

INTRODUCTION

Background and Significance of Problem

The No Child Left Behind Act has increased the visibility of educational achievement gaps in the areas of race, gender and socioeconomic status. As a result, schools have been encouraged to find alternative instructional strategies to raise the academic achievement of all children. In an effort to meet the academic needs of disadvantaged students, schools are beginning to experiment with single-sex instruction by separating boys and girls into single-sex classes within schools or by establishing single-sex schools.

Historically, single-gender classes were commonplace in public schools designed to promote specific gender roles (Kaminer, 1998). The passage of the Title IX legislation in 1972 prohibited any gender-based segregation of students. The law prevented most public schools from continuing to assign students into classes by gender (Federal Register, 2002, May 8). Although some private schools in the U.S. continued single-gender instruction, even private institutions that received federal funds were prohibited from this practice.

The No Child Left Behind Act of 2001 (NCLB) includes provisions allowing local education agencies to use NCLB funding to provide same-gender schools and classrooms (Federal Register, 2002, May 8). The provisions state that if activities are provided for one sex, the other sex must also be offered reasonably comparable activities. There are two restrictions identified in the single-gender provisions: a) participation in single-sex instruction must be optional; and b) for schools that do not provide coed

options, parents must have the opportunity to send their children to another local coed school.

The Office of Civil Rights (OCR) of the U.S. Department of Education created a proposed framework in order to determine the appropriate circumstances in which single-gender schools and classes may be offered in public education. The OCR framework explained that regulations about single-gender instruction prior to NCLB were created to prevent discriminatory practices. In the last 30 years, public education has changed dramatically to offer a far more equitable treatment of females. Because of these changes, increased flexibility is warranted in the NCLB legislation (Federal Register, 2004, March 9).

Former Secretary of Education Rod Paige supported the efforts of using single-gender classes and schools. He believed that the increased flexibility in the provisions would enable schools to make legitimate and important efforts to improve the academic success of all students. When developing the regulatory proposal for single-gender education, the Department of Education aimed to make certain that single-gender classes were not based on sex-role stereotypes and that students were not limited from educational opportunities due to their gender (Federal Register, 2004, March 9). Michael J. Petrelli, former U.S. Department of Education Associate Assistant Deputy Secretary, said it is not reasonable for schools to wait until research is done before implementing single-sex programs. Schools cannot prove its effects until having additional opportunities to experiment with the model (Davis, 2004, March 10). According to Secretary of Education Margaret Spellings, research supports the idea that some students learn better in single-gender environments (Davis, 2006). With the government support

of varied learning environments, single-sex education remains in the spotlight as a cost free, alternative way to reach students.

Despite the push toward using alternative instructional practices such as single-gender classes, schools had been reluctant to implement such programs until ambiguities in the law were settled (Davis, 2006, November 1). Title IX regulations were amended, which provided schools with more freedom and legal protection to use single-gender classes. In the October 24, 2006 edition of the *Federal Register*, the Education Department announced the new rules explaining that current educational research suggests the use of single-gender instruction may be beneficial for certain students. However, the Department of Education limits the use of such programs by requiring certain conditions and analysis. These programs must be related to improving student achievement and to meeting the individual needs of students who otherwise would have limited educational opportunities. Schools are required to assess the effectiveness of their single-gender programs every two years to ensure their compliance with federal regulations.

NCLB requires students and teachers to be more accountable for academic achievement based on standardized testing. The National Association for Single-Sex Public Education explains that at least half of the schools that currently offer single-sex education began the programs primarily due to concerns about Adequate Yearly Progress (AYP). Schools may see this option as a way to increase test scores and improve grades without incurring any additional costs. The number of public schools in the U.S. offering single-sex options has increased from 4 in 1996 to over 241 in 2006 (NASSPE, 2006). One third of these schools offer middle grade configurations. In spite of its increasing

popularity, the academic literature contains very few studies on single-sex instruction in middle schools.

Middle School Reform

Young adolescents are one of the most overlooked groups of students in the educational reform movement. Some refer to the middle school years as the “muddle in the middle” (Bradley, 1999 in Davis, 2005) and others a “vast educational wasteland” (Bandlow, 2001 in Davis, 2005). Bandlow writes that middle schools are failing students at this age by offering too wide a variety of topics and not providing in-depth, appropriate instruction of content needed to prepare them for high school (2001).

As early as 1920, critics argued that elementary schools were not adequately preparing students for high school. Thomas Briggs (1920), one of the major founders of the junior high school model, stated that the “...junior high school is a device of democracy whereby nurture may cooperate with nature to secure the best results possible for each individual adolescent as well as for society at large” (Lounsbury, 1996). The junior high model had not succeeded in ways Briggs envisioned. The limited success of the junior high school model prompted William Alexander to initiate the middle school movement during the 1960s as an alternative to the junior high

Years later, educators continue to refine the instructional practices of the middle school model. In 1982 (and later revised in 1995), the National Middle School Association (NMSA) published a paper titled *This We Believe: Developmentally Responsive Middle Level Schools*, detailing the “essential elements of a true middle school” (NMSA, 1995). The paper states that middle schools must take into account everything that is known about the development of young adolescents as well as their

cultural contexts. *This We Believe* set the stage for a professional and public awareness of the importance of the early adolescent years.

The Council on Adolescent Development of the Carnegie Corporation released a landmark report in 1989, later revised in 2000, which made recommendations for improving education during the middle grade years. This paper, titled *Turning Points 2000: Educating Adolescents in the 21st Century*, has been a guide for schools across the country to best serve the needs of students. The recommendations provide directions for schools to focus on which will maximize student achievement in middle grades. These include ideas such as focusing on instruction that uses methods designed to academically prepare all students, using organizational relationships to increase collaboration and support and creating safe and healthy school environments.

These papers have renewed interest and focus on the teaching of young adolescents. Alexander Inglis, Editor of *The Junior High School*, wrote about the critical stages of every movement in education that are necessary for it to succeed (Briggs, 1920). The first stage is when the movement gains recognition by educators and the public. The second stage occurs when acceptance is won but the practical implementation is incomplete and needs to still be established. This is the place where our nation stands in the area of single-sex education. The results of continued research and development will determine the level of acceptance and application of single-gender classes throughout the country in coming years.

For middle school students, work environments are easily influenced by peer relationships and distractions. *Turning Points* encourages the promotion of self-governing behaviors. Students can more willingly and easily monitor their own

behaviors when schools remove distractions and potential conflicts from the classroom. In the middle grades, this can often be accomplished by separating the boys and girls. Students can also better self-manage behavior because group behavior is similar, making it easier to recognize and approach the average of that behavior (James, personal communication, 2006).

The differences in learning styles for each gender can create natural distractions. This “indirect discipline” occurs by creating a clear mission and offering diverse learning experiences for all students (Lipsitz, 1984). *Turning Points* emphasized the need to accommodate learning styles, especially for middle grades children when they are forming new awareness of their own identities. It explained how student characteristics such as cultural background, language, race, class and gender are “powerful influences on learning” (Jackson & Davis, 2000). Single-gender instruction serves as a method by which teachers can individualize instruction based on the different learning styles of boys and girls.

Middle school is a time of transition for students as they grow from children to young adults. Girls and boys are rapidly changing physiologically and emotionally. *This We Believe* supports a rationale for creating separate-sex middle school classes based on the physiological issues that occur at this age: “Young people undergo more rapid and profound personal changes during the years between 10 and 15 than at any other period of their lives” (NMSA, 2005). It emphasizes the amount of change and the variability of change that occurs in middle schools which affects students and teachers. Perhaps the most important aspect of a middle school student’s life is adapting to social pressures. This is often the source from which students develop a sense of who they are and who

they want to become. The social pressures in the middle school years can prevent students from succeeding academically or they may encourage the formation of positive self-concepts. Teachers must provide high quality instruction for adolescents and accommodate the many differences between the two genders at this age. Alternative instructional methods may help use the social pressures as positive influences by persuading boys and girls to achieve more.

In recent years, more public schools are experimenting with the option of separating the boys and girls to accommodate these differences (Sax, 2005). Our society has a moral obligation to reach out to children at this younger age in order to make necessary accommodations before students give up on school altogether. Waiting until high school to try alternative methods is waiting too long. For students who are at-risk (at any level), Salomone, author of *Same, Different, Equal: Rethinking Single-Sex Schooling*, writes, "...the conscious identification with academic achievement and the same-sex role models these program typically offer prove especially effective" (2003, p. 44).

According to Leonard Sax, executive director of the National Association of Single Sex Public Education, the justification for separating genders in schools is brain-based (2005, March 2). He argues that there are "hard-wired" differences in how boys and girls learn. In addition, gender-specific behavioral differences support the need for differentiated instruction.

Problem Statement

The purpose of this research paper is to determine the effect of single-gender instruction on academic achievement in the middle school grades. The U.S. Department

of Education states that most research on single-sex schooling has been primarily in the private and parochial schools, and more research has been done on girls' schools than boys' schools (2005). According to the latest legislation concerning the use of single-gender instruction in public schools, educators must have "persuasive justification" to implement the program and comply with the law (Salomone, 2006). Instructional decisions should be based on empirical research and data, not unproven theories and trendy education reforms.

To determine possible effects of academic achievement in single-sex classrooms, the current study will use the results of eight public middle schools in the United States that have implemented single-sex instruction within the last five years. The study will include only public schools that are not magnet, charter or schools of choice. The schools are a representative sample of American schools, with wide ranges of socio-economics, funding sources, racial groups and geographic locations. Using a mixed design incorporating quantitative standardized test data and qualitative interview responses, the study will attempt to determine what effect, if any, the use of single-gender instruction has had on their students' academic achievement.

Summary of Thesis

This paper will include research literature and case studies to determine any possible effects of single-sex education. Chapter Two is a review of literature detailing research studies and expert analysis describing the support and opposition of single-gender instruction. The literature review includes the current state of the educational gender gap, brain research as it relates to gender differences and justification for instructional variations for each gender. It further describes studies of single-gender

programs. Chapter Two concludes with summaries from people and groups that oppose single-gender instruction.

Chapter Three includes the methodology and design of the research and will present quantitative and qualitative data from the case studies. Chapter Four presents the results from the case studies for reading and math achievement as well as analysis of achievement by each gender. Finally, Chapter Five is a discussion of conclusions, implications and limitations of the study. Recommendations for further research conclude the thesis.

REVIEW OF LITERATURE

Single-gender education is an issue with many layers. This controversial area has its share of opinionated groups who either support or oppose it. The purpose of this paper is to analyze both sides of the issue, using quantitative and qualitative measures to determine the possible effects of separating genders in schools. The review of the literature begins with the reality of the gender achievement gap in the U.S. today and why it is worthwhile to study the use of single-sex classes. Science provides evidence of the physiological differences between the sexes. Researchers recommend pedagogical methods to support the learning needs of each gender. Students and educators share anecdotal evidence to support or deny the success of single-gender instruction. Finally, data from national research studies provide the background for the individual case studies of current single-gender programs.

Gender Gap

There is a significant gender gap in public education today. Public schools are not fairly serving the needs of boys and girls. Girls are scoring higher on standardized tests and graduate from college at higher rates, while boys make up 70% of students diagnosed with learning disabilities and receive the majority of discipline referrals (Tyre, 2005). In her recent Newsweek article Tyre writes that boys are also more than 30 percent more likely to drop out of high school. No Child Left Behind (2001) makes these gender differences evident with the required disaggregating of data. In 2003, 8th grade boys scored 31 points lower than girls on standardized reading tests and 11 points lower in math (Thiers, 2006).

This is a significant shift from a 1992 study by the American Association of University Women that concluded girls were being shortchanged by public education, especially in the areas of science and math. Possibly due to the excessive attention toward increasing girls' academic achievement in the last thirty years, boys are now lagging behind. It is projected that in 2011, girls will make up over 60% of all college graduates (Sax, 2005). The U.S. Department of Education also says on its web site that the average 11th grade boy writes at a level of an 8th grade girl (2005).

Another area in which gender differences are apparent is in learning disabilities. Nearly 75% of identified special education students are boys (James, A., personal communication, 2006). Girls who are identified as having learning disabilities seem to be fewer in numbers but more severely disabled than boys, especially those with Attention Deficit Hyperactivity Disorder (ADHD). Symptoms for ADHD can differ in girls and boys. Girls with ADHD are primarily more inattentive whereas boys tend to be more hyperactive. James, an author and single-gender teacher, claims that the gender disparity exists due to biological differences, behavioral differences and the bias in referral and assessment for each gender. More males are identified with the major learning disabilities that affect learning in regular education classes. Dyslexia, for example, affects far more males and theorized causes are partially based on brain lateralization. Speech disabilities are more prevalent in males than females as well, and the ways in which verbal disabilities are expressed differs in males and females.

James contends that coeducational classrooms do not meet the needs of mildly learning disabled students (personal communication, 2006). In her experience and research, girls are more willing to please teachers and boys appear more independent.

Girls are more able to develop new learning strategies and boys stick to what they know. She recommends single-sex environments for at-risk students especially due to gender differences in learning approaches, differences in learning disabilities/learning difficulties and differences in maturation levels of boys and girls.

These disparities increase the need for educators and researchers to find ways to meet the needs of both sexes through alternative techniques. The question of why public education seems to work for girls and not boys may be partially answered through the research literature.

Science

To find answers to how educators can help close this gender achievement gap, many researchers turn to science. Research suggests that brain differences between males and females begin in the womb (Achiron, Lipitz & Achiron, 2001). In a study of sex-related differences in the development of the human fetus, researchers found that midway through pregnancy, testosterone levels in boys increase at points to levels comparable to young men. These hormones then bind to brain tissue and begin to change it. These changes cause the brain to be permanently transformed. It is then possible to distinguish a female brain from a male brain during ultrasounds on women who are 26 weeks pregnant.

These gender differences in the brain continue to remain evident after birth. Brain structures for young boys and young girls have such obvious differences that they are visible to the naked eye (Corder, Valenzuela, Torres & Rodriguez, 2000). Corder et al. (2000) examined photomicrographs of brain tissue and noticed dramatic differences in

the structure of male and female brains. Differences were especially apparent in the brain tissue of babies.

Male brains also show asymmetry between the two hemispheres while female brains are more similar (Good et al., 2001). These differences are easily visible by using an MRI scanner. Another study found significant gender differences in the structure of the cerebral cortex, the most advanced part of the brain (Rabinowicz et al., 2002). Specifically, they found a difference in the number of connections of nerve cells. The cerebral cortex is the area of the brain responsible for higher order function such as cognitive and emotional experiences. Researchers found that these areas were substantially more asymmetric for men but not for women. Also, women's association cortex was larger on the right whereas the larger areas for men were on the left (Frederikse, Lu, Aylward, Barta & Pearlson, 1999).

Male brains are on average 8% larger than female brains (Allen & Gorski, 1991). This may be simply because males tend to be larger in general. Despite this size advantage, parts of the female brain have been found to be significantly larger. For example, the massa intermedia, an area of clustered nerves, was 53% larger in females than in males (1991). Scientists have not yet determined the specific function of this area of the brain.

These structural brain differences can easily clarify the functional differences of the brain. Areas of language, navigation and emotion have been researched using MRI scans on males and females. In a study in which researchers mapped the brain to see what areas "lit up" while performing listening exercises, results showed that women used both hemispheres of the brain while men used only the left (Phillips, Lowe, Lurito,

Dzemidzic & Matthews, 2001). The same pattern existed in a study from Yale University in which (right-handed) subjects read. Female subjects used both frontal lobes while men used only the left hemisphere (Shaywitz et al., 1995). These studies demonstrate that men use smaller areas of the brain for one task while women tend to use more of the brain, specifically on both hemispheres, for the same task.

Scientific advancement in brain-imaging technology enables researchers to determine specific differences in male and female brain development. In a study of 508 children ages two months to 16 years, researchers at Virginia Polytechnical Institute found that the brain matures at different rates for boys and girls (Hanlon, Thatcher & Cline, 1999). Jay Geidd, of the National Institute of Health, has compiled the world's largest library of brain growth images using MRI scans of children's brains (Ripley, 2005). He found that the brain size of girls peaks around 11 ½ years, while boys' growth peak occurs on average three years later.

In his 1999 study of 508 boys and girls, Geidd found that regions of the brain involving mechanical reasoning, visual targeting and spatial reasoning matured four to eight years earlier in boys. The brain areas that focus on verbal fluency, handwriting and facial recognition matured several years earlier in girls (Ripley, 2005). Leonard Sax, a physician and psychologist, believes the brain explains why traditional public school often seemingly works for girls and fails for boys. He has conducted numerous studies on gender differences (2005). In his research, Sax found that boys and girls differ in their visual accuracy during infancy. Baby girls tend to focus on details while boys focus more on motions. During adolescence, girls begin to process negative emotions through

the cerebral cortex, the area of the brain for reasoning and language. This connection is not evident in boys.

Physiological differences in hearing between males and females also impact learning. Cassidy and Ditty (2001) conducted a study of 350 normal newborns and found that the hearing threshold for girls was three times softer than the threshold for boys. Boys have a short, stiffer cochlea, which may lead to the increased threshold. The implications for these differences in classes are that girls have more sensitive hearing and generally function better in quieter settings. A teacher speaking loudly may seem to be shouting to girls. Boys more easily disregard instructions in softer voices and benefit more from the stimulus of a louder volume (NASSPE, 2006).

Instruction

Advocates of single-sex instruction believe that because boys and girls learn differently, separate class environments would help maximize learning. Sax believes that it is not that one sex is superior to another but that schools are not teaching them correctly (2005). He argues that during young adolescence especially, boys and girls brains are maturing at such different rates yet we use the same approaches to teach them. Sax contends that coed schools do more harm than good by teaching children in ways that are not developmentally appropriate, therefore turning kids off to learning, creating an aversion to the subject matter and possibly leading them to give up on school altogether (Ripley, 2005).

Current trends in classroom instructional practices strongly favor girls' learning styles. While these practices seem to be positively impacting girls' achievement, the use of cooperative groups, feminized literature, personal essays and even the reduction in

recess time is negatively impacting the environment in which boys learn best (Sax, 2005). In his research and clinical experience, Sax found that boys tend to perform better in whole group settings, are more active, and learn by doing. The principal of one high school that changed core subject instruction to single-sex classes found that boys are more aggressive, which often interfered with girls' learning potential. He found girls were more intimidated with boys' active behaviors in coed classes causing girls to hesitate to participate in class (Newquist, 1997).

Sax recommends that schools of education do their part in reducing the gender gap by helping teachers to recognize and understand the differences in how boys and girls learn and then teach to their needs (2005). Further, he notes that single-sex classrooms would make teaching to gender-specific needs much easier and effective. Sax supports Geidd's (1999) findings of regional brain development delays in girls for spatial reasoning, which he argues may explain a delayed grasp of math concepts for girls. Likewise, by age 12, ninety percent of students excelling at arts are girls. Sax points out that the world's leading artists, such as Michelangelo and Renoir, not surprisingly attended all-boys schools (Howell, 2005).

Studies

From the limited research of single-sex instruction, there seems to be no significant benefit or disadvantage compared to coed classes. While some research notes increases in test scores for girls, gains for boys are slight if at all in most cases (Lapore & Warren, 1997; Salamone, 2005; Riordan, 1990; Vu, 2006). Due to recent changes in legislation allowing public schools to experiment with single-gender options, longitudinal data is scarce.

Newquist writes that adolescents spend an excessive amount of time and energy showing off for each other and fear taking risks in front of the opposite sex (1997). Her study of Presque Isle High School found that boys, especially in math classes, often intimidated girls. In 1989, girls scored 74 points lower than boys in Algebra I. At the recommendation of the teachers who found a significant difference in boy and girl learning styles, the principal implemented single-sex classes for one year. As a result, girls closed the achievement gap to a 16-point deficit after the first year.

A 1986 study by Bryk and Lee found that there was no research that showed a significant benefit for boys attending single-sex classes. They did find much anecdotal evidence that supports the separation of sexes, however. The authors question whether there is a need to prove the benefit of single-sex education when researchers do not seem to be investigating the support for coeducation.

Haag's analysis (2000) of single-sex schools used the studies of LePore and Warren (1997) and Riordan (1990). The study of LePore and Warren found that boys in single-sex schools did not have improved test scores more than their coed comparisons, and though girls did improve slightly, it was not statistically significant (Haag, 2000).

Riordan (1990) used data to evaluate any effects of single-sex education in various populations and academic areas. He found that for African American and Hispanic students in Catholic secondary schools, boys and girls participating in single-gender classes scored higher on standardized tests than the students in coed classes. Riordan argued that the policies that focus on academics within single-sex schools explain the score difference between the two types of schools. Males and females in single-sex schools also had higher scores on attitudinal indicators including leadership.

The research concluded that single-sex schools had a more positive impact than single-sex classes only, possibly due to the nature of the students and parents who choose that type of school setting.

A recurring trend in Riordan's research was that single-gender schools with the most success shared common features: positive role models, leadership opportunities, diminished youth-culture values, affirmative pro-academic parents and student choice (Salomone, 2005). These schools worked best for historically disadvantaged students, particularly African-American and Latino females from low socio-economic groups. There were smaller effects for White middle-class females and almost no effects for White males or affluent students regardless of race or gender (Salomone, 2005).

Haag explained that academic and attitudinal differences are the result of single-sex schools simply "doing something different" (2000). The different instructional approaches may ultimately be reproducible in a mixed gender environment. She concluded that though research is inconsistent about which educational program is better, there are specific indicators in certain areas such as attitudes, behavior, socialization and attendance that contribute to the need for further research of how single-sex instruction affects educational outcomes.

Gillis conducted a study of 5th graders for one year who were all put in single-sex classes (2005). While there was no comparable 5th grade coed control group, survey results found that overall student attitudes were more positive, attendance increased, and discipline referrals were dramatically reduced. Other outcomes included an increase in interpersonal conflicts among female students and no significant increase in test scores.

In 2005, the U.S. Department of Education analyzed 2,221 studies of single-sex classes but ultimately narrowed results down to only 33 studies. Due to the fact that most single-sex schools are private, and those that are public are mostly new, there were very few sources from which they could gather data (Koenig, 2005). Table 1 outlines the results of these studies. Five studies found single-sex schools improved academic achievement. No studies found academic improvement for coed schools. The study concluded that there is some evidence that single-sex instruction benefits academic achievement but no evidence in favor of coed schools. The results of the study also indicated that single-sex schools increased positive academic aspirations of students.

Table 1. Summary Table of Selected Review Outcomes*

Outcome for Girls	N				
	(no. studies)	Pro-SS	Pro-CE	Null	Mixed
Math Achievement Test Scores	11	3	0	8	0
Science Achievement Test Scores	5	2	0	3	0
Self-concept	4	3	0	1	0
School track and subject preferred	8	5	1	2	0
Educational aspirations	2	2	0	0	0
Career aspirations	2	2	0	0	0
Choice of college major	1	1	0	0	0

(SS = single sex, CE= coed)

*values in table retrieved from U.S. Department of Education (2005)

California was one of the first states to experiment with single-sex instruction. In 2001, California conducted a large-scale, three-year study of single-sex instruction in 12 schools, which yielded inconclusive results (Datnow, Hubbard, & Woody). The report described how lack of teacher preparation and training impacted the buy-in and longevity of single-sex classes. In addition, schools cited lack of funding, recruitment and resources as reasons for the single-sex structure's demise. The study concluded that due to the wide variety of factors that contribute to student achievement, it was impossible to determine whether separating the sexes played a significant role in effecting academic performance (2001).

Christina Hoff Sommers of the American Enterprise Institute for Public Policy Research critiqued the California study (2001). Sommers noted that the report failed to achieve its purpose of determining whether single-sex schools improved grades, achievement scores or attendance. Instead, the report "...repeatedly puts the aim of eliminating gender stereotypes ahead of the academic and moral needs of children." The research is limited about the academic benefits of single-gender education.

Opposition

The renewed interest in single-sex education has sparked debate from many interest groups. The American Civil Liberties Union (ACLU) opposes the amendments of Title IX and contends that they are unconstitutional and fail to offer a compelling justification for how these changes would improve American education (2003). The ACLU does not believe such provisions can be offered with academic impact without the assurance of there being no discriminatory impact. Nancy Zirkin, Vice President of the Leadership Conference on Civil Rights questioned the ethics of single-gender education

by comparing it to racial segregation. “Segregation is totally unacceptable in the context of race...Why in the world in the context of gender would it be acceptable” (Martin, 2006).

The November 24, 2006 legislation change now provides public schools in the United States the right to offer single-sex classes as long as it remains optional to parents and students. Some believe that giving parents the power to choose this type of instructional environment in a public education setting may give them too much influence on how and what teachers teach in public schools. Jocelyn Samuels, Vice President for Education and Employment at the National Women’s Law Center in Washington, fears that single-sex instruction “leaves the door wide open to allowing schools to respond to parental requests that can be based on stereotypes and to adopt their own stereotypical thinking about boys and girls” (Davis, 2006).

The American Association of University Women (AAUW) has been especially critical of the recent Title IX provisions, which allow schools that segregate students by gender to receive federal funds. The AAUW criticizes the U.S. Department of Education’s research of single-sex instruction, which primarily used data from Catholic schools and analyzed girls’ schools more than boys’ schools (Thiers, 2006). The research found single sex-schools were neither beneficial nor harmful for students. Those who argue against single-gender instruction contend that ‘separate is never equal,’ and hold that when people are divided on the basis of a physical characteristic, the dominant group is automatically privileged and the ‘other’ group subordinated (Thompson & Ungerleider, 2004).

Debates continue about whether separating boys and girls in school violates civil liberties due to the similarities of separating students on the basis of race. While proponents of single-sex education often rely on brain research to justify the need for teaching students differently, Salomone found these arguments to be too broad and simplistic (2006). While brain research does indicate significant differences in how males and females are “hard-wired,” Salomone argued that innate abilities are “not carved in biological stone” (p. 44).

Psychologists and teachers have recognized that girls enter school with more advanced fine-motor and verbal skills than boys, and boys tend to have stronger visual-spatial skills. Salomone (2003) questioned whether these differences are the results of biology or the social conditioning that perpetuates stereotypical behaviors in boys and girls. The increased achievement for girls in science and math over the last twenty years indicates that abilities are not fixed. When given proper instructional attention, the brain can be changed. While the author did not argue against single-sex instruction, her research indicated that educators are relying on over-generalized and narrow information to justify using single-gender instruction.

Dowling conducted a study of a prestigious private boys’ school in Connecticut to determine the need for and possible advantages of teaching boys separately (2005). He cautioned educators about using this structure simply due to the political pressure surrounding recent legislative changes. He also questioned whether single-gender schooling is inappropriate because it does not mirror reality.

Are we focusing too much on academics while the social implication of separating the sexes is overlooked? Advocates may argue that single-sex schools score

higher than coed schools; however, it may be possible the two groups are not comparable. The majority of single-sex schools today are still private and their academic superiority may be the result of social privilege (Geyerman, 2000). Thompson and Ungerleider write how prior achievement, socio-economic status, parental involvement, and school climate have been found to have an effect on student performance (2004). Unless all other variables are controlled, the true results of single-sex schools cannot accurately be determined.

Chapter Summary

The existence of a current educational gender gap supports the need for alternative instruction techniques to meet the needs of all students. Brain research includes many ways in which each gender has biological differences that pertain to learning (Good et. al, 2001; Hanlon, Thatcher & Cline, 1999). Instruction may be adjusted to better serve students based on the needs of each gender. Studies of single-gender instruction have inconclusive results for academic achievement due to the uncontrolled variables in the schools (Datnow et. al, 2001; Thompson & Ungerleider, 2004). Non-academic benefits in the studies were prolific. The federal government supports single-gender instruction, and some groups oppose the separation of the sexes.

METHODOLOGY

Overview

Case studies include quantitative data from standardized test scores and qualitative interview responses. This paper used data from eight public middle schools in the United States that were non-charter and non-magnet. Schools in the study represent diverse economic, racial and geographic locations. The schools in the study also represent varied standardized test ratings.

Each case study included a description of school demographics (when available) with additional information as it relates to achievement. Additionally, standardized test scores for reading and math in grades 6, 7 and 8 as well as each gender were included (when available). Some schools will include qualitative interview responses from research articles or personal communication. Anecdotal responses were from students, teachers and administration. This information detailed the implementation and effects of single-gender classes.

Case Studies

Coastal Middle School, NC- Principal Interview

This rural school in North Carolina has 730 students, 60% of whom are eligible for free or reduced lunch. It is a Positive Behavioral Support (PBS) school, using rewards as the primary defense against negative behaviors. It began offering single-sex classes to sixth graders in the spring of 2003. The change was the result of the proposal by three of the sixth grade teachers, one of whom attended an all girls' school. The proposal was in response to the concern about increased incidents of sexual harassment at the school. The principal won the support of the Board of Education by structuring the

program so it was optional to students and affected only one team of teachers, including the teachers who originally proposed the change.

School officials commented that the students in single-sex classes were much more focused on academics (NASSPE, 2005). The principal stated that more students were on the honor roll after the first semester than ever before in that sixth grade team. Students in the single-gender classes also earned the annual Superintendent's Award (earning academic averages of 90% or higher) more frequently than students in the coed classes.

Coastal Middle is a school with many challenges. Over 25% of its staff leaves each year, and only 65% of the teachers are "highly qualified" to teach, as defined by the No Child Left Behind legislation (NCDPI, 2005). Teachers indicated the areas in need of most improvement were in time and empowerment, according to the working conditions survey results from the North Carolina State Report Card web site. Fifty percent of the staff feels unsupported by the administration. Eighty-five percent feel some level of distrust and disrespect among the staff. The majority of the staff does not feel a part of the process for choosing and implementing discipline policies. Seventy-eight percent of the staff stated the school is not clean or well maintained. Nearly 50% of the teachers feel unsafe at school.

The data from state standardized testing in reading and math revealed that the school was already growing academically before separate classes began (see Tables 2 & 3). During the two years prior to implementing single-gender classes, reading scores increased in all three grades. Grades 6 and 8 also saw increased proficiency levels in math prior to single-gender implementation.

Table 2. Proficiency levels in reading- Coastal Middle School

Year	Grade 6	Grade 7	Grade 8
2001-02	64	70	70
2002-03	77	77	81
2003-04	76	86	87
2004-05	81	83	88
2005-06	82	86	89

Table 3. Proficiency levels in math- Coastal Middle School

Year	Grade 6	Grade 7	Grade 8
2001-02	76	80	75
2002-03	80	72	80
2003-04	86	79	81
2004-05	88	82	77
2005-06	90	85	85

In order to determine the effects of single-gender instruction on groups of students, scores were analyzed according to cohort groups as well as changes in grade 6 from year to year. Grade 6 made the most significant gains in reading from increasing from 63.3% to 77% proficient in 2003, after one semester of offering a single-gender team.

Cohort groups demonstrated mixed results in math achievement after using single-gender instruction (see Table 3). The original cohort group decreased proficiency levels from 86% in grade 6 to 80% in grade 7. The group increased to 85% proficient in grade 8. The cohort group for the second year of implementation had similar changes in proficiency after moving to the seventh grade. In 2005, sixth grade was 88% proficient in math but the cohort decreased to 85% proficient the next year.

Each year after single-gender implementation, grade six increased in proficiency levels in math (see Table 3). After one semester of offering single-gender classes to half of the sixth grade, the scores increased from 76% to 80% proficient. Scores continued to increase each year in sixth grade. In 2005-06, the entire sixth grade was taught in separate-sex classes, and the math achievement levels reached 90% from 88% the previous year.

Both genders grew academically in reading and math during the implementation year of single-sex classes (see Table 4). All students were making gains before implementation, except a small decrease in girls' performance in math from 80.2% to 79.9% in the two years prior to the single-sex structure. After 2003, when single-gender classes began, both boys and girls increased proficiency levels in reading and math. Notably, boys increased from 70.8% to 77.6% proficient in reading, and girls made

Table 4. Proficiency levels in reading and math by gender- Coastal Middle School

Year	Reading		Math	
	Boy	Girl	Boy	Girl
2001-02	63.2	76.3	70.8	80.2
2002-03	70.8	84.5	74.3	79.2
2003-04	77.3	88.4	77.3	85.2
2004-05	79.6	86.4	79.2	83.2

significant gains in math from 79.9% to 85.2 percent. Boys continued to grow academically in reading and math during year two of implementation while girls decreased slightly in both subjects.

Since the inception of the program, two of the original teachers have relocated. The popularity of the single-gender program has continued to increase each year, and with the approval of the Board, the principal made all of sixth grade separate gender last year. The principal explained that more parents were requesting single-gender classes than she had teachers to teach them. So instead of continuing with one team teaching coed and the other single-gender, both teams had separate-sex classes that year.

This year, the school again offered the coed option for sixth grade. The principal said that the most significant struggle in maintaining and expanding the program was staffing issues. Her original goal was to offer classes that had male teachers with boys and female teachers with girls. The lack of male teacher applicants caused her to abandon that plan and simply find teachers who were willing to teach all boy and all girl classes. In an effort to keep staff morale high, the principal decided to always allow teachers to elect the format in which they will teach.

One of the primary reasons for not expanding the program to the other grades is teacher resistance to change. Teachers simply have not bought into the single-gender benefits. The principal mentioned that some 8th grade teachers indicated interest in adopting the single-gender format, but she is reluctant to offer non-consecutive separate-sex classes for two grade levels. Although the school used a looping system before the principal came to Coastal Middle, she is reluctant to implement looping until she is more assured of teacher buy-in. The school is also in the process of relocating to a new

building, and because of the energy involved with making that change, it would be inappropriate to implement additional changes at this time.

A major problem in the program at Coastal Middle is the lack of teacher training and preparation. The principal described how some teachers left the school after only one year of single-gender teaching because of the unique needs of the classes. She said her goal for next year is to have all trained teachers for the sixth grade single-sex team. At this time, however, the principal did not identify of any specific training programs available.

Parent involvement does not seem to be affected by the use of single-gender instruction. One single-gender teacher explained that her colleagues who teach coed courses have similar parent contact and concerns. The principal explained that the single-gender option appeals mostly to the parents of high-level and parents of low-level students. The average students tend to prefer the coed format.

One teacher of single-gender classes described her experiences teaching all-girl classes. This math teacher has taught for five years in the middle grades. It is in her first year at Coastal Middle and her first year teaching single-gender classes. She described some struggles of teaching single-gender classes but said there were many more benefits. The teacher said the major challenge of teaching single-gender classes is that girls argue and bicker more than boys. This can make for frustrating days when she is unable to get through a lesson. Girls, in her experiences, are more inquisitive and want to know why whereas boys “take what I say at face value.”

Group work is used often in the teacher’s all-girl classes because students get more accomplished with focused discussion and peer assistance. Boys are easier to

manage in a collective group because the teacher stated it is easier to target disruptive behaviors and enforce discipline effectively. Her instructional differences were apparent in the seating assignments in the room. Girls are seated in rows of connected desks with additional girls seated in the extra stand-alone desks. Boys fill the stand-alone with a few students scattered among the connected desks. The boys are more spread out whereas girls are seated close together.

Students at Coastal Middle eat lunch according to class and grade level. The cafeteria time of lunch does not offer single-gender students any opportunity to socialize with other students in coed classes. Students are in mixed classes for electives such as physical education, band or art.

Students who were interviewed had mixed academic changes since beginning single-gender classes. The majority of the students had improved grades since elementary years, although some remained the same and one student had lower grades. All of the girls interviewed described their experiences as being able to learn more easily in class, having more focused lessons and making more friends in single-gender classes. The girls would remain in separate-sex classes in 7th grade if they were offered a choice.

Boys had similar opinions about making more friends, helping each other out and staying more focused in class. Academically, boys in the program had mixed and some positive changes since their elementary grades. The students who stated they had maintained the same grades from previous years were earning A's and B's.

Smithfield Middle School, GA

In the suburbs of a large southern city, Smithfield Middle School serves 1307 students in grades 6-8. Seventy-four percent of the students qualify for free or reduced

lunch and 14% are Limited English Proficient students. According to its school profile, Exceptional Students make up 13% of the student body (Georgia Department of Education, 2006). Fifty-three percent of the students are African American, 28% are Hispanic and 15% of the students are White.

The middle school began offering a few single-sex courses in 2003. The school works in collaboration with Bagwell College of Education at Kennesaw State University (NASSPE, 2006). According to Dr. Charlie Bowen, acting chair for educational leadership at Bagwell College, the majority of responses from teachers and parents have been “overwhelmingly positive” regarding the effects of the single-gender classes. The format expanded in 2005-06, and the district plans to use the single-sex classes school-wide.

In 2002, Smithfield was scoring well below the state averages in both reading and math (see Tables 5 & 6). Scores dropped school-wide in math from 57% in 2002 to 55% in 2003 and in reading from 74% in 2002 to 72% in 2003. Proficiency levels increased significantly during the implementation year of single-sex classes. The largest increase was in 8th grade math with a jump from 48% proficient in 2004 to 69% in 2005. The second year of single-sex classes, scores continued to climb slightly in most areas, though the school average in math decreased from 69% in 2004 to 66% in 2005.

Harris Middle School, KY

Harris Middle School is one of two area middle schools, which serves 222 students (greatschools.net, 2006). For the last two years, the school has made Adequate Yearly Progress, achieving all of the targets for its subgroups. The overall scores still place them in the “assistance” area of the state’s school growth chart. In accordance with No Child

Table 5. Proficiency levels in reading- Smithfield Middle School

Year	Grade 6	Grade 7	Grade 8	school
2001-02	73	76	72	74
2002-03	70	N/A	74	72
2003-04	73	82	83	80
2004-05	76	85	82	81

Table 6. Proficiency levels in math- Smithfield Middle School

Year	Grade 6	Grade 7	Grade 8	school
2001-02	57	65	49	57
2002-03	54	N/A	48	55
2003-04	58	73	69	69
2004-05	66	76	63	66

Left Behind, test scores have put the school as In Need of Improvement-Year 3, which allows parents choice about sending their child to school here. As a Title I school, 62% of the Harris Middle School students qualify for free or reduced lunch (greatschools.net, 2006). Eighty percent of the students are White, 17% are Black and 2% are of Hispanic origin. According to its 2006 School Improvement Plan, the school identifies low parental involvement, increases in bullying/harassment, and growing numbers of discipline referrals to be their greatest challenges. Teacher turnover is an additional burden, with 30% of the staff leaving in the 2005-2006 school year (<http://www.hburg.k12.ky.us/improve>, 2006, p. 6).

Harris Middle School's improvement plan indicates that bullying/harassment and discipline referrals have been on the rise for the past three consecutive years (<http://www.hburg.k12.ky.us/improve>, 2006). Coincidentally, the school began teaching single-sex classes in 2002. Separate-gender instruction was not mentioned anywhere in the improvement plan, but according to the National Association of Single Sex Public Education, the school continues to teach boys and girls separately for some classes (2006).

Data from this school varies based on the type of standardized test used. Grade 6 uses the Comprehensive Test of Basic Skills (CTBS), a national norm reference test, while grades 7 and 8 use the Kentucky state tests. Due to these differences, cohort data were not used for comparisons.

In the first year of separate classes, the 6th grade increased proficiency levels in reading, writing and math (see Table 7). Scores in subsequent years, however, decreased consistently for reading and writing. Math levels decreased slightly in the second year of

Table 7. Proficiency levels in grade 6- National Norm Referenced Test (CTBS)- Harris Middle School

Year	Reading	Writing	Math
2000-01	55	54	52
2001-02	46	43	40
2002-03	51	46	44
2003-04	50	45	42
2004-05	47	44	55

single-gender instruction from 44% in 2002 to 42% in 2003. In 2004, the 55% math achievement rate was the school's highest in 5 years.

Scores on state tests in reading, writing and math for grades 7 and 8 indicated mixed results of single-gender instruction (see Table 8). In reading, 7th graders decreased proficiency from 40% to 36% in the first year of single-sex classes. The second year of implementation resulted in a significant increase in 7th grade reading from 36% in 2003 to 60% in 2004. While the scores in 2005 decreased to 52%, overall reading scores remained higher than before implementation. Writing levels have been increasing steadily since 2001. Math scores in grade 8 increased initially after single-sex classes, from 17% in 2002 to 22% in 2003. The following year, math scores decreased slightly to 20%, and then in the third year of implementation math achievement reached 28% proficient. This proficiency rating is higher than before single-sex classes began.

Hudson Valley Middle School, NY

Hudson Valley Middle School serves 571 students in grades 5-8 (greatschools.net, 2006). The student body is racially diverse and 37% of the students are eligible for free or reduced lunch. One hundred percent of the teachers are highly qualified to teach. In 2005, the Title I school was identified as in need of improvement- year one due to insufficient growth on standardized tests.

Hudson Valley began offering single-sex classes for core subjects in grades 6, 7 and 8, in September 2002. The school administration hoped that single-gender classes would decrease student distractions and lead to higher test scores (Spielhagen, 2006). According to the school superintendent, attendance and behavior improved for both girls and boys participating in the single-sex classes (NASSPE, 2006). The attendance rates for

Table 8. Proficiency levels for grades 7 and 8- Harris Middle School

Year	Reading 7 th	Writing 7th	Math 8 th
2000-01	40	5	27
2001-02	40	10	17
2002-03	36	18	22
2003-04	60	25	20
2004-05	52	38	28

girls in single-sex classes improved by 49% in the first year of the alternate class arrangement. Attendance rates for boys in single-sex classes improved by 54% the first year. Discipline referrals also decreased by 30 percent for all students participating in single-gender classes. Teachers have noted that girls are “thriving and earning higher marks” and boys in general are improving.

According to data from state standardized testing, the school has an inconsistent history of academic achievement. Scores in 8th grade reading and math were steadily decreasing in the years prior to using single-gender instruction (see Table 9). In 1999, reading and math levels were at 47% and 37% respectively. By 2001, scores had decreased to 31% proficient in reading and 22% proficient in math. In 2002, the year before separating boys and girls, proficiency levels increased to 33% in reading and 35% in math.

In the two years following single-sex implementation, student performance increased in reading and math (see Table 9). Scores in reading for all students increased from 33% in 2002 to 38% in 2003. Math scores also increased from 35% to 46% proficient. Despite initial increases, scores in reading and math decreased in the third year of single-gender classes. Reading scores decreased from 44% to 33%, while math scores decreased from 62% to 50% proficient.

Before single-gender instruction, boys were lagging behind girls in reading and math (see Table 10). In the first year of single-sex classes, boys and girls were performing equally well in math. In the second year of implementation, boys surpassed the girls academically in math scoring 67% proficient versus the girls who were 58% proficient.

Table 9. Proficiency levels in reading and math in grade 8- Hudson Valley Middle School

Year	Reading	Math
1998-99	47	37
1999-00	38	34
2000-01	31	22
2001-02	33	35
2002-03	38	46
2003-04	49	62
2004-05	33	50

Table 10. Proficiency levels by gender in reading and math in grade 8- Hudson Valley Middle School

Year	Reading		Math	
	Boy	Girl	Boy	Girl
2000-01	26	34	18	26
2001-02	26	42	30	42
2002-03	35	42	46	46
2003-04	43	54	67	58
2004-05	34	33	58	39

Boys made significant gains in reading and math after one year of single-sex classes (see Table 10). In 2002 boys' reading proficiency increased from 26% to 35% while girls' scores remained constant at 42% after the implementation year. Similarly, boys' scores in math increased dramatically from 30% to 46% in the initial year of single-sex classes while girls made minor increases from 42% to 46% proficient. The second year of implementation resulted in higher gains for boys and girls. In math, boys increased from 46% in 2002 to 67% in 2003, while girls' math levels increased from 46% to 58% proficient.

Patrick Middle School, KY

Patrick Middle School, located in western Kentucky, has an enrollment of 662 students (www.paducah.k12.ky.us, 2006). The school offers a variety of programs for gifted and talented students. At 93.8%, the attendance rate at the school is slightly lower than district and state averages.

In 2001, Patrick Middle School piloted a nine-week single-sex program for a limited number of classes. Because of the positive results, the school created additional single-sex classes in the 6th and 7th grades the following year. The school made their target goals for adequate yearly progress and is not identified as being in need of improvement, according to No Child Left Behind standards (greatschools.net, 2006).

Based on scores on the national norm reference test used in the 6th grade statewide, the initial year of limited single-sex classes yielded equal or lower scores in math, reading and writing (see Tables 11 & 12). In the second year of more expanded single-sex classes in 2003, proficiency levels in reading and math remained near constant at 54% and 43% respectively. After four years of single-gender classes, reading and

Table 11. Proficiency levels in reading- Patrick Middle School

Year	Grade 6	Grade 7	Grade 8 (n/a)
2000-01	54	50	
2001-02	54	53	
2002-03	55	59	
2003-04	54	56	
2004-05	55	65	
2005-06	57	n/a	

Table 12. Proficiency levels in math- Patrick Middle School

Year	Grade 6	Grade 7 (n/a)	Grade 8
2000-01	50		35
2001-02	43		33
2002-03	43		33
2003-04	48		31
2004-05	50		39
2005-06	49		n/a

writing scores are higher than before the implementation. Reading proficiency reached 57% and writing proficiency was 56% (see Tables 11 & 13).

Reading proficiency levels in 7th grade increased from 50% in 2001 to 53% in 2002 before single-gender classes began (see Table 11). After beginning the separate-sex program, the reading scores increased from 53% in 2002 to 59% proficient in 2003. By 2005, 65% of the 7th grade students were scoring proficient in reading.

Math scores in grade 8 decreased each year in the first three years of single-gender classes (see Table 12). In 2006, after four years of separate gender classes, scores increased from 35% proficient before implementation to 39% proficient in math.

Scores in 7th grade writing increased slightly before introducing single-sex classes from 8% in 2001 to 11% proficient in 2002 (see Table 13). After separating genders in more classes the next year, scores in writing increased from 11% in 2002 to 25% in 2003. While scores decreased slightly in subsequent years, they have not returned to the lower levels that existed before single-sex implementation.

A teacher at Patrick Middle School stated that both girls and boys were more comfortable joining class discussions in the single-sex classrooms. The teacher also observed a decrease in passing notes, pulling hair or punching (NASSPE, 2006).

When the current principal took over the school in July of 2005, the single-gender program ended. He explained that despite the positive effects of the program, the staffing issues far outweighed the benefits for the students. The school operates with a team structure, and the teams were becoming too unbalanced and unfair. The academics did not show significant differences that justified the complications involved with the staffing needs of the program (Principal, personal communication, 2007).

Table 13. Proficiency levels in writing- Patrick Middle School

Year	Grade 6	Grade 7	Grade 8 (N/A)
2000-01	51	8	
2001-02	49	11	
2002-03	49	25	
2003-04	52	20	
2004-05	51	19	
2005-06	56	N/A	

Martin Middle School, GA

Located in a southern, urban city, Martin Middle School is a moderately sized school with 637 students (www.doe.k12.ga.us, 2006). It is a Title One school and 72% of its students qualify for free or reduced lunch. According to the Georgia Department of Education, 93% of the students at Martin are economically disadvantaged. The student population is 91% Black, 5% Hispanic and 4% White. Over half of the teachers at Martin hold advanced degrees, and 24% of the staff are first-year teachers (www.greatschools.net, 2006).

Martin was the first middle school in the state to offer single-gender instruction (www.atlanta.k12.ga.us, 2006). In 2003, single-gender classes were offered for sixth grade students (NASSPE, 2006). Since beginning single-gender classes, the absentee rate for more than 15 days has decreased from 15.6% to 8.4% (www.doe.k12.ga.us, 2006). Martin Middle School did not meet their AYP goals for the 2004-05 school year. The school did make AYP for the 2005-06 school year. Despite the progress, it continues to be labeled “Needs Improvement” for the seventh straight year. The school offers supplementary tutoring after school and during summer months.

Scores were available in grades 6 and 8 over the last five years and were used for analysis. Overall, results on standardized tests were mixed after the implementation of single-gender instruction (see Table 14). Reading scores made no significant changes after beginning single-sex classes. Initially, 6th grade reading scores decreased from 71% in 2003 to 63% in 2004 (see Table 15). Reading levels in 8th grade increased from 61% to 66%.

Table 14. School-wide proficiency levels in reading and math- Martin Middle School

Year	Reading	Math
2000-01	59	43
2001-02	66	49
2002-03	65	43
2003-04	66	53
2004-05	64	46

Table 15.
Proficiency levels in reading and math by grade level- Martin Middle School

Year	Reading 6 th	Math 6 th	Reading 8 th	Math 8 th
2000-01	59	48	73	35
2001-02	64	52	69	47
2002-03	71	45	61	43
2003-04	63	58	66	50
2004-05	62	47	62	41

Both grades increased in math achievement after the first year of single-sex classes. Grade 6 made a significant improvement from 45% to 58% from 2003 to 2004. Grade 8 math achievement rose from 43% to 50% proficient after the first year of implementation. The second year of single-sex classes resulted in lower achievement scores in both grades and both tested areas. Sixth grade math experienced the most significant decrease from 58% 2004 to 47% in 2005. Similarly, grade 8 math scores decreased from 50% in 2004 to 41% in 2005.

Disaggregated data indicated that after beginning single-gender instruction, girls' achievement in math increased significantly (see Table 16). Sixth grade girls' math achievement increased from 48% in 2003 to 74% in 2004. Eighth grade girls increased in math achievement as well rising from 48% to 55% proficient after the first year of implementation. Grade 6 math scores for boys remained mostly unchanged after single-sex instruction began, increasing only slightly the first year from 42% in 2003 to 44% in 2004. In 2005, grade 6 math remained unchanged at 44% proficient. In 8th grade, math scores for boys increased initially from 37% in 2003 to 44% in 2004. In 2005, boys' math scores fell in grade 8 to 30% proficient. Sixth grade reading scores decreased each year after implementation.

Reading achievement levels for boys and girls did not improve in the three years after single-sex instruction began (see Table 16). Grade 8 had a small increase in girls' and boys' reading achievement after the first year of implementation. Scores increased from 68% proficient in 2003 to 72% in 2004 for girls. Boys' reading proficiency increased from 54% in 2003 to 59% in 2004. In the 6th grade, reading levels decreased for boys and girls in the first year of single-sex classes. Reading scores continued to fall

Table 16. Proficiency levels by gender in reading and math- Martin Middle School.

Year	Reading 6 th		Math 6 th		Reading 8 th		Math 8 th	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
2000-01	48	70	45	53	72	73	40	29
2001-02	61	70	54	51	67	76	50	49
2002-03	62	83	42	48	54	68	37	48
2003-04	56	73	44	74	59	72	44	55
2004-05	54	70	44	50	53	70	30	52

slightly in the subsequent year as well. Eighth grade boys and girls also decreased proficiency in the second year of implementation, with boys falling to 53%, lower than before single-sex instruction started.

Illead Middle School, FL

Illead Middle School is a large middle school in Florida with 1100 students (www.greatschools.net, 2006). The students are racially diverse being 46% Black, 31% White and 19 % Hispanic. Sixty-five percent of the students qualify for free or reduced lunch, 17% are Exceptional Students and 13% are Limited English Proficient. The school began offering single-sex classes in 2003. After the first year, the principal expanded the program by tripling the number of students in single-gender classes to over 600.

Academically, scores in math increased across the board after the implementation of single-gender instruction (see Table 17). All grade levels were showing gains in math scores on state standardized tests before single-gender classes, and the trend continued after separating boys and girls. Seventh graders decreased proficiency in the third year of single-gender instruction from 60% in 2005 to 56% in 2006. This was the only decrease in math scores, but scores in all grade levels remain higher in 2006 than before single-sex classes began. Math proficiency in the school increased from 50% in 2003 to 57% in 2004, after one year of single-sex classes. The second year of the single-sex structure resulted in additional growth to a 60% proficiency level. Scores leveled off in the third year remaining at 60% in 2005 and 2006.

Table 17. Proficiency levels in math- Illead Middle School

Year	Grade 6	Grade 7	Grade 8	School
2001-02	51	47	36	46
2002-03	51	48	50	50
2003-04	58	56	56	57
2004-05	57	60	64	60
2005-06	59	56	65	60

Reading scores fluctuated across the grade levels. Sixth and 8th grade reading scores initially decreased after beginning single-sex classes (see Table 18). In 2003, grade 6 was 55% proficient and in 2004, their scores decreased slightly to 52%. Grade 8 decreased from 49% to 46% proficient in those same years. Grade 7 increased the first year but decreased in the second year of single-sex classes. In 2003, 7th grade was 54% proficient and in 2004 they increased to 57%. By the third year of implementation, 7th grade reading levels reached the highest in five years to 61% proficient. Sixth grade had a similar trend with minor increases and decreases in scores until 2006 when they scored 60% proficient, their highest level in five years.

A teacher at the school noticed that girls wanted "...to discuss everything" while her male students usually just wanted to know the answers without much discussion. The principal remarked that some students in separate gender classes are on the honor roll for the first time. According to a student survey of 200 students in the program, 94% of the girls said they felt more comfortable learning in single-gender classes. Boys were not as happy as girls about the gender split, although 75% of the boys demonstrated higher academic achievement.

Mountain Middle School, KY

Mountain Middle School is an urban school with 1077 students in grades 6-8. They began offering single-sex classes in 2002 (www.greatschools.net, 2006).

Sixth graders were tested in math, reading and writing using the Comprehensive Test of Basic Skills. In each content area, student achievement levels increased compared to scores prior to single-gender classes (see Tables 19 & 20).

Table 18. Proficiency levels in reading- Illead Middle School

Year	Grade 6	Grade 7	Grade 8	School
2001-02	56	48	36	49
2002-03	55	54	49	53
2003-04	52	57	46	52
2004-05	51	52	47	50
2005-06	60	61	45	55

Table 19. Proficiency levels in reading- Mountain Middle School

Year	Grade 6	Grade 7	Grade 8 (n/a)
1999-00	60	23	
2001-02	62	68	
2002-03	71	66	
2003-04	68	77	
2004-05	67	75	
2005-06	71	75	

Table 20. Proficiency levels in math- Mountain Middle School

Year	Grade 6	Grade 7 (n/a)	Grade 8
1999-00	61		60
2001-02	61		54
2002-03	72		45
2003-04	72		57
2004-05	70		60
2005-06	79		60

Seventh and eighth graders made significant gains in reading and math in the first year of single-sex classes (see Tables 19 & 20). Seventh grade reading increased from 66% in 2001 to 77% in 2002. Eighth graders increased achievement in math from 45% in 2001 to 57% in 2002. During the second year of implementation, 7th grade reading decreased slightly from 77% to 75% proficient. Scores in 8th grade reading continued to increase from 57% to 60%. After the third year of single-sex classes, scores remained the same in 7th grade reading and 8th grade math.

The school eliminated the single-gender program with the change of administration in the fall of 2006 (Principal, personal communication, 2006).

RESULTS

There was variability among achievement scores in all the schools reviewed in this study. After years of implementing single-gender instruction, some schools experienced gains in reading and/or math while others decreased in proficiency levels. Overall, there were more academic gains than decreases in student performance levels. In general, despite the geographic, socio-economic, racial and population differences among the sample schools, all experienced higher test scores after using single-gender instruction. Only one school had a school average decrease in reading of 1%. For schools that made minimal gains, testimonial evidences indicated progress in areas that are projected to support future academic improvement. For most schools, math scores increased slightly more than reading scores. Three schools out of 8 made more gains in reading than math. The average increase in proficiency levels for all schools in reading was 5.3% and 6.9% for math after 2 to 3 years of single-sex classes.

Grade level differences in this study indicated the populations of students who have the greatest benefit from single-sex classes. Further, disaggregated data for genders indicated the impact separate classes have for boys and for girls. Separate scores for boys and girls were available for three schools in the study.

Reading Achievement

Achievement test scores in reading increased overall in 7 out of 8 schools. On average, reading scores increased 5.3 % after two to three years of single-sex instruction (some schools have used single-gender classes for two years, some for three years). Two middle schools in the study increased reading achievement scores by 9% after beginning separate gender classes. While both of these schools are in the south, one is a rural, mid-

sized school and the other is large, suburban school. The majority of schools had largest gains in the first year of single-sex classes.

Sixth grade scores decreased the first year of single-sex implementation in 5 out of 8 schools. During year two, however, only two schools showed a decrease in reading levels for grade six and at a much smaller rate. By year three, those schools demonstrating initial declines all increased proficiency to the level before or above that before implementation.

Seventh and 8th grade reading scores increased at a higher rate than 6th grade scores. The majority of the student achievement growth occurred in the initial year of implementation. Many of the schools experienced additional increases or minimal decreases, which were less than the initial gains in subsequent years. The one exception was a school, which decreased 4 points the first year in seventh grade and increased 24 points the second year.

Reading Achievement for Girls

Results were mixed on achievement tests for girls after single-sex classes. The year before implementing single-sex classes, one school increased girls' reading proficiency levels from 76.3% to 84%. This trend continued after single-sex class implementation with scores increasing to 88.4%. Reading scores for girls at a second school varied before and after single-sex implementation. At this school, girls' proficiency scores initially increased from 68% to 72%. In the second year, girls' reading scores decreased to 70%.

Reading Achievement for Boys

The data did not reveal significant patterns in boys' reading scores. The reading scores for boys were inconsistent. In one school, scores in grades 6, 7 and 8 for boys were lower after two years of single-gender classes. At a different school, reading scores for boys increased each year from 70.8% proficient before single-gender instruction to 79.6% after two years. A third school had an initial growth in its first two years of single-gender instruction and decreased in its third year. Despite the decrease, scores for boys in reading still remained higher than before single-gender classes.

Math Achievement

Scores on standardized tests increased after implementing single-sex instruction in all of the 8 selected schools. Overall, school-wide math scores increased 6.9% after two to three years of single-sex classes. The three schools making the most gains represent a variety of geographic regions, diverse student populations, and varying socioeconomic levels. The largest improvement in math scores was a southern school that increased math achievement 13% after three years of single-gender instruction.

In the majority of the schools, math achievement scores varied according to grade level. Overall, sixth grade appeared to have the lowest rate of improvement in math while the 8th grade demonstrated the most significant gains. The percentage increases include 12 points, 16 points, and 14-point gains at various schools using single-sex instruction.

Math Achievement for Girls

Data from three schools showed an increase in girls' math achievement scores after one year of single-sex classes. Subsequent years yielded varying results. One

school increased 26 points in year one and decreased 24 points in year two. Another school increased 18 points in the first year and decreased 2 points in the second year. A third school increased more in its second year of implementation and decreased significantly in year three to a lower achievement level than before single-sex classes began.

Math Achievement for Boys

Overall math scores increased for boys after single-sex classes, especially in grade 8. Although scores decreased for some of the years, the gains were greater than the losses. The majority of the increases in math scores occurred after the initial year of implementation. One exception was the school with a 16% gain after its first year of single-sex classes and a 21% gain in the second year. During the same time period, the school also closed the gender achievement gap. All of the schools had higher academic achievement in year two than in year three of single-gender instruction. Two of the schools experienced decreased scores in the third year of single-sex classes. For all of the schools sixth grade boys had the least amount of change in academic achievement in math.

DISCUSSION

In recent years, research literature has revealed that schools are searching for and using a variety of instructional practices to help increase student proficiency levels (Datnow et. al, 2001; Gillis, 2005; Haag, 2000; Newquist, 1997). In the early 1990s, public schools began experimenting with the use of single-gender classes in an attempt to increase academic levels in African-American boys. Some states were given exemptions to the Title IX Law, which prohibited student segregation, in order to try out alternative instructional methods.

After the No Child Left Behind Legislation of 2001, schools were allowed to use single-gender classes as long as they followed the guidelines set by the Title IX exemption section. The number of schools using single-sex classes has increased exponentially in the five years after this legislation passed. In November of 2006, Title IX restrictions for single-sex classes were officially lifted as long as schools offer the classes voluntarily and offer comparable courses in a coeducational setting. This opened the door for many more schools to join the hundreds of schools across the country that already offer single-sex classes.

As the U.S. Department of Education continues to promote the use of alternative teaching practices, schools will continue to experiment with single-gender instruction. Schools have the responsibility to determine if instructional techniques such as single-sex classes have substantial, sustained positive effects on student achievement. Educators and school leaders need to learn whether data supports the separation of boys and girls despite the resistance they may experience from outside groups.

There are lessons to be learned from the schools that have used the single-sex approach. The variety of ways in which schools have implemented single-sex instruction enables educators to learn about the benefits and downfalls of the different methods. Some schools began single-gender instruction on small scales by having only one course taught separately while other schools offered every course in a single-sex format. There are entire schools that teach only one gender or the other, and there are larger schools that function as two separate schools by housing boys and girls in separate areas each with distinct administrators and teachers.

Introduction

As schools gain more flexibility to use different instructional practices, the number of single-sex classes and schools will increase. Oppositional groups fear that significant increases of single-gender programs are harmful and no different than legal segregation. Schools have the ethical responsibility to hear the opposition and make instructional decisions based on research.

Discussion of Case Studies

Test Score Trends

Based on data in this study, single-gender instruction does not negatively affect academic achievement. While some schools experienced significant gains in test scores in reading and math, some schools had little or no gains. Achievement levels increased in math slightly more than in reading. The majority of schools, however, already had higher proficiency levels in reading leaving math scores with more room to improve.

The majority of the schools had decreasing tests scores in math and two schools' proficiency scores decreased in reading before beginning single-sex classes. After

implementation of separate-sex classes, all schools in the study increased overall proficiency in reading and math with one exception. One school decreased average math proficiency by 1% but it is worth noting that this school increased writing scores by 10%.

All of the schools in this study had similar trends each year after initial implementation year. The most significant increases in academic achievement occurred in the first two years of separate-sex instruction. Most schools had decreases in either math or reading in their third year; however, the decreases did not outweigh the increases from the initial years. This trend was consistent for both genders as well. Every school had higher achievement scores for girls in years prior to beginning separate classes, and even with higher baseline scores, girls' scores increased more than boys in both areas. Girls showed the greatest growth on average, and one school had significant improvement on boys' math scores, increasing 16% the first year and 21% the second year. This school completely eliminated the gender gap.

Stakeholder Evidence

Stakeholder responses from several schools in the study indicated positive views of separate gender instruction in areas other than academics. For schools that reported the data, attendance increased and discipline referrals decreased. Parent and student reviews found on greatschools.net indicated an overall satisfaction with separate classes (2006). These results align with the findings from studies of Bryk and Lee (1986), who concluded that while single-gender classes do not significantly increase academic performance, they do have a positive impact on non-academic issues in schools.

Anecdotal evidence from several schools indicated that the majority of boys believe separate classes are beneficial and even more of the girls find the separation to be

a positive experience. At one school, all of the girls surveyed said they accomplished more when in class with only girls. Seventy-five percent of the boys felt the same way (Shah, 2005). After one year of single-sex classes, one school continued separate classes despite having no significant improvement in academic achievement. Behavior and attendance improved in the separate classes, and the school officials believed that the improved scores would not be far behind (Brooks, 2003).

Alignment to Previous Research

The data from the schools in the study are supported by previous research. Maddox (1999) conducted a study on how single-sex instruction effects academic achievement of African American males in 8th and 9th grades in which participants were randomly assigned to single-gender or mixed-gender classes. Marking period grades in language arts, reading and math in 8th grade were significantly higher than their mixed grouped peers. Scores on the math sections of the California Achievement Tests were also higher for the single-gender students. Though numerically single-gender African American male classes were higher, the differences could not be generalized to the entire African American male population.

Despite the many interest groups against single-sex instruction, Martin (2006) found that single-gender public schools do not challenge civil rights. Instead, for the low-income and minority parents who make up a large percentage of those who demand this option, single-gender programs are an extension of the civil rights movement and not a threat to it. Evidence can be found in the test scores of schools that set out to use single-gender education as a tool to reach poor and minority students, a group who has long been left behind in traditional public schools (Martin, 2006).

William Lawson founded a single-sex charter school in Houston in an attempt to cater to the needs of low-income Black males (Martin, 2006). Lawson theorized that these students would learn better if they were apart from girls and taught by Black male teachers. Based on the “soaring” scores in math and reading, his theory may have merit. Similar results occurred in Albany, New York, where the Brighter Choice Charter School offers separate buildings for boys and girls. Due to their academic achievements, a third of all elementary students in Albany applied for the 50 slots available at the school last year (2006).

Another example of how using single-sex instruction can be an effective tool for low achieving students is the Thurgood Marshall Elementary School. In 2000, the principal separated boys and girls in order for teachers to focus their attention more on the issues that affected most of the boys (English skills) and the girls (math skills) due to falling test scores. State test results indicated that boys benefited significantly from this change. Overall, test scores increased from 10% proficient to 66% after two years. Girls’ scores also increased proficiency though not as significantly (2006). Additionally, Wright reported that discipline referrals decreased, student morale increased, twice as many students were going to college, and teen pregnancies decreased (“Single-Sex Education,” 2003).

Thiers found single-sex instruction did not show significant benefit or harm in regard to academic achievement (2006). A comprehensive California study of single-sex schools did not verify or reject the idea that single-sex classes effect academic achievement (Datnow, Hubbard & Woody, 2001). After reviewing research studies on single-sex, the U.S. Department of Education concluded that there is “...some support for

the premise that single-sex schooling can be helpful...for many outcomes, there is no evidence of either benefit or harm” (2005). The mixed results from the current study indicate similar conclusions.

Limitations

The major limitation of this study is the number of schools in the sample. Currently, there are only a handful of public, non-charter or non-magnet middle schools that offer single-sex classes in a coeducational setting (NASSPE, 2006). The purpose of this study was to focus on this specific middle school population to eliminate as many outside factors as possible; thus, the sample size was limited. In addition, not all of the schools had disaggregated data available to determine male and female achievement level changes.

A significant barrier is that single-sex education is a new concept in public schools, and this made longitudinal data non-existent. There is no scientifically valid way to determine if the increased or decreased achievement levels were the result of implementing a new program or design in the school. Teachers, curriculum, textbooks, administration, discipline, class size and many other factors cannot be controlled which makes the true cause of changes unknown. Researchers may only make predictions and projections based on cumulative, extensive data to determine whether a program is worthwhile and if it has merit. The study did not investigate extraneous factors that may have also been implemented at the same time as the implementation of single-gender classes. It can only be assumed that, because of the varied sample group and similar results, the separate-gender classes were a contributing factor to the academic changes.

Despite the improvement in test scores and in non-academic areas, the longevity of single-sex schools remains an issue. At least one school in the study eliminated its single-sex program since the start of this research. Contributing factors of this demise include new school administration, lack of immediate results, loss of parent/student interest (it must be voluntary involvement), inadequate teacher training, poor planning, improper teacher placement, and failure to sustain appropriate teaching strategies for each gender-specifically for males.

One school in the study did not offer training for its single-gender teachers and instead relied on “trial and error” to determine best practices for each group. In that same school, teachers of all boys’ classes complained about the difficulties they experienced with handling a room full of “active boys” (Shah, 2005). While this school is continuing with single-gender classes this year, the boys’ interest level significantly decreased after the first year. Only 30% of the original group of boys wanted to remain in the program for a second year.

Perhaps this loss of boys’ interest is due to the reality that teachers have been using teaching methods that are more suited for the female brain. Boys are more active, are louder than most girls, and usually need lessons that consider these characteristics to keep them engaged (Sax, 2006). Unfortunately, quiet, calm classrooms are what society considers being structured, appropriate educational environments. People will usually do what they are accustomed to doing, especially when they are faced with resistance when attempting something different. Without research-based, ongoing training and support, it is not fair to expect teachers to develop teaching methods that will benefit the male brain (2006).

Different ways in which men and women give directions, for example, correlates with brain differences. Men and women use different regions of the brain, according to neuroscientists, when they are solving problems dealing with navigation (Wunderlick, Spitzer, Thomczak & Riepe, 2000). Women use the cerebral cortex while men primarily use the left hippocampus, an area deep inside the brain that helps form memories for the names of things. This area is not stimulated in women's brains during tasks involving navigational skills (2000). While both methods for navigating work, they are very different and the parts of the brains that are used in each sex are completely separate. This physiological difference in navigation sources may explain why women are more likely to use landmarks to give directions whereas men are more likely to use street names and directional words such as north (Sax, 2006).

Brain differences are evident from early stages of development through adulthood. The brain function and structural differences are responsible for the ways in which men and women think and solve problems. This supports the idea that for maximum learning potential, males and females should be taught to account for these differences.

Abigail James suggests that the biological differences between boys and girls should push schools to approach instruction differently (personal communication, 2006). Strategies she recommends for using single-sex classes with the greatest possible advantages include: starting early, assigning single-sex classes with same sex teachers, developing a sense of belonging in school, including cultural ties, providing academic role models and pairing promotion with remediation. The greatest problem for boys in school, according to James, is that they are boys. Single-sex classes increase self-

management of behaviors because group behavior is similar making it easier for students to recognize and correct misbehaviors. Teachers of single-sex classes can focus on group needs, thereby enabling individual students to feel a sense of belonging. In single-sex environments, students will provide support for each other.

Conclusion

Single-sex education is not going away. The recent change in legislation that allows public schools to offer single-sex courses will undoubtedly encourage more schools to experiment with this student assignment design. Increasing pressure on schools to raise proficiency levels is causing school officials consider to alternative practices. No Child Left Behind (2001) encourages the use of varied instructional practices and requires scientific research to back up instructional decisions. The research that exists on single-sex instruction is extensive, but is primarily limited to private and foreign schools. The United States is beginning to assess public schools to determine whether single-gender instruction is a viable and an effective means to impact student academic achievement.

This study provides an overview for what currently exists for single-gender instructional models in public middle schools. Present research indicates that single-sex instruction is not detrimental nor is it beneficial for academic achievement. Educators need to collect longitudinal data and conduct scientifically valid research to determine the true cause for any academic changes in single-sex classes. As more schools implement this design, it is critical that researchers identify how to effectively initiate and to sustain separate-sex programs, which will increase student achievement and other high quality school indicators.

Schools are to be cautioned, however, about using single-gender instruction as a quick fix to poor achievement scores. The challenge of implementing and sustaining a single-sex program with best teaching practices continues to plague schools. Stakeholder buy-in, teacher training and administrative commitment must exist to maximize the benefits of separating boys and girls. Schools must also be prepared to face resistance from organizations and individuals who may find this segregation to be a step backwards.

Due to the random sampling and variety of student populations that had strikingly similar results, it appears from this study's results that single-sex education is worthy of consideration. Although the majority of schools had no teacher preparation or training prior to single-gender implementations, many demonstrated higher student achievement scores. The positive effects of single-gender assignment could be increased if the programs were effectively implemented, supported and sustained.

Recommendations

The lack of longitudinal data for American, public, single-sex education makes it difficult to make concrete conclusions about the impact it could have on academic achievement. The results of this study indicate a need for further research of schools in the U.S. that continue to use this format. The current research indicates that many other areas may also be affected when teaching boys and girls separately. Further research is needed to determine what other factors may be affected. Student attitudes, self-concepts, career and college aspirations, college attendance rates, attendance and dropout rates are some areas in need of additional research.

Another limitation of this study that prevents more valid conclusions about the impact of single-sex instruction was the lack of teacher training. Researchers must

determine what training programs exist, if any, on how to best teach each gender. It is critical to investigate how achievement scores change when trained teachers who receive ongoing support teach separate gender classes.

This study investigated schools that offer single-sex classes within a coeducational environment. Its purpose was to evaluate results from public schools in order to analyze results from heterogeneous groups of students. Further research could determine if single-sex classes versus single-sex schools make more of an impact on student achievement. Do students perform better when they are separated all day or when they have coeducational opportunities in the day? This is a key decision when schools are considering whether or not to begin offering single-sex instruction.

The teacher shortage crisis in the country calls for a need to determine ways to increase teacher recruitment and retention. While some teachers in the study described teaching boys as being challenging, one explained that the challenges also make it extremely rewarding. A teacher at a single-gender academy who currently teaches all girls classes described days with her students as “positively fabulous” and said she has been able to bond with each one personally this year. All girl classes tend to be quieter and allow for deeper discussions.

Teachers of these classes do not need to adjust teaching styles because they are already using female teaching strategies. Teachers in all boy classes, however, have more changes to make in their instructional delivery and assessment practices. It is not clear if teacher training would decrease all of the challenges related to teaching all boys. Additional research is needed to first discover whether single-sex teachers without training are more likely to stay in the field and what changes, if any, training makes with

these results. Will teaching ultimately become easier for teachers if they have only one gender to teach? If so, this model could be a tool to encourage more teachers to join and stay in the field.

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