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Gender Equity for Girls in the Classroom:

Are Single-Gender Classes the Answer?

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Abstract

A gender gap in technology still exists today. Female students are underrepresented in mathematics, sciences and high-technology fields. They enroll in these learning environments at a lower rate than their male peers. “[Females] are only a small proportion of the high-technology workforce. And gender gaps in enrollment grow as the education level becomes more advanced.” (National Association of Secondary School Principals Bulletin, 2000).

This review examines selected quantitative and qualitative research literature from the past two decades. Possible causes for the under performance by girls in math and science will be presented. This review seeks to suggest that single-gender classrooms for girls will address these causes as a viable solution to the gender gap issue. The conclusion will recommend some actions; actions that can provide a basis whereby we can move forward toward valid gender equitable education for our female students.

Introduction

Female underachievement and under-representation in high-technology professions has been well documented in research. “Women are roughly 20 percent of IT professionals. Women receive less than 28 percent of the computer science bachelor's degrees, down from a high of 37 percent in 1984. Women make up just 9 percent of the recipients of engineering-related bachelor's degree.” (AAUW, Tech-Savvy, 2000).

Past studies have shown that young girls enjoy math and science at the same rate boys do. But around the eighth grade, the boys show an interest in science and mathematics careers at double the rate of girls. “As a result, only 22 percent of engineers and scientists are women – even though women make up nearly half the workforce. If this pattern continues, many of today’s girls will miss out on the jobs of the future” (GSA, 2001).

Schools help to prepare students for the changing workforce. Four-fifths of new entrants into the workforce will be women, minorities and immigrants. Given the increasing normalness of high-technology in the 21st century labor market, there will be a critical need for more women to be involved in math and sciences. To offset this gender inequity, we must engage females in mathematics, sciences and high-technology fields early in their schooling. Boys’ and girls’ SAT scores in math and science are fairly even until middle school. By eighth grade, girls are beginning to fall behind and they slide even further through their high school years (NAEP, 1995-1997). There have been small decreases in the SAT gap between males and females in the last decade in math, but there is still room for improvement (NCES Table 132).

- 91-92 Mean SAT Math Score: 521 Males, 484 Females
- 96-97 Mean SAT Math Score: 530 Males, 494 Females
- 02-03 Mean SAT Math Score: 537 Males, 503 Females

Other studies have shown that gifted males achieve higher, educationally and/or vocationally, than gifted females. Gifted women tend to select occupations of lower status, those requiring less education and positions that allow them more compatibility with family time schedules (AAUW, 1999).

Possible Causes of Gender Inequity

A 1992 report, *How Schools Shortchange Girls*, commissioned by the American Association of University of Women (AAUW) Educational Foundation, revealed, from 3000 students, that girls received less attention in the classroom than boys. Teachers called on boys more frequently than girls. When girls were called upon, they often received negative reinforcement. Baker (1986) found teachers in science class questioned boys on subject matter four times more often than girls. Another study found that 79% of classroom science demonstrations were conducted by boys (Tobin & Garnett, 1987). In a Rwanda Secondary school (van Belle-Prouty, 1990), the researcher Van Belle-Prouty, stated that teachers did not offer much encouragement to young girls to progress in their schoolwork. Agreeing with the AAUW report, she noted there tended to be less praise and less general attention given to female students. When attention was given to the girls, it was viewed as negative by the researcher. Van Belle-Prouty found that appraisals of workbooks and teachers' record books supported her field notes that girls were marginalized in the classroom.

Peggy Orenstein (1994) found that boys were unconsciously given more space, more opportunity to respond to questions. Boys 'demanded' it by answering out of turn, pushing the boundaries of politeness that girls tended to stay within. Calling out wrong answers and acting out were ways in which boys consumed the instructor's attention. Orenstein found that girls were scolded far more severely than boys for the same type of behavior.

The AAUW's 1992 study also found that the school curricula ignored or stereotyped women. Materials chosen by teachers were very male-oriented. Often gender stereotyping was found in too many of the materials students studied in their textbooks, videos, computer software, etc. Most of the teachers' resource books referred not to children or pupils but to 'the boys' or 'he'. Additionally, the reading games suggested in the resource books were 'boy-centric', like fishing and football games.

The study also acknowledged that reports of sexual harassment of girls were increasing and many standardized tests contained elements of gender bias. Boys were encouraged to take risks while girls were self-critical. The fear of ridicule from the boys accommodated girls to play it safe in the classroom through silence.

These forms of gender bias undermine girls' self-esteem and discourage them from pursuing courses of study in math and science. Engaging girls in math and science involves participation, connection, attachment, and integration. Can single-gender classrooms re-engage young girls? Now that the Bush administration is changing the way the government is enforcing the 30-year-old Title IX statute that banned discrimination on gender, causing all-girl/all-boy schools to virtually disappear in the U.S., single-gender education in public schools could once again be made available.

Classroom Studies

Crombie, Abarbanel and Anderson (2001) conducted a quantitative research study involving a high school that offered an all-female 11th grade computer science class for three years. It is "one of the few schools in the Ontario, Canada, public school system to experiment with single-sex computer science classes" (p. 44). Results from this program represent some of the first quantitative evidence of the effects on female students enrolled in computer science

courses at a single-gender high school. Female enrollment increased from 10-15% to 40% after the new class was initiated. Over the next two years, this increase in enrollment by females was maintained. “Thus, solely by enrollment, the all-female class has been a success.” (p. 44). In addition there have been some positive effects on the attitudes and future goals of these girls.

A questionnaire was given to the young women in the eleventh grade in 1997 and 1998. A total of 184 females from eight course sections participated in the study. Forty-five were enrolled in the two all-female sections. One hundred fourteen young men and 25 young women were in the six mixed-gender sections. Some interesting results occurred. Similar levels of teacher support were reported from females from the all-female classes and males from mixed-gender classes. Females from mixed-gender classes reported less perceived teacher support. The same teachers taught the all-female and mixed-gender classes using the same curriculum.

Young women reported similar levels of confidence and intrinsic values from all-female classes and young men from mixed-gender classes. Furthermore, these levels were higher than those reported by females from mixed-gender classes. Females from the all-females classes and young men reported similarly high levels as to future academic and occupational intentions in computer science. While female students from mixed-gender classes were less inclined to take more computer science courses. Additionally, they were less inclined to pursue occupations in these related fields. Computer science teachers worked on diminishing female students’ stereotypes about computer science. They offered an all-female learning environment in addition to the traditional mixed-gender classes. Collaborative work activities increased for the female students in the all-female classes. They were comfortable with the group approach and enjoyed it. The males preferred individual work. In all-female classes, students continued on an

assignment until they felt it had been mastered. The young women did not want to move on until satisfied the product was as good as it could be.

The young women, perceived the all-female class as a safe, comfortable environment. The young women did not have to compete against their male peers in that classroom, not that the females were less competitive than their male peers. In fact they were quite competitive among themselves. Students in the all-female classes were quite vocal and very involved. In the mixed-gender classes with a male majority, females tended to be less vocal.

The all-female computer science class was most effective due to curriculum changes and teacher preparedness to develop strategies and adjust their teaching approaches to meet the interests and learning styles of female students.

Keller and Dauenheimer (2003) conducted research on *stereotype threat*, defined as a situational experience where an individual feels vulnerable and pressured by the possibility of confirming or being judged by a stereotype. If sixth grade girls are reminded of the stereotype that girls are not good at math, e.g. blondes are dumb, their subsequent performance on a math test is impaired (Keller & Dauenheimer, 2003). This threatening experience causes under performance, even among highly skilled girls. Participating in the study were 74 students, 35 girls and 39 boys in the sixth grade, from two German secondary schools. The primary dependent variable was performance on the math test. The test was composed of 26 math problems. Nineteen problems were part of the Third International Mathematics and Science Study (TIMSS). The remaining seven problems were selected from math textbooks. Keller and Dauenheimer's research demonstrated that a reduction in stereotype threat improved performance by members of stigmatized groups. The researchers manipulated stereotypes in a performance situation and measured dejection, agitation, and cheerfulness after test completion.

They provided instructions that “were introduced to heighten the activation of promotion concerns and to lower possible prevention concerns” (p. 375), which created “specific circumstances eliciting promotion concerns” (p. 378), or, in other words, that induced a promotion focus before stereotype threat was manipulated. If you bring women into an achievement situation where these types of stereotype threats are applied, they will under perform (see tables below, p. 377).

	Test Description	
	Threat	No Threat
Women		
<i>Mean</i>	18.1	21.7
<i>n</i>	19	16

Mean number of questions attempted.

	Test Description	
	Threat	No Threat
Women		
<i>Mean</i>	11.6	13.8
<i>n</i>	19	16

Mean number of items correct.

Hae-sook and Kyung-ah’s 1996 study attempted to answer questions about the sexual differentiations in academic achievement and the effect the type of school had on the education process and student outcome. The empirical data obtained through this study was expected to generate insights on ways to realize an educational system that offers equal access to education for all students. Schools targeted were high schools physically located in Seoul. Out of 181 high schools, twenty-three were sampled. Eight were girls’ high schools, seven were boys’ high schools and the remaining eight were coed high schools. The sample students represented female and male students from coed middle schools ($n=520$), male students from boys’ middle schools ($n=442$), and female students from girls’ middle schools ($n=490$). Ninety-three teachers, ranging from 25 to 55 years in age with 10-29 years of teaching experience, were randomly selected from

among the schools chosen in the study. Twenty-one were female and 72 were male. Of that, 34 came from coed high schools and 59 from the single-gender schools. Since all the schools were physically located in Seoul, the research finding could not be generalized as representative of the nations' profile. The failure to control the initial academic abilities of students also posed some limits to the analysis of student achievement.

Results from the survey revealed that the number of female teachers in math and science at the girls' high schools was higher than at the other schools, giving female students enjoyment in the opportunity to have female role models. This created a beneficial educational condition for the girls. In the girls' high school, the credit units for math and science were higher than those in either the coed or all-boys' high schools.

But overall, teachers preferred coeducation in the middle and high schools because "it helps students have a better understanding of the other sex, and it facilitates socialization." Additionally, the teachers felt "it brings equality to educational opportunity." Seemingly in contrast, even teachers in the coed high schools preferred single-gender classes by 60.4%, articulating that they were beneficial due to sexual differences in interest and aptitudes, students could concentrate on learning without distraction from the opposite sex, it provided an opportunity to suit instruction to gender characteristics, and eliminated the risk students faced of neutralizing their sexual characteristics in mixed classes.

From the data, female teachers had more progressive gender role attitudes than the male teachers. But 80% of teachers believed there were sex differences in student achievement, specifically that female students were underachievers in math and science. Teachers' concerns for male students to succeed in education and the work force were higher than for girls, whose responsibility for family was more emphasized. Female students in the coed schools were given

less instruction in math and science as compared to vocational subjects. The all-girls' schools provided more instruction in all subjects. Hae-sook and Kyung-ah concluded that coeducation in its reality is nothing more than male-centered education.

Inzlicht and Ben-Zeev conducted an experimental research study where females were placed, in what they called, a threatening intellectual environment. Their goals of this study were to test 1) whether females, due to being outnumbered by males, suffered a sufficient threat to cause deficits in their intellectual performance and 2) “whether minority-induced performance deficits, if any, are specific to a stereotyped domain or generalized to stereotyped and nonstereotyped domains just the same” (p. 366). The experimental model consisted of asking participants to take a test with either two people of the same sex (same-sex condition) or two people of the opposite sex (minority condition).

Seventy-two female undergraduates at Brown University participated in the study. They were randomly assigned to one of four conditions: sex composition (minority condition vs. same-sex condition) X test type (math [stereotyped domain] vs. verbal [non-stereotyped domain]).

The math tests consisted of 20 items and the verbal tests consisted of 25 items. In both tests, items were of equal difficulty taken from multiple-choice questions in the GRE test guide. To minimize one possible threat to the study, the experimenter was present in the room only when it was absolutely necessary as in handing out the test. A male experimenter greeted half of the participants while a female experimenter greeted the other half. “Females in the minority condition demonstrated a decrease in performance on the math test only (and not the verbal test) when compared with females in the same-sex condition” (p. 367).

Inzlicht and Ben-Zeev now questioned whether males would show the same decrease in performance when in the minority. Their next experiment was almost identical to the first except

that eighteen female participants were added to make up a mixed-gender majority condition. Results showed that males were not affected by being in the minority.

Analyzing both experiments, Inzlicht and Ben-Zeev concluded that females, but not males, under perform in stereotyped problem-solving domains such as math, when placed in the minority. Furthermore, they discovered that the threatening intellectual environment increases as the number of males increase. Gender makeup may act as a “causal situational factor in determining whether gender stereotypes, such as negative stereotypes about females’ mathematical ability, will be activated,” (Deaux, & Major, 1987), causing high-achieving females to under perform.

On opening day of the 1999 school year, the Jefferson Leadership Academies became the first public middle school in the country to offer separate classes for boys and girls. About 1000 uniformed 6th, 7th, and 8th graders entered single-gender classes. It’s too early to judge the success or failure “But there is evidence of change,” principal Jill Rojas told Education World. The district has compared cumulative grade point averages (GPAs) to current GPAs for all students who attended Jefferson in 1998-99 and who are currently enrolled in 1999-2000.

Among the findings:

- Student grade point averages for students who had previously attended Jefferson in either 6th or 7th grade increased for all students, male and female.
- The increase was statistically significant for both genders at grade 7 and for males at grade 8.

Findings for the 2000-2001 academic year:

- Average sizes for the math classes were 28.4 students and 33.5 for science classes.

- The percentage of students scoring at or above the 50th percentile of standardized testing were as follows: 6th grade; males 48%, females 45%; 7th grade – males 35%, females 44%, 8th grade – males 35%, females 33%. *California State Tests

General findings:

- In the presence of good elements of education, small classes and schools, equitable teaching practices and focused academic curriculum, girls and boys succeed.
- Some single-gender programs produce positive results for some students, including a preference for math and science among girls.
- Girls are more apt to answer question aloud in class as well as ask them. Girls are learning to be more academically competitive and boys are learning to collaborate.

A representative day at Jefferson shows one group of 35 boys studying reading, writing and social studies. The girls are studying math and science across the hall. At midday, they swap. Boys are assigned to male teachers and girls are assigned to female teachers for their homeroom class. Some opponents attribute the success of the school to smaller classes, skilled teachers and active parents, but not to gender separation. It is important to note, though, that since the school split into single-gender academies, the school's overall standardized test score has improved 16%.

Baltimore's Western High School, founded in 1844, is a public college-prep magnet school that draws most of its students from inner-city neighborhoods. Its students consistently outperform their peers on standardized tests: SAT scores are well above local, state, and national averages. The percentage of students who pass Maryland state achievement tests seldom dips below 98%. Last year nearly all of Western's graduating class went on to college. About 1000 students apply each year for 250 open spots in its freshman class. Western admits only girls.

Proponents say it eliminates the distraction of the opposite sex and allows teachers to accommodate boys' and girls' supposedly different learning styles. According to the principal, "The students are more focused on what's going on. We hardly ever have discipline problems inside the classroom."

Janice Streitmatter (1997) conducted a quantitative study for over two years at one coed middle school that offered girls-only math classes. She examined the attitudes of girls toward themselves and their classmates and their behavior in girls-only 7th grade pre-algebra and 8th grade algebra math classrooms. Her data was obtained from classroom observations and interviews with 14 out of 24 girls at the school. The results revealed that the girls asked and answered more questions about the subject matter in the math class compared to the subject matter in their other coed classes. The girls confirmed that the single-gender setting improved their ability to learn math. Their positive outlook in seeing themselves as mathematicians was also promising. Overwhelmingly, the girls preferred the single-gender classes to the coed classroom.

This study was limited in that only one group of students and one teacher participated, meaning no control group. Another possible threat to the study was the fact that all the girls were relatively high achievers. Plus Streitmatter did not observe the girls' behavior in their other mixed-gender classes. The findings may not be definitive regarding the benefits of a girls-only math program in a middle school but the girls' consistent reports of their enhanced math self-concepts and the power, credited to the experience of being in the class, should provide a foundation for future research in this area.

Smith (1996) studied students' ($n=1300$) attitudes and achievement in one all-boys' and one all-girls' high school in Australia over a 10 year period. He discovered that after the students

went back into a coeducation classroom, both the girls' and the boys' self-esteem declined initially. But after five years their self-esteem increased to a higher level than was measured when the students were in the single-gender schools. Taken as a whole, this study suggests that the benefits of a single-gender school are not sustainable after leaving the controlled environment.

Sadker and Sadker (1994) have researched the concept of gender bias in the classroom for twenty years. They studied patterns of instruction on girls from elementary through high school. Data from this qualitative study came from analysis of field notes from classroom observations. Results of their studies were published in their 1994 book, *Failing at Fairness: How America's Schools Cheat Girls*. The book illustrates female invisibility, harassment of girls, gender bias and self-gender segregation in the classroom paving the way for what the Sadkers called “second class employment” (p. 186). Critics point to some possible problems with the study.

- Schools in only four states were included in the study.
- Girls were lumped into “all-girls”. There was no distinction for ethnicity, socioeconomic status, etc.
- Since the data collector had not received observer training (usually a teacher), observer bias could have occurred.
- Data collectors could have missed interactions. Trying to record everything between an entire class and teacher could be difficult.

A study, centered on the work of David and Myra Sadker, was conducted at the Illinois Mathematics and Science Academy (IMSA). This study, the Illinois Mathematics and Science Academy (IMSA) 1993-94 Calculus-Based Physics/Mechanics Study, focused on one section of

their calculus-based physics/mechanics class. The students in this class were all-girls during the 1993-94 academic year. This year long study was designed to learn more about how students interacted with their teacher, with each other and the classroom content and how this interaction influenced their learning. Three coed sections were also offered of the same course. Girls had the option to enroll in the single-gender section or coed section. Thirteen girls enrolled in the single-gender section the first semester. A total of eleven girls enrolled in the coed section. Course content, expectations and exams were the same for all sections. However, the learning environment, by design, in the all-girls section was different. In the second phase of this study during the second semester, all sections of the course were taught as coed.

Data from student questionnaires and surveys, classroom observations, test performances and reflective journals written by teachers was analyzed from this predominantly qualitative, interpretive study.

A summary of the major findings are as follows:

- More females enrolled in and successfully completed the course than ever before during the first semester.
- Females in the single-gender section demonstrated significantly higher gains in self-confidence than females in the coed sections.
- The atmosphere in the all-girls class was characterized by a deep sense of responsibility for learning, a special rapport with the teacher, a spirit of collaborative learning and a freedom to ask questions, make mistakes and take risks.
- Females in the single-gender section performed better on quizzes, homework and class exams than females in the coed section taught by the same teacher.

Shapka and Keating's (2003) research investigates the benefits of all-girls classrooms within a public coed high school in Canada. They specifically targeted instruction in mathematics and science during grades 9 and 10. Questionnaire data from this longitudinal study was obtained at two different times. The first time in 1993 (Time 1) and the second time in 1995 (Time 2).

“...we had Time 1 questionnaire data and school record data was 786, including 85 girls from single-sex classes, 84 coeducational girls from the target school, 180 coeducational boys from the target school, 235 coeducational girls from the comparison school, and 202 coeducational boys from the comparison school. We had Time 2 questionnaire data for 474 of these participants. Thus the sample for analyses involving Time 2 self-report data included 57 girls from single-sex classes, 51 coeducational girls from the target school, 123 coeducational boys from the target school, 121 coeducational girls from the comparison school, and 122 coeducational boys from the comparison school. Note that the first section of the results examines the data for potential attrition biases from Time 1 to Time 2 (p. 937).”

Enrollment was voluntary by the girls but they had to have at least a 70% average from their 7th and 8th grade math courses to be eligible. Preexisting achievement, background, and psychological characteristics were included as covariates to ensure comparability of the groups.

Mixed results were obtained during this study. The single-gender classroom had a positive effect on the girls' math and science performance and persistence. So the report suggests that single-gender classes in math and science can reduce gender bias. But it did not have a positive influence of their attitudes toward math. In addition, Shapka and Keating found no “evidence that this attitude mediated the relationship between the intervention and the performance and persistence outcomes” (p. 953).

Karen Stabiner (2002) spent a year observing students at Marlborough, an elite Los Angeles prep school, and at The Young Women's Leadership School (TYWLS), a public school in East Harlem. Both schools are girls only.

Marlborough enrolls students from over 100 different public and independent elementary schools. Each year, the seventh grade class consists of approximately 85 girls coming from 40 different elementary schools. Thirty-five percent of the student body are students of color. Tuition for the current 2004-05 academic year is \$22,500.

The Young Women's Leadership School contains grades 7-12 with average class size from 22 to 26 students. The student body is composed ethnically of 6% white, 40% black, 54% Hispanic and 2% Asian. Attendance hovers around 92% and their graduation rate is just over 91%. Enrollment at this school is very selective.

Stabiner traces the ambitions and accomplishments of the girls and their teachers from data received during classroom observation and questioning. Findings from her study show that in an all-girls' classroom environment, girls gained the confidence to speak out and they concentrated on learning instead of popularity. Other findings show the classrooms to be cheerful and well equipped, the classroom size is small, teachers are very attentive to the students and there is a no-nonsense atmosphere. Opponents to Stabiner's research affirm that she does not study a coed school for purposes of comparison.

Conclusion

Studies over the past two decades have produced mixed results on the effects of a single-gender education. Some suggest that little is gained from separating males and females, as it relates to either in achievement or attitude toward schooling.

The AAUW has come out against single-gender schools, initially in the 1998 report, *Separated by Sex*, which challenges that the research on single-gender schools and classrooms does not conclusively show any benefits for girls. They contend that single-gender education sends the message that boys and girls need a different kind of education. And specifically for

girls, it sends the message that they need special attention. To the boys, the message says that you're too wild, loud, impatient and dominant to be taught in the presence of girls. They point to possible contamination of research data professing the benefits of all-girls' classes to the fact that most studies grouped all the girls together while ignoring ethnicity, socioeconomic status, etc. The AAUW concludes that boys and girls must learn in a mixed-gender setting in order to get along together in the "real" world of life. Their recommendation is that the only way to remedy the gender inequities in the classroom is not to take the girls out, but to educate teachers to the inequities themselves.

On the other side, many studies show that girls do better in academics in all-girl programs and that their self-esteem improves. Some research, mostly qualitative, points to positives with respect to girls' career aspirations in math and science. Single-gender classes may offer female students the educational advantages of learning in a comfortable, non-threatening classroom environment where they are encouraged to enthusiastically participate in classroom discussions and activities. As a result of this positive experience, female students are more likely to pursue higher education in the hard sciences.

Thorne (1993) observed at a middle school that when given a choice of companions, boys so often choose boys and girls choose girls. Just one look at the gender makeup at the lunch tables in the cafeteria confirms his notes. He suggests that shared interests and gender identity is natural.

Have schools made progress toward gender equity in the classroom since the mid 1990's when most of the studies were published? In critical areas such as math and science, the answer for girls is yes. However, as girls narrow performance gaps in math and science, new gaps could develop in computer science, biotechnology, and environmental science. In the 21st century,

America's public schools must meet the needs of an increasing student body. New gender equity research and practice will have to take place to account for the unique needs of diverse populations of girls entering the public schools.

As American schools search for way to improve student achievement, educators may once again consider single-gender education. Suppose a large majority of girls do better in coed classrooms. Would the remaining girls in the minority do better in a single-gender class? Do we not owe it to them to find out? Single-gender education is not for everyone. It is a choice. Parents and students in public schools deserve the opportunity to choose single-gender education just like their peers in private and parochial schools.

“There is no definitive study that says absolutely, positively, without a doubt the best way to educate kids is single-sex classrooms. But there's also no definitive study that says absolutely, positively, without a doubt the best way is coed classrooms”, says Karen Stabiner.

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