

# Single-sex Education: What Does Research Tell Us?

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*There has been considerable research and policy debate internationally about whether single-sex schooling yields academic and social advantages for girls and/or boys. This article outlines some of the findings from research on single-sex education conducted in English-speaking countries. In particular, it looks at research on the impact of single-sex schooling on academic achievement, subject take-up, personal and social development, and adult outcomes. In doing so, it attempts to provide a critical perspective on some of the key issues involved in comparing the two settings.*

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## INTRODUCTION

A number of countries, including Australia, New Zealand and Ireland, continue to have a sizeable number of single-sex schools. In other countries, such as the United States and Britain, there has been a growing promotion of single-sex schools, or more usually of single-sex classes, in response to perceived underachievement by boys or to the persistence of gendered patterns of subject take-up. This article outlines some of the findings from research on single-sex education conducted in English-speaking countries. In doing so, it attempts to provide a critical perspective on some of the key issues involved in comparing the two types of settings.

A number of explanations have been proffered for differences between single-sex and coeducational settings in educational processes, and ultimately, in student outcomes. One of the most commonly discussed differences between the two types of settings relates to the dominant presence of boys in the classroom. Most studies have indicated that boys contribute more to classroom interaction (for example, by “calling out” answers) and dominate in “hands-on” activities, such as laboratory work and computer sessions (Askew and Ross 1988; Howe 1997; Francis 2004). Furthermore, boys tend to be more disruptive in the classroom and experience more negative interaction with teachers as a result of their misbehaviour (Francis 2000; Warrington and Younger 2000). From this perspective, the presence of boys in the

classroom is seen as having a negative effect on girls' academic engagement and achievement. Other commentators have pointed to the "distraction" inherent in mixed gender educational settings for adolescents. Coleman's (1961) study pointed to the strong emphasis on "rating and dating" in American high school culture, with peer groups having a negative effect on achievement, especially among girls (see also Riordan 2002). A number of studies have explored the way in which schools serve as sites for the construction of masculinity and femininity. Thus, particular subjects areas, such as mathematics and physics, may become constructed as "masculine", leading to tensions for female students in selecting these subjects and performing well in them (Mendick 2005). Discussions of single-sex education must be placed in the broader context of research on, and policy attention to, male underachievement, which is variously attributed to the absence of male role models in schools, gender differences in learning styles, and the emergence of a "laddish" culture, among other factors (for an overview, see Smyth 2007). In sum, although different studies emphasise different aspects of a mixed gender setting, most hypothesise that significant differences in school process and outcomes will be evident depending on the gender mix of the class. The following section outlines the main findings from research on the impact of single-sex education on student outcomes.

## **SINGLE-SEX EDUCATION AND STUDENT OUTCOMES**

### **Academic Achievement**

The discussion of the influence of single-sex education on student outcomes has chiefly focused on academic performance, either using a summary measure of overall achievement or examining achievement in particular subject areas. Findings have differed across and within countries, according to the method of analysis used and the specific outcome selected. Two sets of countries can be identified: countries (such as Britain and the United States) in which single-sex schools, at least currently, make up a small, somewhat selective, group; and countries (such as Australia, New Zealand and Ireland) which have a sizeable number of single-sex schools, albeit with some important compositional differences between single-sex and coeducational schools.

One of the first large-scale studies of single-sex education was conducted by Dale (1969, 1971, 1974) in the British context. Dale's research suggested that coeducation provided the optimal preparation for adult life for both sexes. In relation to academic performance, he found that girls' educational progress was not held back by coeducation, although the research findings indicated some disadvantages for girls, especially in mathematics and science performance. A number of further studies conducted in Britain in the 1970s and 1980s indicated that girls tended to have higher academic achievement levels in single-sex classes and/or schools (Ormerod 1975; Spender and Sarah 1980; Deem 1984). Many of the latter studies were small-scale in nature and did not control for important social background and prior achievement differences between students attending single-sex and coeducational schools. In a meta-analysis of existing studies, Bone (1983) argued that broader school factors were more important than the gender mix of the school. The availability of multilevel modelling techniques led to increased attention to school-level effects in British research from the 1980s onwards. Using National Child Development Survey data on the cohort of young people born in 1958, Steedman (1983a, 1983b), using statistical controls for prior student ability and family social background, found that "very little in their examination results is explained by whether schools are mixed or single-sex once allowance is made for differences in intake" (1983a, 98). Similarly, other British studies found no significant advantage in the educational achievement of girls in single-sex schools, once intake differences among schools were taken into consideration (Goldstein et al., 1993; Thomas et al. 1994).

Three more recent studies point to somewhat different conclusions on the effects of single-sex schooling in the British context. Spielhofer et al. (2004) found that, in England, average academic achievement levels for males do not differ significantly between single-sex and coeducational settings, but there are some performance gains for lower-achieving boys in single-sex schools. For females, an advantage was found for those attending single-sex schools across a range of achievement outcomes, with the greatest advantages found in the area of science and for the lowest prior attainment group. Malacova (2007) found that both boys and girls in more selective single-sex schools had a performance advantage but, within non-selective schools, only lower ability boys and girls achieved higher grades in a single-sex setting. Sullivan et al. (2010), using the 1958 cohort data previously analysed by Steedman, found that girls in single-sex schools had higher chances of obtaining five or more pass grades in the State O-level exam

(Ordinary level exam), taken at the age of 16, than girls in coeducational schools, all things being equal. However, the difference was non-significant if other achievement cutoffs were used. Furthermore, single-sex/coeducational differences were not significant in overall grades in the A-level exam (Advanced level exam), a State exam taken at the end of upper secondary education at the age of 18. Some differences were evident across different subject areas. For O-level exams, girls were more likely to obtain science and mathematics passes in single-sex than coeducational schools; in contrast, boys were more likely to obtain language passes in single-sex than coeducational schools. Gendered patterns were also evident at A-level, with single-sex girls receiving more mathematics, physics, and chemistry passes and single-sex boys receiving more passes in English and modern languages. Studies in Northern Ireland, which has a different school structure to that in England and Wales, have found no significant difference in overall achievement levels between single-sex and coeducational schools (Daly 1996). Similarly, no significant differences are found in science, English and mathematics performance (Daly 1995, 1996; Daly and Shuttleworth 1997).

A number of research studies have been carried out in the United States, where (until very recently) single-sex education was confined to the private school sector, especially to Catholic schools. Early studies, such as that by Coleman (1961), indicated that coeducation had a negative effect on girls' academic achievement due to peer pressure to prioritise relations with the opposite sex rather than schoolwork. Several studies of the Catholic school sector have indicated small but significant negative effects of coeducation on girls' achievement as well as on other outcomes (Lee and Bryk 1986, 1989; Bryk et al. 1993). Bryk, Lee, and Holland (1993) used a range of control variables (including social background, prior achievement and so on) and found clear positive effects for girls' academic achievement as well as for social and personal development outcomes in girls' schools. However, analyses of the Catholic school sector by Marsh (1989a, 1989b) have found no significant differences in overall achievement or in reading, writing and vocabulary test scores once controls are used. Similarly, Gilson (2002) found no differences in mathematics and quantitative ability test scores between single-sex and coeducational school girls. Comparing Catholic single-sex schools with Catholic and public coeducational high schools, Riordan (1985) found a significant achievement advantage to single-sex education for females but no significant difference for

males. Other American studies have further explored the extent to which any advantage of single-sex education is confined to certain groups of students. Riordan (2002) indicates a positive effect of single-sex schooling for the school engagement and achievement of both boys and girls but he suggests that the effect is much greater for, if not limited to, low socio-economic status and ethnic minority students. Similarly, Riordan (1994) had found an advantage to single-sex education among African American and Hispanic schools. In contrast, Garcia (1998) points to no significant difference in achievement between the two sectors for Asian and African American girls.

The Republic of Ireland is one of the countries with a historical tradition of single-sex schooling, with single-sex schools still making up over a third of all secondary schools. Single-sex and coeducational schools differ in their intake by social class background and prior academic ability levels. Controlling for these prior differences, a large-scale study indicated no significant differences in overall academic achievement between single-sex and coeducational schools for both girls and boys at lower and upper secondary levels (Hannan et al. 1996). Further analyses indicated similar non-significant differences for performance in English. However, there was evidence that girls achieved somewhat lower mathematics grades in coeducational than in single-sex schools.

A number of studies examining the effects of single-sex schooling have been conducted in the Australian context. Carpenter's (1985) study showed that, controlling for social background, prior performance and a range of other factors, there was little overall difference between single-sex and coeducational schools in student performance. Later Australian studies indicated the existence of some performance differences in particular subject areas. Yates and Firkin (1986) found that high performers in mathematics were more likely to come from single-sex schools, all things being equal. Young and Fraser's (1990) study of science achievement suggested significant advantages of single-sex education for girls (but somewhat in contradiction to their later 1992 study indicated no significant differences in physics performance; see also Young 1994).

In New Zealand, achievement advantages to single-sex education were found for both males and females, even controlling for background and prior attainment (Woodward et al. 1999). However, Harker and Nash (1997) found no significant differences in English,

mathematics and science test scores for female students, all things being equal. Harker (2000) found non-significant differences in English, mathematics and science achievement for both males and females once controls were introduced.

A systematic review of international research on single-sex education included only those studies which met certain methodological criteria (Mael et al. 2005). These studies were mainly American and related to secondary rather than primary schools. Of the studies on achievement reviewed, 23 indicated “null” (or non-significant) findings, 15 indicated an advantage to single-sex education and only one study showed an advantage to coeducational schooling. Assessing findings across a range of outcomes, the authors suggest that the review provides “a degree of support for SS [single-sex] schooling” (Mael et al. 2005, xvii). In contrast, a review by Smithers and Robinson (2006) suggested that existing research “found little evidence of consistent advantages in either single-sex or co-education” (Smithers and Robinson, 2006, i) and the authors point to the difficulty in making accurate comparisons between single-sex and coeducational schools, given the selectivity of the former.

Surprisingly little attention has been given to the question of whether the effect of single-sex education is context-specific, with the exception of two studies. Baker et al. (1995) point to cross-national variation in the size of single-sex/coeducational effect and suggest that this variation is likely to be related to the size and selectivity (“national context”) of the single-sex sector. In countries, such as New Zealand and Belgium, where the single-sex sector is larger, between-sector differences in achievement are small and mostly non-significant. In contrast, in countries such as Thailand, where the single-sex sector is small and selective, girls do better academically in single-sex schools. However, the orientation of single-sex schools is also important since in Japan females do worse in single-sex schools, which are traditionally oriented towards “educating” females for higher status marriage but not competitive careers. Gorard and Smith (2004), using data from the PISA survey, explore cross-national variation in the proportion of single-sex schools. They find no relationship between size of the single-sex sector and the gender gap in literacy scores. However, they find a strong correlation between the size of the single-sex sector and the proportion of religious schools, reflecting the historical origins of many single-sex schools.

## Subject Take-up

The introduction indicated that girls and boys may construct their gender identities differently in coeducational and single-sex settings. On this basis, we might expect to see differences in the take-up of traditionally “male” or “female” subjects across school sectors. In keeping with this hypothesis, a number of studies have pointed to more gender-stereotyped subject attitudes and choices in coeducational schools. Thus, girls in coeducational schools have been found to have less favourable attitudes to “male” subjects such as mathematics and physical sciences (Vockell and Lobonc 1981; Bryan and Digby 1986; Stables 1990; Gill 1992). Differential attitudes translate into the greater take-up of “male” subjects among girls in single-sex schools (Ormerod 1975; Shaw 1976; Ditchburn and Martin 1986; Spender and Sarah 1980; Deem 1984; Bone 1983). In Catholic schools in the US, girls in single-sex schools show a greater interest in mathematics and are more likely to enrol on mathematics courses (Lee and Bryk 1986). In England, Spielhofer et al. (2004) indicate higher enrolment on higher level mathematics and science among both girls and boys in single-sex schools. Girls in single-sex schools are somewhat less likely to take traditionally “female” subjects (such as foreign languages and Food Technology). However, contrary to expectations, boys in single-sex schools were even less likely than coeducational boys to take non-traditional subjects. In fact, such findings are not universal. In the US, analyses by Marsh (1991) found no difference in mathematics, science and vocational course take-up between single-sex and coeducational Catholic schools. Similarly, in Australia, Ainley and Daly (2002) found that, all things being equal, there were no significant differences between single-sex and coeducational schools in the take-up of physical sciences or biology. In the Irish context too, the take-up of science subjects is found to reflect school-level characteristics rather than the gender mix of the school (Smyth and Hannan 2006).

## Personal and Social Development

As well as looking at the educational processes involved, a number of studies have assessed the extent to which single-sex education can influence aspects of personal and social development among young people. There appears to be a general consensus that male and female students in coeducational settings are more positive about their schools and about the developmental aspects of their schooling

(Feather 1974; Schneider and Coutts 1982; Schneider, Coutts, and Starr 1988; Stables 1990). For example, Dale (1969, 1971, 1974) found that both boys and girls were more satisfied with coeducation, seeing it as a more “natural” environment and feeling it helped their relationships with the opposite sex. Similarly, Hannan and Shortall (1991) found that male and female ex-students of coeducational schools in Ireland were more positive about the personal and social development aspects of their schooling.

The picture is once again more complex when other aspects of self-concept are considered. In a systematic review of studies concerning a wide range of measures including locus of control, attitudes to school, and homework engagement, the results are almost evenly divided between those favouring single-sex education and those finding no statistically significant differences (Mael et al. 2005). Some studies have indicated that girls are more likely to develop higher academic, and socially competent, self-images in the less competitive environment of single-sex classrooms and schools (Carpenter 1985; Mahony 1985; Rowe 1988). Thus, girls in single-sex schools are more positive about their own abilities and their control over their lives, have less stereotyped gender role attitudes and hold higher aspirations for the future (Bryk et al. 1993; see also Cairns 1990). Other studies have explored self-concept across different subject areas. Sullivan (2009) indicates that the gender gap in self-concepts (with males having higher ratings of their aptitude in mathematics and science, and females in English) is reduced in single-sex settings. Thus, to some degree, single-sex schooling promotes a gender-atypical self-concept. In contrast, other studies (see, for example, Marsh 1991) have indicated no significant differences in academic self-concept and locus of control when systematic comparisons are made. Indeed, a small number of studies indicate that single-sex schools may be more academically competitive with consequent negative effects on academic self-image (Schneider et al. 1988).

### **Adult Outcomes**

Fewer research studies have looked at the longer term consequences of having attended a single-sex school (Mael et al. 2005). Sullivan et al. (2010), in Britain, find no difference in the attainment of post-school qualifications or in literacy and numeracy scores tested at age 42. However, in keeping with their findings on reduced subject stereotyping, they

find that women who attended a single-sex school are more likely to study “male” subjects and less likely to study “female” subjects at their highest post-school qualification. Similarly, Billger (2009) finds no significant differences in college entry rates in the US (see also Marsh 1991). However, a number of studies have indicated that single-sex school-leavers tend to enter the least segregated fields of study within college education (Karpiak et al. 2007; Billger 2009; Sax 2009). In relation to labour market outcomes, Marsh (1991) finds no differences in the likelihood of post-secondary unemployment in the US, in contrast to Woodward et al. (1999) who suggest lower post-school unemployment chances among single-sex-educated males and females in New Zealand. Billger (2009) finds variable results in relation to income in the US, with some income gains for African Americans and low income groups. Overall, very few studies have looked at the labour market impact of single-sex schooling.

### **THE REBIRTH OF SINGLE-SEX EDUCATION?**

The discussion so far has indicated cross-national variation in the size of the single-sex sector. Recent years have seen a rebirth of single-sex schooling, either in the form of single-sex classes within otherwise coeducational schools or in separate single-sex schools, in a number of countries including the US, Britain and Australia (Datnow and Hubbard 2002; Younger and Warrington 2005). Such interventions have had different motivations, relating to a desire to address male underachievement and/or to promote mathematics and science course take-up and achievement among girls. This subsection considers the nature of such initiatives and their consequences for student outcomes.

In the United States, the legality of single-sex provision in public schools was unclear until 2006. Before then, a number of initiatives had been introduced regarding single-sex schooling. The 1990s saw the Single-Gender Academies Pilot Program in California, initially intended to provide single-sex schools but subsequently focussing on providing single-gender classes within coeducational schools. Teachers saw the initiative as “working for the girls” but that “boys were becoming more troublesome” (Herr and Arms 2002). Issues were raised about the lack of attention to challenging gender stereotypes and about the fact that the intervention was driven by the desire to

improve test results rather than to foster gender equity (Herr and Arms 2002). Within a very short period, the number of California districts providing single-sex classes had reduced significantly. The sustainability of the initiative has been seen as being undermined by a lack of clear commitment among administrators and teachers to single-sex education as well as principal and teacher turnover and concerns over legality (Hubbard and Datnow 2002).

In 2006, the Department of Education confirmed the legality of single-sex classes in the US (Billger 2009; Spielhagen 2008), and, since then, there has been a proliferation of single-sex provision. In 2008, 442 public schools in the US offered single-sex education, mostly through single-sex classes within coeducational schools (Datnow and Hubbard 2008), and this figure grew to over 500 in 2009 (Jackson 2010). As with the earlier California initiative, schools are found to differ in their motivations for introducing single-sex education which, in conjunction with different school and class climates, is likely to lead to variable outcomes for students (Datnow and Hubbard 2008). Streitmatter (2002) examined perceptions of students in single-sex mathematics classes (which were taught by the same teacher) in one US public high school. Girls reported less distraction and more self-confidence in their mathematics ability, which they contrasted with male dominance and misbehaviour in other classes. Boys had more neutral views but felt being in a single-sex class had made no difference to their mathematics achievement. Positive results from such interventions have also been reported by Salomone (2006) but it is too early for any effects of the expansion of single-sex schooling in the US to be apparent.

In Britain, the Raising Boys' Achievement initiative was introduced in 2000 to combat male underachievement: one of the measures introduced was the use of single-sex classrooms. Younger and Warrington (2006) reported mixed results in relation to actual achievement levels and varying perceptions across the case-study schools of the value of single-sex schooling, related in part to teacher commitment to the concept. They suggest that single-sex classes have the potential to raise the achievement of both boys and girls and to have a positive influence on learning climate but only if "developed within gender relational contexts" (Younger and Warrington 2006, 579) – that is, in ways which challenge existing gender stereotypes. A study of all-female computer science classes revealed positive effects on achievement (Crombie et al. 2002) as did single-sex physics

classes for girls (Gillibrand et al. 1999). However, some studies of single-sex mathematics classes indicated no significant effects for either boys or girls (Marsh and Rowe 1996; Dunlap 2002; Gilson 2002).

In parts of Canada, single-sex classes were introduced in the 1980s and 1990s to address low take-up of – and achievement in – mathematics and science among girls. Research indicated that single-sex schooling did not necessarily result in learning gains (Demers and Bennett 2007). Teachers and students were found to be positive about the safe and secure climate in single-sex classrooms, but challenges remained in bringing about a fully inclusive climate and in actively promoting gender equity (Sanford and Blair 2002). This section has indicated mixed findings from interventions promoting single-sex education. However, a number of common issues can be identified from existing studies. Firstly, single-sex classes are rarely introduced in isolation from other school reform measures: "Single-sex arrangements are often part of multi-faceted educational reforms that include changes in curriculum delivery and discipline policies." (Spielhagen 2008) It is therefore often difficult to disentangle the effects of single-sex schooling from those of related interventions (Herr and Arms 2002; Younger and Warrington 2006). Secondly, such interventions have been criticised for relying on essentialist notions, positing "false binaries" of "male" and "female", rather than allowing for differences within as well as between groups of male and female students (Jackson 2010). Consequently, single-sex schooling on its own is unlikely to be effective unless it challenges dominant notions of masculinity and femininity (Jackson 2002; Younger and Warrington 2006).

## CONCLUSIONS

This article has attempted to summarise the main research findings on the potential impact of single-sex education on student outcomes. It points to considerable variation between and within countries in the conclusions reached, depending on the research methods and analytical techniques employed, and outcomes considered. There appears to be very little consensus on whether single-sex education is advantageous to girls' or boys' academic achievement. However, there does appear to be, at least tentative, evidence that attitudes to subject areas may become more gender-stereotyped in a

coeducational setting. Looking at studies of single-sex education raises a number of broader issues for educational research. The first issue relates to the societal context within which coeducational and single-sex education take place. With a few notable exceptions, researchers have tended to neglect the potential influence of the national context on the processes at play. In particular, there appears to be considerable potential for the future in exploring the potential relationship between the broader “gender régime” (Connell 2002) and way in which gender is constructed (and reconstructed) within single-sex and coeducational schools.

Secondly, it is difficult to systematically compare single-sex and coeducational schools or classes. In many countries, single-sex schools are highly selective in their social and ability profile; even in countries with a larger number of single-sex schools, the two school sectors differ in their intake. How then do we “control” for these differences in assessing the impact of single-sex education? Researchers have used a

variety of statistical techniques (including multilevel modelling) but any such techniques will not solve the problem of comparison if the two sectors are very different indeed. Researchers have also differed about the kinds of variables to be controlled for in looking at the net impact of single-sex grouping. Some control for intake differences (such as social background and prior ability or achievement) while others control for a number of school climate factors. This raises very important questions as to the appropriate comparison to be made: are we concerned with the differences that result from having a mixed gender setting per se or from the broader nexus of school factors that are often characteristic of single-sex schools? More clearly specifying the basis of comparison may provide a way forward in assessing the merits of single-sex and coeducational education.

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