td>GENDER</td>
<td>.809</td>
<td>.331</td>
<td>.103</td>
</tr>
<tr>
<td></td>
<td>CAUCASIAN</td>
<td>-.786</td>
<td>.371</td>
<td>-.090</td>
</tr>
<tr>
<td></td>
<td>HISPANIC</td>
<td>.599</td>
<td>.830</td>
<td>.030</td>
</tr>
<tr>
<td></td>
<td>ASIAN</td>
<td>-.726</td>
<td>1.619</td>
<td>-.019</td>
</tr>
<tr>
<td></td>
<td>OTHER</td>
<td>-1.100</td>
<td>.977</td>
<td>-.047</td>
</tr>
</tbody>
</table>

This regression analysis shows that gender is a statistically significant factor in the perceived self-esteem of 5th and 6th grade students with p values of 0.000 and 0.015 backing the ANOVA analysis results. In terms of 5th grade students, gender was found to have the greatest influence with a beta weight of 0.185. Amongst 6th grade students, gender again
maintained the greatest influence with a beta weight of 0.103. It is interesting to note the influence of gender at both 5th and 6th grade levels is positive and matches the findings for motivation but are different than the findings related to academic achievement. However, the relative influence of the control (independent) variables is minimal as evidenced by the R square values of 0.038 for 5th and 0.023 for 6th graders.

Summary

Results of the analysis by grade level indicate that statistically significant differences between males and females do exist in the 4th, 5th and 6th grades in terms of the perceived academic achievement, motivation and self-esteem of students in single-sex classrooms. ANOVA and multiple regression results show overwhelming support for gender differences between male and female students in 5th grade single-sex classrooms. The ANOVA results for each of the dependent variables demonstrated a p value of 0.000 for 5th grade students indicating something is taking place at this grade level that is not at others. A review of the survey results show no irregularities in the distribution of schools represented in the sample of 5th grade students. Also, the sample size of 5th graders is in line with other grade levels but the split of males to females is 36% to 64% showing that males might be under-represented. However, the responses from 7th graders is split 37.7% males to 62.3% females but does not produce the gender differences that are evident at the 5th grade level. Since there appear to be no disparities in the data set, the question involving the cause of the strong effect taking place
amongst 5th graders may only be answered through the observation of the classrooms themselves as well as personal interviews with survey participants.

Taking a look at the data involving 5th graders might bring to light some possible explanations when compared with the values for all grade levels combined. The mean values for each of the dependent variables are displayed in table 20 comparing the values for 5th graders to the overall mean values for all grade levels. In assessing this data, some interesting findings highlight benefits that are achieved by 5th graders that are not quite as evident for other grade levels.
Table 20: Comparison of 5th Grade Mean Values

<table>
<thead>
<tr>
<th></th>
<th>All 5th Grade</th>
<th>Male 5th Grade</th>
<th>Female 5th Grade</th>
<th>African American All 5th Grade</th>
<th>Caucasian All 5th Grade</th>
<th>Hispanic All 5th Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Achievement</strong></td>
<td>20.73</td>
<td>21.99</td>
<td>20.56</td>
<td>20.61</td>
<td>20.88</td>
<td>22.77</td>
</tr>
<tr>
<td></td>
<td>21.4</td>
<td>22.71</td>
<td>19.45</td>
<td>20.95</td>
<td>21.26</td>
<td>22.67</td>
</tr>
<tr>
<td><strong>Motivation</strong></td>
<td>40.25</td>
<td>42.39</td>
<td>39.46</td>
<td>40.93</td>
<td>44.06</td>
<td>41.26</td>
</tr>
<tr>
<td></td>
<td>41.26</td>
<td>43.17</td>
<td>38.21</td>
<td>41.15</td>
<td>42.05</td>
<td>44.00</td>
</tr>
<tr>
<td><strong>Self-Esteem</strong></td>
<td>15.58</td>
<td>16.00</td>
<td>15.26</td>
<td>15.87</td>
<td>16.79</td>
<td>15.95</td>
</tr>
<tr>
<td></td>
<td>16.38</td>
<td>14.91</td>
<td>16.03</td>
<td>15.59</td>
<td>16.38</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Male</th>
<th>Female</th>
<th>African American</th>
<th>Caucasian</th>
<th>Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Academic Achievement</strong></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>2127</td>
<td>372</td>
<td>986</td>
<td>134</td>
<td>1141</td>
<td>238</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>2062</td>
<td>360</td>
<td>959</td>
<td>137</td>
<td>1103</td>
<td>223</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>2150</td>
<td>376</td>
<td>1002</td>
<td>142</td>
<td>1148</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>Self-Esteem</strong></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>2150</td>
<td>376</td>
<td>1002</td>
<td>142</td>
<td>1148</td>
<td>234</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>Valid N (listwise)</strong></td>
<td>1891</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


These statistics show that all mean values for the 5\textsuperscript{th} graders are greater than those for all grade levels combined. When combining all of the dependent variables together, the cumulative value for 5\textsuperscript{th} grade males is less than 1\% greater than all grade levels combined. On the other hand, the combined mean value of 5\textsuperscript{th} grade females is over 7.6\% greater than all grade levels combined demonstrating stark differences between males and females at this grade level. Unexpectedly, the 5\textsuperscript{th} grade cumulative mean value for the ethnic group of Caucasian is 7.66\% greater than all grade levels whereas African American and Hispanic are only 4.64\% and 5.26\% greater than the average for all grade levels. These results surrounding ethnicity are dramatically different than other grade levels where African American and Hispanic participants perceive more benefits than Caucasian participants. Caucasian females seem to draw more benefits at the 5\textsuperscript{th} grade level than any other grade level tested. The reason behind the unusually high scores at the 5\textsuperscript{th} grade level warrants further exploration, but is outside the scope of this study. This observation needs further research in order to contribute to ongoing research involving single-sex education.
CHAPTER FIVE: CONCLUSION

The literature reviewed in this paper highlights the impact of gender bias at all levels of education. This bias was found to ultimately affect the motivation, academic achievement and self-esteem in both male and female students. Societal gender stereotyping has long influenced available educational and career opportunities which can ultimately affect the success and socioeconomic status of both genders. Educators and researchers continue to debate what educational programs offer the most gender equitable environments alternating between single-sex educational settings where males and females are taught in separate classrooms versus coeducational settings where the genders are integrated. The current educational environment not only in the United States but throughout the World utilizes varying degrees of venues including both single-sex and coeducational systems in public and private institutions according to the needs of the students.

Past research on single-sex education has found mixed support that this educational system improves student motivation, offers greater academic achievement opportunities and enhances the self-esteem of both boys and girls. However, as indicated in the review of literature, past and present research was hindered by selection bias and other methodological issues. Some of the research limitations could be minimized by utilizing large sample sizes. Existing longitudinal studies presently in progress in conjunction with the National Associations for Single Sex Public Education offer opportunities and a means of examining educational
gender issues. Future research on single-sex education should consider all aspects of classroom educational instruction including the interaction of the teacher-student, the academic requirements related to the core curriculum, the adequacy of the facilities and other instructional material as well as the interaction of students with other students. Additionally, further research should also focus on the interaction of the teacher’s gender within different course subjects in both single-sex and coeducational environments. Future research efforts which are attempting to contribute empirical evidence to the debate on the use of single-sex education should weigh the extent of the impact each gender indicator has on educational achievements and related outcomes for male and female students.

Interpretation

By and large, research results have been mixed on the evaluation of the effectiveness of single-sex classrooms in terms of the perceived benefits received by males and females. Some research findings have found differences between males and females whereas other studies found no differences. Research results obtained as part of this study did find some differences between males and females enrolled in single-sex classroom. However, these differences were present in only certain grade levels (4th through 6th grade) depending on the variable tested. Also, other control (independent) variables such as grade level and ethnicity seem to have some impact on the perceived benefits received by male and female students making it difficult to draw any direct cause and effect conclusions. Although some gender differences were
identified as part of this study, the study failed to provide any clear evidence supporting the use of single-sex public education.

Unfortunately, these results are in line with past studies that have attempted to test educational differences between male and female students. A study conducted in early 2000 by researchers at Emory University attempted to diagnose the effect of gender stereotyping on the motivation and achievement of students in reading, writing, and language arts. The authors concluded “that it is the masculinity or femininity of students’ beliefs rather than their gender per se that account for differences in motivation and attainment between girls and boys. Most of the significant advantages in motivation and achievement accrue to pupils with ‘feminine’ beliefs, whilst the desire to succeed is a function not only of a ‘masculine’ mindset, but very specifically related to boys rather than girls” (Pajares and Valiente 2001, p.366). These findings highlight the gender stereotyping that exists within different course subjects which have trained females to believe they will perform better in reading, writing and language arts whereas males have been taught to believe that they will excel in math and science courses.

In California, the Jefferson Leadership Academies was the first public middle school in the United States to offer separate classes for girls and boys starting in 1999. In total, about 1,000 students in sixth, seventh and eighth grades participated in single-sex classes over the next several years. Results showed that the grade point average of 6th and 7th graders who had attended coeducational classrooms improved in grades seven and eight when switching over to single-sex classes (Sharpe 2000). This increase was statistically significant for both male
and females at grade seven and only for males at grade eight. In spite of this success, Kristi Kahl, then the coordinator of the Long Beach California Unified School District’s middle school reform, acknowledged that “it is really hard to say how you can attribute [improvements] to gender separation, how much you can attribute to instruction, and how much you can attribute to parent commitment. But in reality, probably all of those things come into play” (Sharpe 2000, p.1). This example highlights the challenges of single-sex educational research to clearly delineate the impact of single-sex education as opposed to other environmental variables.

Limitations

Substantial and significant evidence exists documenting the success of some students who participate in single-sex educational environments. However, in almost every instance, research surrounding single-sex education is hampered by selection and observation biases which lessen the ability of researchers to make any definitive conclusions. Research on single-sex education has also been limited by many environmental variables which are difficult to measure. Some of these research limitations are documented below.

Pygmalion Effect

Mixed research results on the effectiveness of single-sex education can be attributed to many factors ranging from poor research methods, to differing measurement instruments that are based on state defined achievement tests as well as other confounding effects. Thought to have a significant impact on research results, the observer-expectancy effect can produce
biased expectations that affect reality and can create a self-fulfilling prophecy. The Pygmalion Effect, first coined by Robert Rosenthal and Lenore Jacobson in 1968 in reference to Greek mythology as well as George Bernard Shaw’s play, refers to incidents where some students perform better than others just because they are expected to do so. As part of their research, Rosenthal and Jacobson found that students who were labeled good students by their teachers performed better because of this expectation whereas students who were labeled bad students performed worse because of this negative influence (Rosenthal and Jacobson 1968). The Pygmalion Effect closely relates to the Hawthorne Effect which suggests that study participants perform better simply because they are being observed.

In a 1963 paper published in the *American Scientist*, Robert Rosenthal hypothesized “that experimenters’ expectations might affect the responses obtained from their research subjects within the context of the psychological experiment” (Rosenthal 1963, p.280). As part of his conclusion, Rosenthal postulated that this same type of self-fulfilling prophecy might exist in the classroom whereby the expectations of teachers ultimately affect the intellectual performance of their students. Shortly after publication, Rosenthal was contacted by Lenore Jacobsen, then principal of an elementary school in California, to explore the basis for his claim and offered the use of her school as a test subject for experimentation of this self-fulfilling prophecy concept.

As part of this experiment, false information was given to teachers about the past performance of their students in regards to IQ test scores. From the results of these IQ tests,
the researchers identified “spurters” who were about to have a spurt in academic performance. However, these “spurters” where identified at random with no consideration given to the IQ test results. The names of these “spurters” where shared with teachers. The same IQ test was administered to all students after years one and two showing that a significant number of the “spurters” had actually made performance and intellectual gains and had maintained these improvements over time. Also, the written reports from teachers as well as the grades given by these teachers showed marked improvements in behavior and learning for most of these “spurters” (Yatzin 2009).

Rosenthal and Jacobson noted that teachers gave “spurters” subconscious signals through the use of body language that showed more support for these “spurters”. Examples of this body language included nods of approval and smiles directed towards “spurters”. “Spurters” were also given more opportunities to ask and answer questions and teachers used a different tone of voice when speaking with “spurters”. The results of this experiment showed that teachers’ expectations of students and their unconscious communication of those expectations improved the academic success of those students who were thought to be academically promising (Rosenthal and Jacobson 1968).

Many studies have been conducted since the Pygmalion Effect was first documented to further boost the claim that teacher expectations impact the learning process of students. As a result, critics have come to accept that a teacher’s expectations are an important and determining factor in the success of children. As noted by Rosenthal in 1978, “345 studies have

104
been conducted and they show beyond doubt that interpersonal self-fulfilling prophecies not only occur, but that their average size of effect is far from trivial” (Rosenthal and Rabin 1978, p.377).

Additional work by Rosenthal on the Pygmalion Effect led to the development of a four factor theory of the mediation of teacher expectancy effects as well as the establishment of instruments which could be used to measure a students’ sensitivity to nonverbal cues emitted by their teachers. As part of the four factor theory, Rosenthal hypothesized that a teachers’ behavior can be categorized in one of four buckets that relates to a teachers’ expectancy effect. The first factor is climate and refers to the socioemotional climate that teachers create for their students. Higher expectancy students are afforded a warmer climate which is evident in both verbal and nonverbal communication channels while lesser expectant students are commonly given the “cold shoulder”. The second factor of feedback points to an instructors’ tendency to give more differentiated feedback to higher expectancy students thus allowing these student’s to better understand the corrections needed to master a particular skill or technique. The third factor of input is an indicator of the tendency of teachers to use quantitatively more material as well as material that is academically more challenging for higher expectancy pupils. The final factor of output references the tendency of teachers to spend substantially more time with higher expectancy pupils as well as provide them with numerous opportunities to respond, neglecting those students with a lower expectancy (Rosenthal and Jacobson 1968; Tauber 1998).
Many characteristics possessed by students influence the expectations of teachers, providing a mechanism by which teachers draw predetermined conclusions. Self-fulfilling prophecy research conducted by Good (1987) shows that teachers assign labels to pupils based upon characteristics such as gender, ethnicity, race, body build, surname and/or given name, dialect, attractiveness, and socioeconomic status among others (Good 1987). Once a person is given a label, they are treated based upon the preconceived perceptions of others with similar characteristics. For example, research shows that a mesomorph person, one with a great body build that is muscularly defined but tone, is better off than ectomorphs, one with thin or chubby body types. Mesmorphic are predicted to be more competent, to be better professionals, go on to assume more leadership roles, put the concerns of others before their own, and even turn out to be better parents (Brylinsky and Moore 1984; Collins and Plahn 1988). The same methodology applies to attractive people where research shows that charismatic students are bestowed with positive attributes just because of their looks as opposed to their academic performance (Kenealy, Frude and Shaw 1988). In terms of education, the self-fulfilling prophecy has been found to be a two-way street. Using the characteristics mentioned above, students are just as likely to form expectations similar to and as often as their teachers (Hunsberger and Cavanagh 1988).

Clearly, sound empirical evidence has been presented and widely accepted that suggests that the expectation of teachers greatly impacts student success. Surely, these teacher expectations would exist in both coeducational and single-sex classrooms skewing the
results of any research that compared the effectiveness of these two environments. Further research on single-sex education will need to control for the effects of teacher expectations to boast the validity of single-sex research findings.

Other Explanatory Variables

Behavioral or social science research is not always as clear cut as research conducted within the realm of the physical sciences. Because of this, social science research results tend to be affected by many confounding variables that are not only difficult to control but also difficult to identify and measure. Moderator variables may limit or change the relationship that independent (control) variables have on single-sex schooling and important outcomes. “One obvious moderator is the sex of the student: SS schools may affect girls differently than they affect boys. Also, the level or age of the students could moderate the effects of SS schools; for instance, they could be more beneficial for students in high school than elementary school” (Mael, Smith, Alonso, Rogers and Gibson 2004, p.ii). Further, developmental characteristics or the specific personality of girls and boys might moderate the effects of single-sex schooling.

Some researchers who have studied single-sex education have come to the conclusion that gender differences in brain activity between males and females affects their ability to learn. Michael Gurian established the Gurian Institute in 1996 as an entity to further research neuro-biology and the interoperability of the brain. Gurian’s research has primarily focused on the field of education discovering the means by which humans learn. Early on, Gurian bought into the notion that girls and boys learning capabilities were a function of the brains ability to
process information presented to it and because of this link he felt instruction was most effective in gender separate learning environments. Likewise, a girls’ brain functions different than a boys’ to process and interpret material dissimilarly. Research has proven that some regions of the brain that are involved in mechanical reasoning, spatial reasoning and visual targeting appear to mature on average four to eight years earlier in males. The parts of the brain that handle verbal fluency, recognizing familiar faces and handwriting develop several years earlier in girls (Ripley 2005).

Many believe that the personality and behaviors of students is one of the biggest contributing factors in determining the success of any learning environment. However, significant evidence exists that suggests that adolescent brain development varies for both males and females and as such should be considered in the development of instructional techniques. Despite this proof, the explanation that brain differences between males and females is hotly contested more so than the theory that a students’ personality contributes to their academic success. “Jay Geidd, one of the preeminent neuroscientists studying brain development in children (including gender difference) cautions that gender is much too crude a tool to differentiate educational approaches: the variation within each gender is often larger than the average difference between genders, and there’s substantial overlap in the distributions” (Mead 2008, p.1). As has been apparent in most social science research initiatives, confounding or moderating variables are ever present, hindering the ability of
researchers to draw any definitive conclusions linking brain development difference between adolescent boys and girls.

Summary of Findings

However inconclusive the evidence surrounding the impact of single-sex education, numerous applications and reports of its success suggest that educating youth in gender segregated environments can be successful in some settings for some students. Further research is needed to identify the environmental variables which impact the learning process the most. For example, it is believed that the pedagogical techniques utilized by the instructor can play a major role in the effectiveness of students understanding the concepts presented to them. Some techniques are said to be more successful with girls whereas others work better for boys. A better understanding of the impact of the different instructional methods will help clarify the uncertainty surrounding the effectiveness of single-sex public education and allow for structured approaches to be implemented in single-sex environments which are backed by sound empirical evidence.

Successful applications of single-sex education seem to maintain some unique characteristics which are not always prevalent in coeducational environments. As noted in the Woodward Elementary study, instruction is tailored based on the behavior of the students. Instructors of the boys’ classrooms use lessons which allow the students to get up out of their seats and maintain a high level of interactivity in a fairly unstructured environment. However, girls’ instructors provide a more stable environment which is structured in a manner where the
students know what to expect and when. These environments are flexible and provide a culture that promotes comfortable surroundings while limiting distractions that hamper the learning process. It is this type of critical analysis that is needed of all single-sex public educational efforts as a means to understand when single-sex environments are most productive.

Although this study found no differences in the perceived academic achievement of male versus female students, quantifiable statistically significant evidence exists supporting the improvements in academic achievement for both boys and girls who participate in single-sex schooling. These improvements can be found in all subject areas from mathematics, to language arts, social studies and science achievement test scores. Approximately a third of the research projects within these different subject areas have shown positive effects for single-sex schoolings. The remainder of the studies have shown mixed or null results (Mael et al. 2004), granted the research methods along with the validity and reliability of some of these studies could be questioned. When looking at academic performance regardless of the subject area, about half of the studies support improvements in single-sex classes while the rest found no difference and reached a null conclusion. However, few if any found academic improvements in coeducational schooling, signifying overwhelming support for single-sex schooling as a public school choice option (Mael et al. 2004). Despite this empirical evidence in support of single-sex public education, only a couple of studies have attempted to collect data over a long-term to highlight the lasting effects of single-sex schooling. As research in this area is in its infancy,
more longitudinal studies will need to be conducted to document the long-term effects of
single-sex schooling on academic success, college graduation rates, postsecondary test scores,
gr graduate school admissions, and even career achievement.

In terms of socio-emotional development as well as individual student adaption, the
evidence is not as clear cut. Of those studies on single-sex education that looked at a student’s
self-concept and/or locus of control, about half showed positive benefits in single-sex
environments while the remainder found no difference at all (Mael et al. 2004). In testing the
concept of self-esteem, results seemed to be even more confusing. On the surface, research
indicates that males demonstrate a higher level of self-esteem in coeducational environments
whereas the self-esteem of females seems to be greater in single-sex schools. However, these
results may appear insignificant as the relationship between self-esteem and schooling success,
long term career achievement, delinquent behavior and leadership have been found to be
modest to nonexistent (Mael et al. 2004).

Although research results from this study show little to no effect of ethnicity on a
student’s academic achievement, motivation and self-esteem, other past research has shown
single-sex classrooms to be particularly beneficial to minorities or those with a lower
socioeconomic status. Research by Riordan (1990) uncovered not only positive impacts for girls
but even more dramatic improvements for Hispanic and African American children regardless
of gender (Riordan 1990). He confirmed these results finding tests scores for Hispanic and
African American students to be on average almost one year higher for pupils in single-sex
classrooms as opposed to those in coeducational settings (Riordan 1994). During a roundtable discussion conducted by the American Association of University Women (AAUW) in 1997, Riordan summarized existing research efforts noting the benefits of single-sex schoolings as being:

“The academic and developmental consequences of attending one type of school versus another type of school are virtually zero for middle-class and otherwise advantaged students; by contrast, the consequences are significant for students who are or have been historically or traditionally disadvantaged – minorities, low- and working-class youth, and females (so long as the females are not affluent)” (Riordan 1998, p.53).

Finalized in 2009, the Black and Latino Male School Intervention Study (BLMSIS) was a three year study funded by the Bill and Melinda Gates Foundation that attempted to identify the factors and interventions in single-sex schools that are most beneficial to Black and Latino boys. The results of this study highlighted multiple theories explaining why single-sex schooling is a viable educational intervention model for the dilemma facing inter-city Black and Latino boys. One theory in particular, outlined in figure 8, encompasses the BLMSIS Single-Sex Schools Preliminary Theory of Change (Fergus, Sciurba, Martin and Noguera 2009).
Figure 8: BLMSIS Theory of Change

This theory frames educational success as a factor of both social/emotional issues and academic issues. As such, single-sex schools are expected to provide a positive, nurturing community with a leadership and brotherhood philosophy along with social/emotional elements such as community meetings, advisory sessions and pride groups. In response to this environment, students are expected to have a higher likelihood of success as well as being more culturally responsive. The net result of these efforts output more Black and Latino boys who have higher academic performance and go on to assume more urban leadership roles (Fergus et al. 2009).

So why is it that some students do better in single-sex environments than they do in coeducational schools? One of the most prominent explanations offered is the influence that the opposite sex has over each other. In coeducational classrooms, “there is a good deal of
gawking, speculating, and general preoccupation with those of the opposite sex who are most proximate” (Hawley 1994, p.13). By eliminating this influence, single-sex classrooms enable students to focus on academics allowing them the opportunity to “pursue their studies, classroom discussions, and school activities without needing to be confronted on a daily basis with male-female socializations issues” (Lee and Marks 1990, p.589). The principal of the single-sex school Jefferson Leadership Academies, Jill Rojas, has first-hand experience with the impact that social distractions can have and the benefits that can be obtained by eliminating these distractions. As stated by Rojas, “we have seen many students start to focus heavily on academics. They no longer clown or try to impress the opposite sex. Girls are more apt to answer questions aloud in class as well as ask them. Girls are learning to be more academically competitive and boys are learning to collaborate” (Rojas 2000, p.1).

Riordan’s research offers several other explanations of the positive benefits of single-sex schools to include:

- A greater degree of control and order;
- The fading strength of youth’s cultural values;
- The use of more successful role models;
- A decrease of sex differences in opportunities and curriculum;
- A decrease of sex bias in student-teacher interaction;
- A decrease of sex stereotypes in peer interaction;
- More leadership opportunities are available; and
- Parent/student choice option which promotes academics (Riordan 1994).

Research by Trickett, Trickett, Castro and Schaffner (1982) found that single-sex schools were perceived to have a greater academic orientation and focus, along with enhanced competition and task emphasis as opposed to coeducational schools (Trickett, Trickett, Castro and Schaffner 1982). Overwhelmingly, research has found significant and substantial benefits to females, minority and at-risk students who participate in single-sex environments. However, the benefits to males are not as clear and this is particularly evident in the case of Caucasian males. According to past research, Caucasian males in single-sex classrooms only perceive slight benefits or none at all in relation to coeducational environments.

**Recommendations**

As has been the case in all research studies looking at single-sex education, impartial and methodically sound research methods have been practically nonexistent, diminishing the ability of researchers to generalize results across broad populations of students. Because of this deficiency, critics such as the National Organization of Women and the American Association of University Women have been steadfast in their dispute and denial of the benefits proposed by single-sex environments. To address these concerns, highly structured and formalized experiments need to be conducted controlling for selection bias, teacher expectancy effects and varying types of pedagogical techniques presently in use. These studies should also attempt to collect data over multiple time periods as well as include a look at the long-term outcomes such as performance in college, graduate school admissions, career success, criminal
records and other data points. Until rigorous evidence based research is developed supporting single-sex schooling, any policy decisions supporting such environments will be highly criticized.

Few single-sex education studies have addressed the satisfaction of both teachers and parents involved in single-sex classrooms. The South Carolina data set did include survey results for parents and teachers; however the sample size of these participants was minimal highlighting limitations in the data to study multiple constituent groups. The influence that both parents and teachers have on the success of students is significant and because of this, these constituents should be included as part of experimental designs developed to test the effectiveness of single-sex classrooms in relation to coeducational environments.

Because of the complexity in forming and identifying successful educational solutions that can be applied generally, educational best practices don’t exist and little effort has been put forth to develop these. However, guidelines need to be developed by the different government agencies responsible for public education which can describe how best single-sex education can be implemented, arming students, parents and teachers with the information needed to make the experience as successful as possible. Much of the teaching efforts in single-sex classrooms are presently based on trial and error causing great disparities in the success of different single-sex programs. With guidelines outlining best practices, single-sex education can be given a firm footing from which programs can start.

The Gurian Institute, previously mentioned, has attempted to provide some structure to single-sex educational programs by implementing a comprehensive training program that
instructs prospective and current teachers on the pedagogical techniques that work best in single-sex environments. As noted by Gurian in the summer of 2009, the Gurian Institute had trained over forty thousand teachers in more than two thousand districts and schools over the past decade in both single-sex and coeducational environments (Gurian, Stevens and Daniels 2009). If single-sex education is to be embraced as a viable alternative for our public schools, a government sponsored entity should be established at the federal level to support the different states in their efforts to promote single-sex education. This entity would be responsible for coordinating research, establishing methodologies by which new single-sex programs could be launched, providing training resources on effective single-sex pedagogical techniques, and monitoring the overall progress of single-sex education to ensure the principals embedded within the No Child Left Behind Act which permit single-sex education are followed to the fullest extent.

Implications

From this research and the evidence presented, it is possible to deduce the general elements which are most beneficial to the ‘ideal’ intervention study on single-sex education. An effective and contributing study should: (1) utilize large sample sizes along with a standardized assessment of students’ characteristics in an attempt to control for student selection into single-sex or coeducational classrooms using appropriate statistical techniques, (2) be longitudinal in nature to capture and report on the results from multiple schooling years to assess the potential long-term effects as well as to draw upon differences in pedagogical
techniques, (3) reduce the confounding factors related to the educational treatment of students in different groups (i.e. ensure that the same teacher instructs both single-sex as well as coeducational groups), (4) prevent Pygmalion Effects as much as possible by concealing the purpose of the gender-related intervention project, and (5) reduce and limit attrition in the sample as well as group changes which can be accomplished by careful supervision of the project. Items three through five require the attention and support of the participating teachers who need to ensure that known biases are eliminated or minimized. The use of written guidelines as well as regular meetings between researchers and the teachers is vital to the successful implementation of single-sex education research projects and will ultimately lead to the development of the sound empirical evidence needed to assess the full impact of separating boys and girls in different learning environments.

Summary

The history surrounding public education in the United States has greatly changed over time taking on many forms in attempt to maximize student outcomes. However, concerns of gender inequality brought on changes where single-sex educational environments were an accepted and common public education practice in the late 1800’s and early 1900’s to exclusive use of mixed gender environments in the middle and late 1900’s. However, research supporting single-sex educational environments has brought on policy changes permitting the use of single-sex classrooms in public schools. These changes were outlined as part of the No
Child Left Behind Act in 2006 detailing the circumstances by which schools could offer single-sex classrooms.

In response to this policy change, the use of public single-sex classrooms has grown tenfold since 2006 with more than 500 classrooms nationwide catering to male and female students separately. The South Carolina Department of Education has embraced the use of single-sex public classrooms more so than any other state offering well over 300 single-gender classrooms. As such, the Office of School Choice within South Carolina’s Department of Education, actively monitors the success of these classrooms engaging participants to provide regular feedback. One avenue of feedback includes a survey administered to students, teachers and parents who are involved in these single-gender classrooms. This survey was first administered from April to May 2008 and the results of which were obtained for additional analysis.

As part of this analysis, survey questions were assessed in an attempt to identify indexes representative of student outcomes while enrolled in single-sex classrooms. The three dependent variables of academic achievement, motivation and self-esteem where validated with reliability analysis testing for Cronbach’s Alpha. ANOVA analysis was conducted against these dependent variables identifying differences between male and female students in terms of their perceived motivation and self-esteem. No statistically significant differences were identified in regards to the perceived academic achievement of male versus female student’s, however differences were identified in the perceived motivation and self-esteem of these
students. Regression analysis confirmed these findings but in the process highlighted the substantial impact that grade level had on the results. In response, additional analysis was conducted to explore the diminishing impact of single-sex classrooms in relation to grade level. As a result, grades 4th, 5th and 6th showed the highest levels of perceived academic achievement, motivation and self-esteem while older grade levels saw much less of an impact on the dependent variables.

Additional research should be structured to factor in grade level or age as well as ethnicity and other demographic variables to better formulate the picture of who stands to benefit most from public single-sex education. Research has shown this educational alternative leads to positive outcomes to some students in some situations. However, highly structured and tightly controlled studies which track progress over a long period of time are needed to further support these claims and attempt to clarify all of the factors that impact student success such as the teaching skills of the teacher, the use of performance proven pedagogical techniques, as well as the multitude of environmental variables that are present in public classrooms across the United States.
APPENDIX INITIAL SOUTH CAROLINA SURVEY RESULTS

South Carolina Surveys on Single-Gender Education, May 2008

Three surveys were posted on the South Carolina Department of Education website in April and May 2008. The link to the surveys was sent to schools with single-gender classes, and teachers were encouraged to ask their students and parents to complete the survey as well as complete their own survey. Participants were asked to indicate their level of agreement to different statements. There were seven levels of agreement: Strongly Agree, Agree, Somewhat Agree, Neutral, Somewhat Disagree, Disagree, and Strongly Disagree. The surveys closed on May 9, 2008. Roughly 2200 students, 178 parents and 181 teachers completed the surveys from 41 different elementary, middle, and high schools around the state. Some schools started with single-gender classes in August 2007 and others have had more experience. The number of students completing the survey at each school varied from 1 student to 294 students. Participation in all surveys was voluntary and identity was anonymous.

The purpose of the survey was to be a tool for schools to learn more about student, parent, and teacher perception of their single-gender program as well as the overall perception of single-gender education in the state. It was designed with the intent of helping schools and the state learn what was working and what needed attention in terms of student, parent, and teacher perception and the impact that the program was having on its students.

Questions, please contact:
David Chadwell, Coordinator for Single-Gender Initiatives
Office of Public School Choice
South Carolina Department of Education
1429 Senate Street, B-10-A
Columbia, SC 29201
803-734-6261
dchadwel@ed.sc.gov
South Carolina Surveys on Single-Gender Education, May 2008

Common Strands Across All Surveys
- Overall, teachers perceive single-gender classes as having an impact on the categories at the highest percentage (80%), parents (75%), students (66%).
- Improvement with Behavior is the category with the lowest level of agreement across all three groups though typically above 50% for each.
- African-American students and parents agree at a higher rate than Caucasian students and parents.
- The categories with the highest level of agreement were different for each group.

Student Results
- Overall, more than two-thirds of the students agree that single-gender education is a factor in improving each of the categories.
- Overall, less than twenty percent of the students disagree that single-gender education is a factor in improving each of the categories.
- Nearly three-quarters of the students agree that single-gender education is a factor in improving in Desire to Succeed (72%), Participation (72%), Ability to Succeed (73%), and Determination (73%).
- Students indicate that they have friends outside of single-gender programs.
- Students indicate that they are comfortable talking with students of the opposite gender.
- Girls tend to agree at a higher percentage than boys, 60-80% and 50-70% respectively.
- Female highest agreement is with Desire to Succeed (75%), Independence (74%), Participation (74%), Ability to Succeed (75%) and Determination (75%).
- Male highest agreement is with Ability to Succeed (72%) and Completing Classwork (72%)
- Attitude toward School and Behavior had the lowest agreement at 60% and the highest disagreement at 23% and 20% respectively.
- African-Americans had the highest agreement with Desire to Succeed (77%), Ability to Succeed (78%) and Determination (77%).
- Elementary students agreed at a higher rate than middle school students.
- High school students agreed at a higher rate than middle school students.
- Eighth grade lowest agreement from 50-60%.
- Seventh grade had a lower agreement within 60-70%
- Caucasians had the lowest agreement 50-65%, but disagreement was typically less than 20%
Teacher Results

- Overall, more than 80% of the teachers agree that single-gender education is a factor in improving each category.
- Teachers of female students agree more than teachers of males.
- Behavior is the category with the lowest agreement 78% for teachers of females and 70% for teachers of males.
- Teachers at all levels (Elementary, Middle, High) tend to agree at a percentage of 80% for each of the categories.
- Teachers believe that the categories with the greatest area of improvement for students are Collaboration (92% female, 87% male) Participation (91% female and 86% male) and Self-Confidence (90% female and 86% male).
- ELA teachers agree at a higher percentage than Math, Science, and Social Studies teachers.
- Behavior tends to be the category with the lowest levels of agreement across teachers by subject area, though ELA is the highest of these.
- For teachers of girls, the lowest level of agreement and highest level of disagreement is with Math Teachers.
- For teachers of boys, the lowest level of agreement and highest level of disagreement is with Social Studies Teachers.
- ELA teachers tend to agree between 80-90%.
- Math, Science, and Social Studies teachers tend to agree between 70-80%.
- Independence and Participation tend to be between 80-90% agreement for subject area teachers.
- Attitude tends to be at least two-thirds agreement for subject area teachers.
- Math teachers agree at the lowest percentage for females, but still typically three-fourths or more (except for behavior and attitude). Science teachers agree within the highest percentages for females typically 90%.
- Science and Social Studies teachers agree at a lower percentage for boys, but typically around two-thirds agreeing.
Parent Results

- Overall, typically three-quarters of the parents agree that single-gender is a factor in improving their child in each of the categories.
- The categories with the highest level of agreement for parents are Self-Esteem (80%), Independence (79%), and Self-Confidence (78%).
- Behavior is the lowest level of agreement at 56%, but only 10% disagreeing.
- Parents believe that the teacher meets the needs of their child at a rate of 78%.
- Nearly three-quarters of the parents would place their child in single-gender classes the next year if available, only 15% disagreeing.
- Parents of boys consistently agree at a higher percentage than parents of girls that single-gender education is a factor in improving the categories, 75-85% and 65-75% respectively.
- African-American parents consistently agree at a higher percentage than Caucasian parents 70-85% and 70-80% respectively, with disagreement below 10% and 20% respectively. (The numbers of Asian-American, Hispanic and Other were too low to make a comparison.)
- Lower elementary and sixth grade parents tend to agree at the highest levels.
- By grade level, behavior is the category with the lowest level of agreement (typically around 50%), but disagreement is typically around 10%.
- Parents of seventh grade students agreed at the lowest level (50-60%).
<table>
<thead>
<tr>
<th>By being in the single-gender program I have increased or improved my ...</th>
<th>Percent of students who responded Strongly Agree, Agree, or Somewhat Agree</th>
<th>Percent of students who responded Neutral</th>
<th>Percent of students who responded Strongly Disagree, Disagree, or Somewhat Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Students (n=2200)</td>
<td>All Students (n=2200)</td>
<td>All Students (n=2200)</td>
<td></td>
</tr>
<tr>
<td>self-confidence</td>
<td>67%</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>desire to succeed in school</td>
<td>72</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>interest in trying new ways to learn</td>
<td>69</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>independence</td>
<td>70</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>participation during class</td>
<td>72</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>ability to succeed in school</td>
<td>73</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>attitude in school</td>
<td>60</td>
<td>18</td>
<td>23</td>
</tr>
<tr>
<td>behavior in school</td>
<td>60</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>grades</td>
<td>67</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>determination</td>
<td>73</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td>make friends</td>
<td>69</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>complete homework</td>
<td>61</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>complete class work</td>
<td>71</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>focus</td>
<td>67</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>comfortable talking with people of opposite gender</td>
<td>81</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>friends not in SG</td>
<td>86</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>
## Student Data by Gender

<table>
<thead>
<tr>
<th>By being in the single-gender program I have increased or improved my ...</th>
<th>Percent of students who responded Strongly Agree, Agree, or Somewhat Agree</th>
<th>Percent of students who responded Neutral</th>
<th>Percent of students who responded Strongly Disagree, Disagree, or Somewhat Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female (n=1178)</td>
<td>Male (n=1033)</td>
<td>Female (n=1178)</td>
</tr>
<tr>
<td>self-confidence</td>
<td>71%</td>
<td>64%</td>
<td>14%</td>
</tr>
<tr>
<td>desire to succeed in school</td>
<td>75</td>
<td>68</td>
<td>13</td>
</tr>
<tr>
<td>interest in trying new ways to learn</td>
<td>70</td>
<td>67</td>
<td>15</td>
</tr>
<tr>
<td>independence</td>
<td>74</td>
<td>65</td>
<td>16</td>
</tr>
<tr>
<td>participation during class</td>
<td>74</td>
<td>70</td>
<td>13</td>
</tr>
<tr>
<td>ability to succeed in school</td>
<td>75</td>
<td>72</td>
<td>14</td>
</tr>
<tr>
<td>attitude in school</td>
<td>62</td>
<td>57</td>
<td>17</td>
</tr>
<tr>
<td>behavior in school</td>
<td>60</td>
<td>59</td>
<td>21</td>
</tr>
<tr>
<td>grades</td>
<td>68</td>
<td>67</td>
<td>16</td>
</tr>
<tr>
<td>determination</td>
<td>75</td>
<td>72</td>
<td>16</td>
</tr>
<tr>
<td>make friends</td>
<td>70</td>
<td>69</td>
<td>14</td>
</tr>
<tr>
<td>complete homework</td>
<td>64</td>
<td>59</td>
<td>18</td>
</tr>
<tr>
<td>complete class work</td>
<td>72</td>
<td>70</td>
<td>17</td>
</tr>
<tr>
<td>focus</td>
<td>69</td>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>comfortable talking with people of opposite gender</td>
<td>80</td>
<td>83</td>
<td>9</td>
</tr>
<tr>
<td>friends not in SG</td>
<td>88</td>
<td>84</td>
<td>5</td>
</tr>
</tbody>
</table>
### Student Data by Racial/Ethnicity Group

| By being in the single-gender program I have increased or improved my ... | Percent of students who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D) |
|---|---|---|---|---|---|
| | African-American (n=1320) A/N/D | Asian-American (n=26) A/N/D | Caucasian (n=673) A/N/D | Hispanic (n=99) A/N/D | Other (n=93) A/N/D |
| self-confidence | 70/14/15% | 85/4/12% | 63/17/19% | 66/20/14% | 54/23/24% |
| desire to succeed in school | 77/12/10 | 77/15/8 | 64/19/17 | 67/15/18 | 59/17/24 |
| interest in trying new ways to learn | 71/14/14 | 85/12/4 | 64/17/19 | 74/13/12 | 59/20/20 |
| independence | 74/16/11 | 85/12/4 | 63/21/17 | 61/19/19 | 67/16/16 |
| participation during class | 76/12/12 | 81/8/12 | 67/18/15 | 73/14/14 | 64/20/16 |
| ability to succeed in school | 78/13/9 | 77/12/12 | 64/19/17 | 71/14/14 | 70/14/16 |
| attitude in school | 62/18/20 | 81/4/15 | 53/18/29 | 76/14/9 | 56/23/21 |
| behavior in school | 63/18/19 | 77/12/12 | 52/24/24 | 69/20/10 | 52/24/25 |
| grades | 72/15/13 | 77/8/15 | 58/21/21 | 72/12/16 | 59/28/13 |
| determination | 77/15/8 | 76/24/0 | 66/19/14 | 71/15/13 | 67/18/15 |
| make friends | 72/14/15 | 81/15/4 | 64/17/20 | 78/12/10 | 65/18/17 |
| complete homework | 66/18/17 | 81/15/4 | 52/24/24 | 66/13/21 | 58/17/25 |
| complete class work | 76/15/9 | 92/4/4 | 61/22/17 | 74/14/11 | 60/20/21 |
| focus | 71/14/15 | 85/8/8 | 59/18/22 | 65/16/18 | 61/24/15 |
| comfortable talking with people of opposite gender | 83/8/9 | 68/20/12 | 81/10/9 | 74/9/16 | 71/20/10 |
| friends not in SG | 84/7/9 | 88/8/4 | 89/5/6 | 93/4/3 | 84/11/5 |
### Student Data by Gender and Racial/Ethnicity Group

By being in the single-gender program I have increased or improved my...

<table>
<thead>
<tr>
<th>Percent of students who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D)</th>
<th>African-American Female (N=725) A/N/D</th>
<th>Caucasian Female (N=331) A/N/D</th>
<th>African-American Male (N=592) A/N/D</th>
<th>Caucasian Male (N=340) A/N/D</th>
</tr>
</thead>
<tbody>
<tr>
<td>self-confidence</td>
<td>72/13/15</td>
<td>70/13/17%</td>
<td>68/16/16%</td>
<td>56/22/21%</td>
</tr>
<tr>
<td>desire to succeed in school</td>
<td>80/10/10</td>
<td>66/18/16</td>
<td>74/15/11</td>
<td>61/20/19</td>
</tr>
<tr>
<td>interest in trying new ways to learn</td>
<td>73/13/14</td>
<td>65/19/16</td>
<td>69/16/15</td>
<td>63/15/22</td>
</tr>
<tr>
<td>independence</td>
<td>77/15/9</td>
<td>69/19/12</td>
<td>70/17/13</td>
<td>56/22/22</td>
</tr>
<tr>
<td>participation during class</td>
<td>77/12/11</td>
<td>71/16/13</td>
<td>75/12/13</td>
<td>64/19/17</td>
</tr>
<tr>
<td>ability to succeed in school</td>
<td>78/13/9</td>
<td>68/17/15</td>
<td>78/13/9</td>
<td>61/21/18</td>
</tr>
<tr>
<td>attitude in school</td>
<td>63/13/21</td>
<td>55/18/27</td>
<td>60/20/20</td>
<td>51/17/31</td>
</tr>
<tr>
<td>behavior in school</td>
<td>63/18/19</td>
<td>53/27/20</td>
<td>63/17/19</td>
<td>50/21/29</td>
</tr>
<tr>
<td>grades</td>
<td>72/14/14</td>
<td>60/20/21</td>
<td>72/16/12</td>
<td>58/22/21</td>
</tr>
<tr>
<td>determination</td>
<td>78/15/7</td>
<td>69/18/13</td>
<td>77/14/9</td>
<td>65/21/15</td>
</tr>
<tr>
<td>make friends</td>
<td>72/13/15</td>
<td>65/15/20</td>
<td>72/14/14</td>
<td>63/18/19</td>
</tr>
<tr>
<td>complete homework</td>
<td>67/16/16</td>
<td>54/23/23</td>
<td>63/19/17</td>
<td>50/25/25</td>
</tr>
<tr>
<td>complete class work</td>
<td>76/14/10</td>
<td>62/23/15</td>
<td>75/16/9</td>
<td>61/21/18</td>
</tr>
<tr>
<td>focus</td>
<td>71/14/15</td>
<td>64/17/19</td>
<td>71/14/15</td>
<td>55/19/26</td>
</tr>
<tr>
<td>comfortable talking w/ opp. gender</td>
<td>81/9/11</td>
<td>81/9/9</td>
<td>85/8/7</td>
<td>81/10/9</td>
</tr>
<tr>
<td>friends not in SG</td>
<td>86/5/8</td>
<td>90/5/5</td>
<td>82/8/10</td>
<td>88/6/6</td>
</tr>
</tbody>
</table>
### Student Data by Grade Level

<table>
<thead>
<tr>
<th>By being in the single-gender program I have increased or improved my...</th>
<th>Percent of students who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Second Grade (n=34)</td>
</tr>
<tr>
<td></td>
<td>A/N/D</td>
</tr>
<tr>
<td>self-confidence</td>
<td>71/18/12</td>
</tr>
<tr>
<td>desire to succeed in school</td>
<td>88/3/9</td>
</tr>
<tr>
<td>interest in trying new ways to learn</td>
<td>91/0/9</td>
</tr>
<tr>
<td>independence</td>
<td>80/3/17</td>
</tr>
<tr>
<td>participation during class</td>
<td>88/3/9</td>
</tr>
<tr>
<td>ability to succeed in school</td>
<td>89/6/6</td>
</tr>
<tr>
<td>attitude in school</td>
<td>89/3/9</td>
</tr>
<tr>
<td>behavior in school</td>
<td>89/6/6</td>
</tr>
<tr>
<td>grades</td>
<td>91/3/6</td>
</tr>
<tr>
<td>determination</td>
<td>94/6/0</td>
</tr>
<tr>
<td>make friends</td>
<td>86/6/9</td>
</tr>
<tr>
<td>complete homework</td>
<td>80/9/11</td>
</tr>
<tr>
<td>complete class work</td>
<td>86/9/6</td>
</tr>
<tr>
<td>focus</td>
<td>89/3/9</td>
</tr>
<tr>
<td>comfortable talking w/ opp. gender</td>
<td>85/6/9</td>
</tr>
<tr>
<td>friends not in SG</td>
<td>89/0/11</td>
</tr>
</tbody>
</table>
South Carolina Surveys on Single-Gender Education, May 2008

All Teachers

<table>
<thead>
<tr>
<th>Being in a single-gender program, my students have increased or improved their ...</th>
<th>Percent of teachers who Strongly Agree, Agree, Somewhat Agree (A), Neutral (N), Strongly Disagree, Disagree, Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teachers with Female Students (n=150) A/N/D</td>
</tr>
<tr>
<td>Self-Confidence (n=155)</td>
<td>90/5/5</td>
</tr>
<tr>
<td>Desire to Succeed (n=153)</td>
<td>88/5/7</td>
</tr>
<tr>
<td>Self-Esteem (n=152)</td>
<td>89/7/5</td>
</tr>
<tr>
<td>Independence (n=150)</td>
<td>88/7/5</td>
</tr>
<tr>
<td>Participation (n=150)</td>
<td>91/5/4</td>
</tr>
<tr>
<td>Attitude (n=150)</td>
<td>83/10/7</td>
</tr>
<tr>
<td>Behavior (n=150)</td>
<td>78/9/13</td>
</tr>
<tr>
<td>Collaboration (n=147)</td>
<td>92/5/3</td>
</tr>
</tbody>
</table>

Teacher Data By Grade Level

<table>
<thead>
<tr>
<th>Being in a single-gender program, my students have increased or improved their ...</th>
<th>Percent of teachers who Strongly Agree, Agree, Somewhat Agree (A), Neutral (N), Strongly Disagree, Disagree, Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elementary Teachers</td>
</tr>
<tr>
<td></td>
<td>With Female Students N=33 A/N/D</td>
</tr>
<tr>
<td>Self-Confidence</td>
<td>97/0/3</td>
</tr>
<tr>
<td>Desire to Succeed</td>
<td>94/3/3</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>100/0/0</td>
</tr>
<tr>
<td>Independence</td>
<td>97/3/0</td>
</tr>
<tr>
<td>Participation</td>
<td>97/3/0</td>
</tr>
<tr>
<td>Attitude</td>
<td>97/3/0</td>
</tr>
<tr>
<td>Behavior</td>
<td>97/0/3</td>
</tr>
<tr>
<td>Collaboration</td>
<td>100/0/0</td>
</tr>
</tbody>
</table>
Teacher Data By Type of Classes Taught

<table>
<thead>
<tr>
<th>Being in a single-gender program, my students have increased or improved their ...</th>
<th>Percent of teachers who Strongly Agree, Agree, Somewhat Agree (A), Neutral (N), Strongly Disagree, Disagree, Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ELA Teachers</td>
</tr>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>Students</td>
</tr>
<tr>
<td></td>
<td>(N=34)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>Students</td>
</tr>
<tr>
<td></td>
<td>(N=33)</td>
</tr>
<tr>
<td></td>
<td>A/N/D</td>
</tr>
<tr>
<td>Self-Confidence</td>
<td>85/12/3</td>
</tr>
<tr>
<td></td>
<td>85/12/3</td>
</tr>
<tr>
<td>Desire to Succeed</td>
<td>94/3/3</td>
</tr>
<tr>
<td></td>
<td>88/3/9</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>94/6/0</td>
</tr>
<tr>
<td></td>
<td>87/13/0</td>
</tr>
<tr>
<td>Independence</td>
<td>91/9/0</td>
</tr>
<tr>
<td></td>
<td>82/12/6</td>
</tr>
<tr>
<td>Participation</td>
<td>100/0/0</td>
</tr>
<tr>
<td></td>
<td>88/6/6</td>
</tr>
<tr>
<td>Attitude</td>
<td>85/15/0</td>
</tr>
<tr>
<td></td>
<td>87/10/3</td>
</tr>
<tr>
<td>Behavior</td>
<td>81/13/6</td>
</tr>
<tr>
<td></td>
<td>70/9/21</td>
</tr>
<tr>
<td>Collaboration</td>
<td>94/6/0</td>
</tr>
<tr>
<td></td>
<td>85/6/9</td>
</tr>
</tbody>
</table>
## All Parents

By being in the single-gender program my child has increased or improved in ... |
| Percent of parents who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D) |
| N=178 |
| A/N/D |
| Self-Confidence | 78/15/7 |
| Desire to Succeed | 72/20/8 |
| Self-Esteem | 80/12/7 |
| Independence | 79/16/6 |
| Ability to Succeed | 76/16/8 |
| Attitude | 71/17/12 |
| Behavior | 56/34/10 |
| Grades | 62/21/17 |
| Teachers Understand Child | 84/11/5 |
| Teachers Meet the Needs of Child | 78/13/9 |
| Next Year Would Select SG | 73/11/15 |

## Parent Data By Gender of Child

By being in the single-gender program my child has increased or improved in ... |
| Percent of parents who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D) |
| Female |
| N=72 |
| A/N/D |
| Male |
| N=103 |
| A/N/D |
| Self-Confidence | 71/18/11 | 83/12/5 |
| Desire to Succeed | 67/28/6 | 75/15/10 |
| Self-Esteem | 75/15/10 | 83/11/6 |
| Independence | 74/19/7 | 82/13/5 |
| Ability to Succeed | 74/18/8 | 77/15/8 |
| Attitude | 66/22/12 | 74/14/13 |
| Behavior | 53/37/10 | 56/33/11 |
| Grades | 60/26/14 | 62/18/19 |
| Teachers Understand Child | 86/11/3 | 82/12/6 |
| Teachers Meet the Needs of Child | 74/18/8 | 80/11/10 |
| Next Year Would Select SG | 69/14/17 | 76/9/15 |
South Carolina Surveys on Single-Gender Education, May 2008

Parent Data By Ethnicity of Child

By being in the single-gender program my child has increased or improved in ...

<table>
<thead>
<tr>
<th></th>
<th>Percent of parents who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>African-American N=40 A/N/D</td>
</tr>
<tr>
<td></td>
<td>Asian-American N=2 A/N/D</td>
</tr>
<tr>
<td></td>
<td>Caucasian N=126 A/N/D</td>
</tr>
<tr>
<td></td>
<td>Hispanic N=5 A/N/D</td>
</tr>
<tr>
<td></td>
<td>Other N=2 A/N/D</td>
</tr>
<tr>
<td>Self-Confidence</td>
<td>80/18/3 100/0/0 76/14/10 100/0/0 100/0/0</td>
</tr>
<tr>
<td>Desire to Succeed</td>
<td>74/23/3 100/0/0 70/21/10 100/0/0 50/0/50</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>85/10/5 50/50/0 78/14/8 100/0/0 50/0/50</td>
</tr>
<tr>
<td>Independence</td>
<td>87/10/3 50/50/0 76/17/7 100/0/0 50/50/0</td>
</tr>
<tr>
<td>Ability to Succeed</td>
<td>88/10/3 100/0/0 71/20/10 100/0/0 50/0/50</td>
</tr>
<tr>
<td>Attitude</td>
<td>83/13/5 50/50/0 65/19/16 100/0/0 100/0/0</td>
</tr>
<tr>
<td>Behavior</td>
<td>66/24/10 100/0/0 49/40/11 100/0/0 50/50/0</td>
</tr>
<tr>
<td>Grades</td>
<td>63/20/17 100/0/0 58/24/18 100/0/0 100/0/0</td>
</tr>
<tr>
<td>Teachers Understand Child</td>
<td>85/15/0 100/0/0 83/10/6 80/20/0 100/0/0</td>
</tr>
<tr>
<td>Teachers Meet the Needs of Child</td>
<td>80/12/7 100/0/0 75/14/10 100/0/0 100/0/0</td>
</tr>
<tr>
<td>Next Year Would Select SG</td>
<td>76/15/10 50/50/0 71/11/19 100/0/0 100/0/0</td>
</tr>
</tbody>
</table>
South Carolina Surveys on Single-Gender Education, May 2008

Parent Data By Grade Level of Child

By being in the single-gender program my child has increased or improved in ...

<table>
<thead>
<tr>
<th></th>
<th>Percent of parents who responded Strongly Agree, Agree, or Somewhat Agree (A), Neutral (N), or Strongly Disagree, Disagree, or Somewhat Disagree (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2nd Grade N=12 A/N/D</td>
</tr>
<tr>
<td>Self-Confidence</td>
<td>92/0/8</td>
</tr>
<tr>
<td>Desire to Succeed</td>
<td>92/0/8</td>
</tr>
<tr>
<td>Self-Esteem</td>
<td>100/0/0</td>
</tr>
<tr>
<td>Independence</td>
<td>92/8/0</td>
</tr>
<tr>
<td>Ability to Succeed</td>
<td>92/8/0</td>
</tr>
<tr>
<td>Attitude</td>
<td>83/8/8</td>
</tr>
<tr>
<td>Behavior</td>
<td>50/42/8</td>
</tr>
<tr>
<td>Grades</td>
<td>75/8/17</td>
</tr>
<tr>
<td>Teachers Understand Child</td>
<td>100/0/0</td>
</tr>
<tr>
<td>Teachers Meet the Needs of Child</td>
<td>100/0/0</td>
</tr>
<tr>
<td>Next Year Would Do SG</td>
<td>100/0/0</td>
</tr>
</tbody>
</table>
LIST OF REFERENCES


Jones, V. (1971). The Influence of Teach-Student Introversion, Achievement and Similarity on Teacher-Student Dyadic Classroom Interaction, University of Texas at Austin.


Behavioral Brain Science 1: 377-386.

Ruddock, P. (2004). Government Moves to Address Male Teacher Decline. A. G. s. Department, 

Longmans.

Male and Female Students. N. I. o. Education. Washington, DC. (ERIC Document 
Reproduction Service No. ED245839).

Sadker, M., & Sadker, D. (1986). "Sexism in the Classroom: From Grade School to Graduate 

Leadership 46: 44-47.

Directions for Teaching and Learning 49 (Teaching for Diversity): 49-56.

Press.

York, Macmillan.


