

Empirical evidence on the coeducational/single-sex schooling debate

Ian Smith, University of Sydney

1. Introduction

The public debate in Australia over the relative advantages and disadvantages of coeducational and single-sex schooling shows no signs of abating. Regular articles appear in the popular press and in academic journals on the merits of both types of classes and schools. A similar debate is occurring in England where some of the most prestigious 'public' schools have become coeducational in the past decade. This debate, however, is virtually non-existent in continental Europe or in the United States, where coeducation continues to be the norm. A recent history of coeducation in American public schools (Tyack and Hansot, 1990), for example, found that sex-segregation of school classes occurred on the periphery rather than at the centre of the curriculum in the Nineteenth Century. By 'periphery' these authors mean such subjects as home economics and physical education. They argued that the value of supporting local, community schools and the widespread distribution of the population across the country rendered single-sex schools uneconomic. In Australia, on the other hand, the early Church influence on education and the concentration of the population in relatively few large cities allowed the development of single-sex schools. During the recent recession of the 1980s there has occurred the amalgamation of many single-sex schools, but there has simultaneously been pressure to establish single-sex classes in coeducational schools. In New South Wales this policy has the support of the Minister for Education, Mrs. Virginia Chadwick.

What is the research evidence in support of such changes in educational policy and practice? Why does the coeducational/single-sex schooling debate continue to generate such heat in Australia, whereas in the U.S. one reviewer summed up the situation in the following way:

The average high school was just too small to accommodate separate academic classes for boys and girls, and coeducation was too deeply entrenched in America's public schools to be abandoned.
(Kaufman, 1991, p. 23)

This paper will review the research evidence on the coeducational/single-sex schooling debate before outlining a five-year-long empirical study of the impact of the transition from single-sex to coeducation in two Sydney state high schools on student achievement and self-concept, as well as upon teacher perceptions of the coeducation process.

2. Review of literature on the coeducation/single-sex schooling issue

Single-sex/coeducational comparisons are hampered by the problem of selecting equivalent schools of each type of gender-based enrolment. Because single-sex schools are more likely to be selective state or independent schools, their students are generally brighter and come from higher socio-economic backgrounds than students from coeducational schools. Therefore, comparisons between the two types of schools are fraught with methodological difficulties. Nevertheless, there has been a number of studies which have compared schools from a single system (e.g., single-sex and coeducational comprehensive high schools and English grammar schools). Other research has compared single-sex and coeducational classes within the same schools.

It has been widely demonstrated (e.g., Gilligan, 1982; Spender, 1982) that boys typically attract more of the teacher's attention than girls in coeducational classrooms. Dale Spender has documented this generalisation in her book "Invisible Women". Spender found that girls, especially in the junior secondary years, are reluctant to express their viewpoints in front of boys. Gill (1991) reported that higher teacher-male student interaction was more common when the teacher was inexperienced. More experienced teachers adopted strategies in the classroom to reduce the imbalance in interaction with boys and girls. Nevertheless, boys still received more teacher attention than girls. The reluctance of girls to speak up in class does not necessarily mean that girls are disadvantaged in terms of their classroom learning or educational achievement. In an extensive classroom observational study in South Australian schools, Gill (1992) reported that boys asked more trivial questions merely to gain the teacher's attention, whereas girls were more likely to seek clarification for their learning problems from friends or their seating partner.

Historically, the most important research into single-sex/coeducational differences is the English psychologist, R.R. Dale's (1969, 1971, 1974) 26-year-long study of English grammar schools, where students were selected on the basis of their performance of the 11+ examination. Dale's major emphasis was on the social effects of co-education. In his third volume (1974), however, he expanded his research variables to include overall and subject-specific indicators of student achievement. On the basis of his research findings he concluded that "it has been demonstrated that the average coeducational grammar school is a happier community for both staff and pupils than the average single-sex school; it has equally been demonstrated that this happiness is not at the expense of academic progress" (Dale, 1974, p 273). When reporting the specific findings on mathematics achievement, Dale stated that: "Throughout the researches there is a clear superiority of co-educated boys over boys in boys' schools ... Similar superiority may exist for the co-educated girls over girls in girls' schools, though ... its amount is sometimes hidden by the operation of other forces" (1974, p

59). For attainment in English, Dale found no clear support for the advantage of either type of school for boys or girls. Dale concluded that "a cautious summing up would be that the progress of boys is probably improved by co-education while that of girls is not harmed" (1974, p 269).

Dale's research has been criticised on the grounds that its findings are dated and that he was biased against single-sex schools. The question might be raised: "What researcher does not have personal biases?". The first criticism is countered by the results of a more recent Committee of Inquiry into the Teaching of Mathematics in schools in England and Wales. This Committee concluded:

Although it is possible to identify some girls' schools in which levels of mathematical attainment are high, it is often the case that there are other factors, such as the fact that the school is selective, which may provide the explanation. (Cockcroft, 1982, p 64)

Recent research in England and Wales by Steedman(1985) and in Northern Ireland by Daley(1994) has confirmed that, when student and school background factors are controlled, single-sex schooling does not result in superior academic performance for girls in public examinations.

Australian research findings on the effects of gender-based education are conflicting. For example, a longitudinal study was conducted in a

Victorian high school which randomly allocated Year 7 and 8 students into coeducational or single-sex classes in a coeducational school. When the students were administered items from standardised mathematics achievement tests on three occasions over a two-year period, the researcher (Rowe, 1988) found no gender differences in achievement based on the type of maths class, but did report increased levels of confidence in learning and using mathematics by girls in single-sex classes. He concluded that being placed in a single-sex class leads to girls' greater confidence about their maths ability "which, in turn, significantly increased the likelihood of their subsequent participation in senior mainstream mathematics education" (Rowe, 1988, p 80).

On the other hand, Carpenter (1985) examined the Year 12 achievement scores of a sample of over 1200 carefully selected Queensland students.

He reported that student achievement in a given type of school was influenced by a number of variables including the curriculum, teachers' encouragement and the social class background of the students. He found that "while single-sex schooling appears an advantage to the daughters of mothers who are white collar workers to avoid low year 12 marks and gain medium results, coeducational schooling offers such girls a small advantage in achieving high marks. Among girls whose

mothers did not hold a paid job single-sex schooling offers a little more insurance against scoring low marks" (Carpenter, 1985, p 469).

A review of U.K. and Australian studies on the alleged academic advantages of single-sex over coeducational school attendance concluded that "the empirical evidence in favour of single-sex schooling is of questionable value" (Willis and Kenway, 1986, p. 132). These reviewers maintained that a causal relationship between single-sex school attendance and superior achievement has not been established, arguing that separate schooling is dangerous in its potential for greater social divisiveness. Students who are educated in separate schools may develop attitudes towards the opposite sex which are outdated and stereotypical (Phillips, 1979).

A survey of U.S. Catholic school and public school achievement levels (Lee and Bryk, 1986) suggested that students attending Catholic single-sex schools outperformed their public school peers. High academic achievement, especially for girls, was associated with attendance at single-sex schools. A reanalysis of these data by Marsh (1989), however, cast doubt on the equivalence of the student populations who attended the two types of schools.

On the issue of the social advantages of coeducational schools, Harris (1986) surveyed over five hundred first-year Australian university students. She found that most students, especially those who had attended coeducational schools, believed that coeducational schools are preferable and lead to a more natural attitude towards the opposite sex. While Harris admitted that the single-sex schools attended were generally smaller, more urban and more selective than the coeducational schools, making comparisons difficult to interpret, she concluded that "coeducational schooling, at least for this selective sample, may have some advantages in fostering interactions with the opposite sex (Harris, 1986, p. 117).

The complexity of the interactions between single-sex/coeducational schooling, social class, teacher and curriculum variables is such that it has led one reviewer of the field to the following position:

"Research reviewed leads to the conclusion that type of school makes little difference to gender inequalities (especially those suffered by

girls); that single-sex classes for specific purposes in coeducational schools are only of limited value; and that new ways of reducing sexism in all types of school, whether mixed or sex-segregated, must be found". (Gray, 1987, p 34)

3 Description of this study

With this background of mixed research evidence in mind, I would now like to outline the 5-year-long research project that our group conducted at two Sydney high schools (Marsh, Smith, Marsh and Owens, 1988). Both schools were comprehensive Government high schools which became coeducational in 1983. Prior to 1983 one was an all-boys' school, while the other was an all-girls' school. They are located in the same geographical area, being separated by parkland in a Northern Beaches suburb. The initiative for the transition to coeducational status in both schools came from the parents who believed that a coeducational school would provide a better social and academic environment for their children. Because it was State Government policy at the time for new Government high schools to be coeducational, the Minister for Education, Mr Paul Landa, agreed to the proposed change. I became involved in the transition when I was invited by the Principal of the former girls' high school to spend a day at her school speaking to staff and senior girls about the implications of the change for teachers and students. One of the educational implications of the transition was the allocation of students into classes in the various subjects. For instance, the mathematics staff had decided to stream the students on the basis of past mathematics achievement. They were concerned about placing girls into the top maths class in Year 11 if only a few merited it. As it turned out the top maths classes in the year co-education commenced were almost equally composed of girls and boys.

Towards the end of the in-service day I suggested to the Principal of the former girls' high school that this transition provided a unique opportunity to study a social experiment in action. Approval was given to administer self-concept questionnaires and collect achievement data before, during and after the transition to coeducational status in both schools.

The research into student self-concept as a measure of social development was guided by two questions:

1. Do students attending single-sex classes have different self-concepts from those attending coeducational classes?; and
2. It was anticipated that there would be sex differences in some areas of self-concept. Are such differences affected by attending single-sex or coeducational classes?

Similarly, our research into student achievement in mathematics and English was aimed at answering two questions:

1. Do students attending single-sex schools achieve differently from students attending coeducational classes?
2. It was anticipated that girls would achieve higher scores than boys in School Certificate English and, perhaps, lower scores in School Certificate mathematics. Are such differences affected by attending single-sex or coeducational classes?

The transition from single-sex to coeducational status in the two high schools took place over a two-year period in order to minimise disruption to students studying for the School Certificate and Higher

School Certificate. In 1983 Years 7, 9 and 11 became coeducational in both schools. In 1984 all classes in all six grades from 7 to 12 were coeducational. Yearly testing took place over the period 1982-1986. Year 12 students were unavailable to participate in our research because they were involved in Higher School Certificate examinations.

It is now proposed to discuss the results separately for student self-concept, achievement in School Certificate mathematics and English, and teacher perceptions of the effects of coeducational classes on students.

4. Method

Sample

In 1982 (Year 1 of the study) a boys high school (BHS) and a girls high school (GHS) were separate single-sex (SS) high schools serving the same suburb of metropolitan Sydney. Largely on account of the initiative of parents, the decision was made to form two coed schools. To minimize the anticipated disruption caused by the onset of the transition for students in grades 10 and 12 who were preparing for external examination, the transition was implemented over a 2-year period. In 1983 (Year 2) students in grades 7, 9, and 11 from both schools attended coed classes, whereas their respective schools. In 1984 (Year 3) and 1985 (Year 4) all students in both schools attended coed classes. Hence, Year 1 is referred to as the pretransition, Year 2 as the transition, and Years 3 and 4 as the posttransition.

Procedures

Self-concept scores. The Self Description Questionnaire (SDQ) II (described later in the section titled 'The SDQ II Self-Concept Instrument') was administered to groups of students in each of the two high schools on consecutive days near the end of the academic year by researchers not otherwise connected with the schools. Each group consisted of students from the same grade level (i.e., year in school).

Instructions were read aloud, several practice items were presented, questions about the instructions were answered, and then the items were read aloud at a fairly rapid pace (though students had a copy of the instrument in front of them so that they could read along if they chose to do so). The primary purpose of reading the items aloud was to ensure that students spent a standard amount of time on each item and finished within the time limit allocated for the task.

A total of 3,816 SDQ II instruments were completed by students (51% male) in grades 7-11 during all 4 years of the study. The smaller number of responses completed by grade 11 students is because grade 10 has been the traditional school-leaving time, when students are awarded a School Certificate, so that grade 11 enrolments are considerably smaller. Because grade 12 students did not attend school during the last part of the academic year when the data were collected, responses from these students were not collected as part of the study.

As part of the study, students were assured of the anonymity of their responses and asked, but required, to put their names on the self-concept instrument; approximately 75% did so. Because 25% chose not to do so, it was not possible to match instruments completed by the same student from one year to the next or to match self-concept responses and achievement scores. Instead, data for each grade level in each year of the study were based on the responses by all students who attended school the day the self-concept instruments were

administered. Students in each age cohort were largely, though not completely, the same from one year to the next, but longitudinal effects were treated as between-group comparisons. An important feature of the study is that responses from students in grades 7-11 were collected in each of the 4 years of the study. Because age and age-related variables were relatively constant across the 4 years of the study, such effects are not confounded with the intervention effects. In this respect, the design is like the sequential research design described by Goulet that combines characteristics of longitudinal, cross-sectional, and time-lag designs. The logic and statistical analysis of comparisons based on this design are considered in more detail in the presentation of results.

Achievement indicators. Academic achievement was assessed by scores from the externally moderated School Certificate awards in mathematics and English. All grade 10 students in the state of New South Wales complete standardized examinations in English and mathematics administered by the NSW State Department of School Education. Scores on these examinations determine the distribution of grades to be awarded by each high school. That is, high schools that score better on the standardized examination award correspondingly higher grades to their students. The grades assigned to individual students within a particular school, however, are based on performance measures established by each high school that are consistent with a statewide curriculum. School performance, therefore, is the basis of the relative ranking of students within each high school, but the translation of the school performance measures into grades is externally moderated according to the school's performance on the standardized examination. Hence, the mean and distribution of school certificate grades awarded in a given school are completely determined

by how well students performed on statewide examinations. For this reason, school certificate grades in English and mathematics are reasonably comparable from one school to the next and from one year to the next even though they are based on internal assessments.

The SDQ II Self-Concept Instrument

The SDQ II, a self-concept measure for high school students, is based on the Shavelson model of self-concept (Marsh & Shavelson, 1985; Shavelson et al., 1976) and the multiple dimensions of self-concept defined by that model. The SDQ II contains 11 scales of self-concept defined by responses to 122 items, approximately half of which are negatively worded, on a 1-False to 6-True response scale. The 11 scales are General Self, Mathematics, Verbal, General School, Physical Abilities, Physical Appearance, Relations With Same-Sex Peers, Relations With Opposite-Sex Peers, Relations With Parents, Honesty, and Emotional Stability. For purposes of the present investigation, scale scores were computed as the mean of nonmissing responses to each of the 11 SDQ II scales so long as no more than one item response was missing. When more than one item was missing, the scale was assigned a missing value, but this occurred less than 0.1% of the time and so had little effect on the results.

A detailed review of the SDQ instruments is beyond the scope of this paper, but, briefly, (a) factor analyses have consistently identified the factors each is designed to measure; (b) the reliability of each factor is generally in the 0.80s or 0.90s, whereas correlations among the factors are modest (median r s generally .2 or less); (c) self-concept factors are significantly correlated with self-concepts in matching areas as inferred by teachers and significant others; (d) self-concepts in academic areas are substantially correlated with

academic achievement, whereas non-academic facets of self-concept are not; and (e) self-concept factors are systematically and logically related to a variety of other constructs such as sex, age, locus of control, self-attributions for the causes of academic analyses based on the present data, a factor analysis identified the 11 SDQ II factors and an item analysis showed the factors to be reliable (alphas from 0.84 to 0.92; median alpha = 0.90; see Marsh, Parker, & Barnes, 1985, for a more complete description of the analyses and similar findings for a different sample).

5. Results

Self-concept in the Single-sex and Coeducational Schools

The effects of the single-sex/coeducational transition were evaluated from two different perspectives. The first method our research team employed to examine gender difference was to compare Years 7 to 11 self-concept scores in 1982, the year before coeducation commenced, with self-concept scores in 1984-85 when all classes in both schools were coeducational. When the graph for boys in 1982 across all grades is compared with the 1984-85 graph in Figure 1 (A), it is clear that the boys in coeducational classes scored significantly higher in Years 8, 9 and 10 than those in single-sex classes. For girls, a similar result was obtained except that the advantage of co-education appeared a year later than for boys, in Year 9 and 10, as indicated in Figure 1 (B). There were no advantages in self-concept terms for Years 7 or 11 in coeducational schools. Figure 1 (C) suggests that the self-concept does not decrease in the middle years of high school for either boys or girls, as has been found in previous research (e.g., Marsh, Parker and Barnes, 1985). Longitudinal analyses of these cohorts of students over a four year period confirmed this trend (Marsh, Smith Marsh and Owens, 1988).

A second method of examining the effect of the change to coeducational classes on student self-concept was achieved by comparing the 1983 transitional year scores of students in Years 7, 9 and 11 (those in coeducational classes) with those of students in Years 8 and 10 (who were still in single-sex classes). When the self-concept scores of Year 8 and 10 students were averaged, they were more positive than those students in Years 7, 9, and 11, as indicated in Figure 2. This finding was interpreted as a temporary effect of the organisational change which impacted on students in the coeducational classes more than those in single-sex classes and which led to lower self-concepts of coeducational students.

When total self-concept scores were broken down into their eleven components (i.e., verbal, maths, academic, physical abilities, appearance, same sex and opposite sex relationships, relationship with parents, honesty, emotional stability and general self-concept), post-transition scores were found to be higher for all eleven dimensions of self-concept, though four of the differences failed to reach statistical significance. Girls had higher self-concepts than boys in the areas of verbal, academic, relationships with same sex peers and parents, and honesty self-concept while boys were more positive in their maths, physical abilities, appearance, relationships with the opposite sex, emotional stability and general self-concept. The transition effects were similar for boys and girls, such that these gender differences in self-concept were neither increased nor decreased due to the transition from single-sex to coeducational classes.

In summary, once the transition from single-sex to coeducational status

was complete in both schools, self-concept scores were higher for students attending coeducational classes than for those in single-sex classes. These advantages occurred for both boys and girls.

Achievement in Mathematics and English

The Year 10 School Certificate results in mathematics and English were chosen as measures of school achievement because, at the time, these two subjects were the only two externally moderated subjects in the School Certificate examination. This moderation process allowed comparisons in performance across the two schools. We were not able to gain access to Higher School Certificate scores, because of the confidentiality of these highly sensitive scores.

The School Certificate scores of boys and girls in mathematics and English were compared over a five-year period from 1982 - 1986. In 1982 and 1983 these students had attended single-sex classes, while in 1984, 1985 and 1986 they were in coeducational classes. Figures 3 (A) and (B) demonstrate clearly that the shift to coeducational classes made no difference to either boys' or girls' achievement in maths or English. Girls remained significantly ahead of boys in English over the five year period, while boys scored slightly better than girls over the same period in maths.

In summary, the belief that coeducational schools are good for boys' achievement and bad for girls' achievement received no support from these results. In terms of both maths and English School Certificate performance it was demonstrated that there was no effect of the transition to coeducational classes in either a positive or a negative direction.

Teacher Perceptions of the Effects of Coeducational Schools

Towards the end of 1985 when both schools had been fully coeducational for almost two years we asked the teachers of both schools for their perceptions of the advantages of coeducational and single-sex schools. We analysed their questionnaire responses separately for boys and girls. The responses of teachers in both schools were combined, because we did not want to make invidious comparisons between the two schools. Most of the teachers had chosen to stay at the same school during the change to co-education.

The findings revealed an interesting pattern of teacher perceptions of the relative advantages of coeducational and single-sex schools for girls and boys. Table 1 indicates that teachers believed that both boys and girls preferred coeducational schools. They maintained, however, that classroom discipline problems are greater in coeducational schools for girls but not for boys. Teachers perceived that male and female students get along with each other better in coeducational schools, at the same time believing the learning

environment is more competitive for girls in a single-sex school. Another interesting perceived gender difference is the higher achievement of girls, but not boys in maths, science and computer studies in single-sex schools. On the other hand, teachers believed that boys' achieve better English scores in coeducational schools, with no difference for girls in either a single-sex or coeducational school. Some examples of teacher comments are included in Table 2.

When the discrepancies between actual student achievement in School Certificate maths and English and teacher perceptions were revealed to

the teachers, they responded with some surprise. They told us their perceptions were based partly on personal experience, but also upon the general community belief that coeducational schools are good for boys and bad for girls.

Ten Year Follow-up Study

Follow-up research at the two schools ten years after the two schools became coeducational revealed that the improved level of student self-concept that was observed after coeducation occurred had been maintained. While there were some gender differences in several self-concept dimensions that paralleled the findings of the initial study reported earlier, the increased level of self-concept that was observed in the three years after the two schools became coeducational was found to be at least as high in students from Years 7 to 12 measured in 1993. Figures 4(A) and 4(B) illustrate these small gender differences.

These self-concept comparisons made ten years apart need to be interpreted cautiously. It is not justifiable to conclude that the transition to coeducation at the two schools caused these long-term increases in student self-concept. The students whose self-concept was measured belonged to two different cohorts. Both schools had changed in several respects besides their coeducational status over the ten year period between the beginning of the first study and the follow-up study. The population from which the two adjacent schools drew their students is ageing, with fewer teenagers available for enrolment at both schools; one school became academically selective in 1990; the other school has increased the enrolment of students with an intellectual disability; there is a nearby Government girl's high school which is highly attractive to parents of girls in these conservative times; and, finally, the participation rate of students staying on to Years 11 and 12 has increased at both schools over the past ten years. It may be concluded, however, that average student self-concept has remained remarkably buoyant across all Years from 7 to 12, in spite of all these changes occurring inside and outside the two schools. Most students continue to evaluate their personal qualities and abilities in a positive manner.

6. Discussion

This ten-year-long investigation into the impact of coeducation at two Sydney high schools has clearly undermined the myth that coeducational schools are 'good' for boys and 'bad' for girls. The self-concept data demonstrated that there are social advantages for both girls and boys in attending coeducational schools. While there occurred a temporary decrease in student self-concept during the transition year for those students in coeducational classes, the level of self-concept subsequently rose to exceed that measured before coeducation began. When student self-concept was re-tested ten years after the coeducation process had occurred, it remained at the higher level measured two years after coeducation of the two schools was complete. Many changes had occurred at the two schools besides coeducation over the ten years of the study. These changes may have confounded the impact of coeducation. For instance, one of the two schools had been declared a selective school in 1990, with Year 7 students being admitted on the basis of their results in a competitive examination. This change was reflected in their higher academic self-concept scores compared with their peers at the other school which remained comprehensive.

The authors do not claim that the long-term maintenance of buoyant levels of student self-concept at the two schools was a direct result of the coeducation process. The extensive school changes, some of which were documented earlier in this paper, make it impossible to isolate the major factors contributing to high student self-concept levels. It is maintained, however, that despite all the changes that had occurred at the two schools from 1983 to 1993, self-concept levels had risen and remained at a relatively high level. It is concluded that there were social advantages for girls and boys attending the two coeducational schools, as measured by student self-concept. Coeducation was found in this study to have no academic disadvantages for either girls or boys. No changes occurred in the Year 10 School Certificate performance in English or mathematics of girls or boys over the five-year period from 1982 to 1986. If coeducation is 'good' for boys' school achievement, then performance would have risen over the five years of the original study. On the other hand, if coeducation is 'bad' for girls' achievement, then girls' performance in School Certificate would have fallen. In both cases achievement remained constant over five yearly assessments. Coeducation had made no impact one way or the other. Some critics might argue that the crucial results for students in New South Wales are the Higher School Certificate scores at the end of Year 12. Unfortunately, the researchers were unable to gain access to the highly confidential HSC results. Nevertheless, the aim of this project was to investigate the

impact of coeducation on the whole cohort of students at the two schools, not just on the 70% of students who continued on to complete the HSC.

Despite the findings of social advantages and no measured academic disadvantages for students attending the coeducational schools, teacher attitudes about coeducation remained ambivalent. In their responses to our attitude questionnaire teachers agreed that students were happier being in a coeducational school. On the other hand, they believed that girls were disadvantaged in certain school subjects, such as mathematics, science and computer studies, by being in coeducational classes. When the inconsistency between their attitudes and girls' performance in School Certificate mathematics was revealed to them they were surprised. They explained that their perceptions were influenced by the community belief that coeducational schools are *ibadi* for girls' achievement, especially in such traditionally male-dominated subjects as mathematics. Hopefully, the results of this study and those reviewed earlier will contribute to changing teacher attitudes about the relative advantages and disadvantages of coeducational schools.

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