

Academic Performance Differences: A Summary of Empirical Studies of Students in Single-Sex and Coeducational Settings

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This paper addresses the question, “*Are there academic performance differences for students in single-sex or coeducational schools?*” Although this topic is not the subject of my MST thesis, it is a topic of great interest to me personally for two reasons. First, I have a daughter, and the issue of all-girls versus coeducational schooling may come up for her in the future. Second, one of my long-range intentions is to eventually start a small private school, therefore, learning about the current empirical evidence for or against single-sex schools, single-sex classes within coeducational schools, and fully coeducational schools and classes would have a bearing on how my school would be organized. Additionally, as I read through the arguments and evidence and summaries, I found this topic to be rich with debate and context, and perhaps something I would be interested in pursuing more formally. In a sense, I’m thankful that my original topic had no available literature (student models of ferromagnets on a microscopic scale), because I would not have learned the issues surrounding the single-sex vs. coeducational schooling debate.

Historical Framework

The resources used in this paper reflect the studies performed in several different countries, namely, The USA, Thailand, New Zealand, and Nigeria. It is important, therefore, to get a sense of the cultural and historical contexts in which the debate has unfolded and continues to unfold on the national and international stage.

The USA

Early American education varied mostly by region, with Western states using predominantly coeducational (CE) schools, and the Northeast and South using predominantly single-sex (SS) schools (Mael). However, by the 1900s, most elementary/secondary schools were CE, not due to philosophical or pedagogical reasons but mostly due to financial woes (Mael). In 1972, Congress passed the *Education Amendments of 1972*¹, and Title IX of these amendments expressly forbids sex discrimination, especially around the concept of equitable resource allocation. This statute was intended to combat sex discrimination in CE schools and open the doors of exclusive All-Male schools², like Harvard and Yale, to female students. Intentionally or not, it has also served the purpose of mostly eliminating all public SS schools. Currently, therefore, most SS schools in the US are private schools, and many of these are Catholic schools (Lee, Marks, & Byrd (1994)). In recent years, however, some schools have defied the statute in order to help, as they saw it, populations of disadvantaged students (Salomone). The Supreme Court upheld the statute in *United States v. Virginia* when it

1 The full text of Title IX is available from various sources, one of which is the Department of Labor's Office of the Assistant Secretary for Administration and Management (DOL OASAM) <http://www.dol.gov/oasam/regs/statutes/titleix.htm>.

2 I will abbreviate All-Male schools as SSm (for single-sex male) and All-Female schools as SSf.

ruled in 1996 that Virginia Military Institute (VMI) must admit female students (Mael). Compounding the problem, the 2001 No Child Left Behind Act³ approved funds for “same-gender schools and classrooms” that work within existing statutes. Shortly afterward, the Department of Education issued a report that it was considering revising the sex-discrimination regulations to afford more flexibility to individual schools (Salomone). Finally, in 2004, the Office of Civil Rights “issued proposals that would permit single-sex schools and classes with few limitations” (Salomone, p 779). It is apparent that the new regulations are going to be challenged against the back-drop of Title IX and the 1996 Supreme Court ruling. This underscores the need for a more complete empirical description of SS and CE schools, and how they may best serve various populations of students.

Thailand

Until 1921, Thai girls were not educated. The changes were formalized in 1932 with the passage of a law requiring compulsory education for both sexes. Since then, and by 1970, 48% of students in primary, and 42% in secondary were female. Most families choose SS schools (typically Catholic schools) for the increased exposure to English language instruction (Jimenez & Lockheed).

New Zealand

Although no detailed history of New Zealand schools was given in any of the papers used in this report, it was pointed out that SS schools have been a part of the New Zealand educational landscape for quite some time. Whereas in the US most (if not all)

³ The full text of No Child Left Behind is available from the Department of Education, <http://www.ed.gov/nclb/landing.jhtml>.

SS schools are private, this is not the case in New Zealand, where public SS schools have strong support (Harker).

Nigeria

Until 1976, the type and format of schooling differed considerably from region to region. In 1976, though, a National Policy on Education set universal standards of a 6-year primary followed by two 3-year secondaries (lower and upper). Educational opportunities for women are reduced compared to men, due to two factors. First, the northern part of the country is Muslim, and so there is little value placed on educating girls. Coeducation is not an option, and the SSf schools that do exist have very poor resources. In the rest of the country, although girls are educated, it is at a much reduced rate compared to boys. In 1982, only 14% of girls aged 12-17 were enrolled in school, compared to 42% of boys. (Lee & Lockheed (1990)).

Procedure

In identifying the studies used in this paper, I relied primarily upon Google Scholar, <http://scholar.google.com/>. I originally identified roughly twenty studies and papers that discussed empirical data regarding SS or CE schools, looking in particular for a diversity of views, a diversity of represented cultures, and a wide spectrum of publications dates without going so far back in time as to have the data be outdated. Another factor was whether the paper had any citations, which Google Scholar lists in its search results.

Once the original twenty or so papers were identified, I selected the eight I felt met the criteria I have identified above. I chose one paper that was slightly more

theoretical (Salomone) because I saw value in its synthesis of the issues and its discussion of elements of educational history in the US, particularly its discussion of No Child Left Behind and the current trend in the US to see potential value again in SS schooling. In addition, I selected a review paper (Mael) that I felt summarized the major arguments and synthesized the evidence both for and against SS and CE. The Mael paper was also relatively recent, so I expected to use it to help guide my structuring of this project, and indeed it served in that role well. I felt the three Lee (et al) studies were important to include so that one researcher's work could be investigated in relative depth.

Summary of Propositions

The most salient feature of the various studies read for this project was the level of debate and re-interpreting of results from one researcher to the next. It was not uncommon to find results given as evidence toward a particular view in one study turn up in a different study supporting the contrary position. Much of the debate here is primarily driven by to what extent the researchers have controlled for *prior ability* in the students investigated. Prior ability reflects the abilities, generally assumed to be academic abilities, that a student may possess before becoming part of a research study. If a student is already a high achiever upon entering a SS school, and then tests well on a research battery, the result could be seen as that student doing well because she is a member of the SS school, or could instead be seen as that student simply continuing her positive academic trend. Therefore, it is imperative to control for prior ability before any claims can be made regarding the effectiveness of one program over another.

Likewise, it is equally important to apply appropriate controls, rather than

selective controls that assist in “tweaking” the data toward a particular bias. Any two statisticians, given the same dataset, could easily reach two starkly different conclusions, depending upon which assumptions they make, how the data are manipulated, and how and to what extent controls are implemented. A quick browse through *How to Lie With Statistics*⁴ provides ample cause for concern whenever a) initial studies make particular claims, and b) when a “re-interpretation” of the data using different controls turns up contrary conclusions.

The major propositions discussed in the studies selected for this project, in answering the question of whether or not there are performance differences for students in SS or CE schools, are:

- Performance differences vary by subject area;
- Performance differences vary by socioeconomic status;
- Performance differences vary by country; and
- Performance differences vary by gender.

Subject Area

There are three categories within the subject area differences: a) differences in actual achievement, b) differences in frequency of participation, and c) differences in classroom climate and/or personal attitudes. Technically, b) and c) are not performance differences, but work in developmental psychology demonstrates strong correlations between attitude and achievement (Salomone). In addition, getting students involved in more math courses, more science courses, and more advanced courses of any sort, leads overall to a raising of the educational bar, and this can't be bad.

4 Huff, D. (1982). W.W. Norton & Company.

Achievement. The most persistent finding in terms of differences in academic achievement was that girls in SSf schools do better in mathematics (Jimenez, Mael, Lee (1990)) compared to girls in CE schools. At the very worst, no difference was found between SSf girls and CE girls in mathematics achievement (Harker). Second to math was that girls in SSf schools do better in science (no specific sciences were delineated, so this could be in biology, chemistry, and/or physics) than girls in CE schools (Lee & Bryk (1986), Jimenez, Mael). As with mathematics, no difference in girls' science achievement was found by Harker (this is in New Zealand, which will be discussed more in the differences by country section).

Boys, however, did not fare so well. Although SSm school boys showed some achievement gains in the language arts (Salomone), they typically either did worse than their CE counterparts in mathematics (Jimenez, Lee(1990)) and in science (Jimenez), or showed no difference in achievement from CE boys (Harker).

Non-traditional classes. Many of us engaged in education see first hand how females are under-represented in mathematics and the physical sciences. Although females make up 60% of the college undergraduate population (Lee (1994)), most of these students are enrolled in sex-typed programs (e.g., foreign languages, biology, history) and not in non-traditional classes (e.g., math, physical science). Therefore, perhaps even more important than measured achievement gains (or not, depending on the study) on standardized tests, it is crucial to understand to what extent, if any, SS schools could help mitigate the disparity found in math and science, especially in how many of each course students of different genders take.

Every study that investigated this issue found that girls in SSf schools and boys in SSm schools took, with higher frequency, classes non-traditional to their gender. Specifically, SSf girls took more math courses (Lee (1986), Jackson, Salomone, Mael) and more science courses (Salomone, Mael). Beyond simply taking more courses, SSf girls also took more advanced and upper-level math and science courses (Salomone) when compared to CE girls.

Similarly to girls, boys have their own collection of non-traditional courses. Boys in SSm schools tend to participate more in non-traditional courses like language arts and the humanities (Salomone), but also engage in more non-traditional extra-curricular activities such as choir, student government, and drama (Mael, Salomone).

Classroom climate and attitudes. Another very powerful widening force in the separation of females from traditionally male careers is societal attitude. There is no clear path evident to overcome the many cultural, religious, or secular obstacles that keep gender-equity always out of reach, but there does not need to be. One of the primary messages of the *Tao Te Ching*⁵ is “be yourself, the rest will follow.” Therefore it is encouraging to find that girls in SSf schools were more likely to want to be remembered as smart rather than pretty (Lee (1986)), felt more confident and enjoyment from math and science classes (Jackson & Smith, Salomone), and were less self-conscious about asking questions in science classes (Salomone). As individual students make such changes in themselves, society has no choice but to eventually follow.

Contrasted to these results is a study of four types of class (chemistry, calculus,

⁵ See, for example, verses 2, 3, 6, 7, 9, 12, 13, 17, 20, 23, 30, etc.

english, and history) in seven US CE schools (Lee (1994)). Although observations in CE chemistry classes accounted for only 20% of the total observations, they accounted for 66% of all observed instances of sexism in the CE schools (typically these were of the form Gender Domination, where either males spoke over females, or teachers called on males at the exclusion of females). An example was given in the study of one male chemistry teacher who answered a female student's question about how to use a graduated cylinder by dumping the contents (water) of a graduated cylinder onto her, to the laughter of the mostly male class (Lee (1994)).

This is not to say that SS schools were absent of negative engendering events; the SSm schools investigated had the only instances of blatant sexism, where a male English teacher encouraged sexual interpretations of classical literature (Lee (1994)). Perhaps more deeply vexing were the instances of subtle sexism found in some SSf schools, such as the “dumbing down” of calculus equations or the discussion of chemistry labs as practice for cooking (Lee (1994)). However, it is impossible to have gender domination (GD) type discrimination when there is a single sex present, and GD accounted for the vast majority of sexist events in CE schools. The sexism found in SSf schools was exclusively of the less intense forms, while only the one SSm school showed evidence of extreme sexism. Further, only 45% of the schools investigated (all SS and CE combined) evidenced *any form* of obvious sexism.

It is worth noting that the attitudinal and classroom climate gains discussed for girls, just like academic achievement, were not present for boys, and in some cases boys' attitudes worsened in SSm environments (Jackson).

Socioeconomic Status

One of the types of selection bias is that of socioeconomic status. A question raised by many critics of studies that show gains for SS school children is that proper controls had not been established to squelch out bias due to prior achievement, prior ability, and socioeconomic status (all predictors of future success) (Harker).

Although it is beyond the scope of this project to evaluate the controls used by researchers in this field, discussion of socioeconomic status is possible to an extent. For example, it has been noted that students from disadvantaged households will reap more gains from SS schooling than will their more advantaged peers (Jimenez, Salomone). This effect is due to peer groups. When a student has peers who do well, that student tends to also do well (Jimenez). Therefore, since disadvantaged households tend to have fewer resources, and lower achieving peer groups, the gain seen in these students when attending SS schools is sensible.

Country

Educational systems are different from nation to nation. The US has public schools that are almost universally CE, with a dwindling (since the 1960's and more after the 1972 Title IX) number of SS schools (Salomone). However, New Zealand has had public and private SS and CE schools for as long as there have been schools there (Harker). Therefore, it is difficult to generalize results from one country to the next. This difficulty is compounded when cultural and religious differences are considered. For example, certain Muslim countries (e.g., Saudi Arabia) simply do not educate girls, as Thailand did not until the 1920s (Jimenez).

From the available studies, the conclusions are that New Zealand school children do not experience any significant gains or losses by being enrolled in either SS or CE schools, whereas US, Thai, and Nigerian students experience results mixed by gender (more about this in the next section).

Gender

Gender differences have already been discussed to some extent in earlier sections. Here, a summary of those discussions will be combined with some additional information and analysis.

Females. It is safe to say that girls tend to be the most favored by SS instruction, whether in a SS school (Lee (1986), Jimenez, Mael, Salomone, Lee (1990)), or in a SS classroom within a CE school (Jackson). These gains are manifested in higher academic achievement and increased enjoyment of non-traditional subjects (e.g., math and science). Additionally, girls in SSf settings tend to gain in self-confidence and report feeling more at ease to ask questions or express themselves in non-traditional subjects (Salomone). In one study, Nigerian girls felt physically safer in a SSf school (Lee (1990)), due to decreased exposure to ongoing violence in that area.

By way of example, in a SSf math class (within a CE school), 38% of the girls said the main difference between SS and CE was not getting made fun of or picked on for incorrect responses (Jackson). It is generally accepted that girls tend to favor collaborative versus competitive academic environments (Salomone), and these environments are realized in SS settings. Jimenez found that if you take two girls with similar backgrounds, place one in SS and one in CE schools, then the one attending SSf

school will do, on average, 40% better than the one in CE school.

Males. If girls benefit the most, then boys must benefit the least from SS instruction. However, while it is true that they benefit less than girls, the more unhappy reality is that they do not benefit at all; in fact, their progress and achievement is generally hurt by SS settings when compared to CE. Several different researchers have posited suggestions as to why that may be, and these are summarized below.

Jimenez found that if two boys of equal backgrounds are sent to SSm and CE schools, then the boy in SSm school will do 20% worse than the boy in CE school. He attributes this to peer groups, in that boys with only male peer groups tended to do worse, independent of school type. Thus, girls were seen as having a positive effect on the boys' peer groups, whereas boys were seen as having a negative effect on the girls' peer groups.

Boys are very rarely the subject of sexism at school (Lee (1994)), so they would gain no benefit in that regard from being in a SSm or a CE environment. Girls, however, are the usual target of domination type (the most frequent type) sexism, so they have more benefit potential when removed from the more oppressive environment of CE schools (Mael, Salomone).

Exposed by these gender differences is the problem that “you can't have it both ways.” If SSf situations are indeed beneficial to girls, and CE situations are indeed beneficial to boys, these are mutually exclusive states. If all the girls are enrolled in SSf schools, there won't be any left to put the “co” in coeducation for the boys.

Implications for Practice

One strategy that has been implemented (Jackson) is that of combining SS classes

into CE schools. From the studies used in this project, there is strong evidence suggesting that girls experience real performance and attitude gains in non-traditional subjects when they work on those subjects in a SS environment. Boys, however, benefit mostly from the presence of girls, who tend to act as “civilizing agents” for them (Salomone). However, a girl instructing her classmates to clean up after themselves serves only to strengthen sex-role stereotypes. As Vizzini says in the *Princess Bride*, “I am not a great fool, so I can clearly not choose the wine in front of you. But you must have known I was not a great fool, you would have counted on it, so I can clearly not choose the wine in front of me.” What we have is a case where we cannot choose either of the wines available to us, for they each have poison.

I believe the poisons are mitigated, however, in the combination approach I mentioned above. By having some classes taken as SS, any benefits from doing so can be realized. Likewise, by having some classes taken as CE, those benefits may be realized. From what the studies have shown, perhaps the greatest gain is to be had with SS classes in math and science, and CE classes in the humanities. This combination also minimizes the observed sexism; CE Chemistry and SSm English/History accounted for the most instances of sexism, whereas CE English/History and SS Calculus had the least instances of sexism (Lee (1994)). Therefore, SS Science/Math and CE English/History seem an appropriate approach.

Additionally, those classrooms that are run as CE should have posters and displays that are more representative of each gender's contributions, while those classrooms that are run as SS should avoid stereotypical sex-roles (e.g., the girls

chemistry area does not have to be painted pink). Active efforts, through the creation of gender-equity committees can also serve to equilibrate the gains and minimize the shortcomings of each approach.

Implications for Future Research

Clearly there is a need to determine to what extent combination SS and CE settings can benefit all students. Investigations into school management strategies and teacher practices⁶ are key in more fully understanding how to best parse our available resources.

Additionally, very little work has been done on the individual differences among students. Perhaps there are sub-populations within females, for example, who are not affected positively by being in a SSf math class. We need to better understand the predictors, apart from simply gender, that determine success in one environment versus another.

All of these implications are becoming increasingly important as Congress and others seek strong empirical evidence to support or squelch the creation of additional SS programs available to (especially disadvantaged) students.

Conclusions

Female students can expect, at worst, no additional performance gains by attending a SSf school. More likely, however, they can expect very real gains in terms of math, science, self-concept, and enjoyment. Thus, for female students, having at least some experiences in SSf classes or schools seems really to be a no-brainer: it can't hurt,

⁶ It was teachers who perpetrated almost all observed instances of sexism (Lee (1994))

and more than likely it will be a benefit. Unfortunately, boys are in the opposite situation, in that more than likely they will experience reduced performance by attending SSm schools (but perhaps not just SSm classes within a CE school). So, the answer to the question, “Are there academic performance differences for students in Single-Sex or Coeducational schools?” is: *It Depends*. Not everything is certain; that's why we do research.

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