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Abstract

This paper examines the impact of single-sex schooling on a range of academic outcomes for a sample of British people born in 1958. In terms of the overall level of qualifications achieved, we find that single-sex schooling is positive for girls at age 16, but neutral for boys, while at later ages, single-sex schooling is neutral for both sexes. However, we find that single-sex schooling is linked to the attainment of qualifications in gender-atypical subject areas for both sexes, not just during the school years, but also later in life.

The question of whether single-sex schooling has any impact on academic outcomes remains highly contested. Recent reviews of the evidence have noted the difficulty of comparing like with like, and have commented on the small number of studies that use adequate statistical controls, and the lack of evidence regarding longer term outcomes, such as post-school academic attainment (Mael, et al. 2005; Smithers and Robinson 2006). The current study addresses these issues using longitudinal data collected from a representative British sample of people born in 1958.

Britain and Northern Ireland have a long history of single-sex schooling. However, the progressive school movement in the early 20th century, and Dale's later influential work (Dale 1969; Dale 1971; Dale 1974), both stressed the advantages of boys being educated with girls. Dale's unashamedly partisan volumes argued that boys did better academically in mixed schools, but not at the expense of the girls. He claimed that girls' greater industriousness was communicated to the boys, and boys were spurred on by competition with the girls. Mixed-sex schooling was also more 'natural' and provided protection against homosexuality. *"That men and women are complementary is a biological fact. That they also influence each other's conduct – from the gift of flowers to the hurling of the kitchen utensils – is an inevitable accompaniment of life in a bisexual world. A family has a father and a mother; lacking one of these each feels incomplete and unsatisfied…So it is with other institutions when they are one-sex – as we know from the homosexual activities in Public School…"* (Dale 1969, p.114). [In Britain, the term 'Public School' has historically been applied to élite private boarding schools for boys].

The liberal consensus regarding the benefits of co-educational schooling was contested by the women's movement in the late 1970s and early 1980s. Some feminists of this period began to re-assert that single-sex education was actually better for girls. For example, Spender's work presented small scale observational and survey evidence that girls got more teacher time and attention and better access to resources in girls-only schools (Spender and Sarah 1980). She and others (Shaw 1976; Stanworth 1983) believed that both the curriculum content and the teaching style in girls' schools were more 'girl-friendly' and helped to raise girls' attainment and self-esteem.

More recently, the increased academic attainments of girls have led to a moral panic about the 'gender gap' in academic achievement in Britain and elsewhere, and this has also reinvigorated the debate on single-sex schooling (Epstein, et al. 1998). As a result, single-sex classes are now being piloted as a way of helping boys to achieve and to find forms of masculinity which are not aggressive or anti-learning (Swan

1998; Warrington and Younger 2001). Several studies have assessed the impact of single-sex classes within co-educational schools (Jackson and Smith 2000; Marsh and Rowe 1996; Shapka and Keating 2003). A recent review finds inconclusive results, and argues that much depends on the context in which single-sex classes are introduced (Younger and Warrington 2006). Where single-sex classes are introduced with the aim of raising boys' achievement, girls may be given less attention and fewer resources. In the US, the debate over single-sex schooling has also been revived by the prospect of the revival of publicly supported single-sex provision. Salomone (2006) suggests that this has produced a strange alliance between *"…social conservatives touting "hard-wired" differences between girls and boys, political conservatives interested in a free market of parental choice, feminists…, and urban educators and activists…"* (p.781).

The issue of subject 'choice' in mixed-sex schools has also been of longstanding concern. Despite girls' increased levels of educational attainment, the under-representation of females in maths and sciences has been persistent. Disquiet regarding this dates back as far as a Schools' Inspectorate report (DfES 1975) and an Equal Opportunities Commission report (Byrne 1978) stating that both boys and girls in mixed-sex schools made more sex-stereotyped choices than their peers in single-sex schools, despite the greater availability of science facilities in mixed-sex schools than in girls-only schools. Concerns continue to be raised that both boys and girls are less likely to pursue sex-atypical subjects in mixed schools, where the pressures to conform to gender stereotypes may be greater than in single-sex schools (Elwood and Gipps 1999; Francis, et al. 2003; Marsh and Yeung 1998). Studies have examined a range of outcomes including students' orientation towards gendered subject disciplines, their attainment in these disciplines, and the likelihood of them studying these disciplines (Ainley and Daly 2002; Daly 1995; Hannan, et al. 1996; Spielhofer, et al. 2002; Stables 1990; Van de gaer, et al. 2004). The balance of studies support the view that single-sex schooling is a more favourable environment for maths and sciences for girls, but there are some conflicting findings, and the question of boys' attainment in arts and languages has been relatively neglected.

Of course, the cultural and policy contexts regarding single-sex schools, and the nature of the schools themselves, vary internationally (Baker, et al. 1995). The US context is particularly distinctive, in that title IX legislation had led to the virtual extinction of single-sex public schools, although they have recently experienced some resurgence (Mael 1998). US research has therefore inevitably focussed on private (usually Catholic) schools. This has been seen as raising difficulties of interpretation, as it is unclear to what extent any advantage conferred by these schools is due to their single-sex status per se, and to what extent findings can be generalized to non-Catholic schools (Lee and Bryk 1986; Lee and Marks 1990; Marsh 1989b; Marsh 1991; Riordan 1990) .

Much apparently conflicting research evidence continues to be produced internationally regarding the impact of single-sex schooling on levels of academic attainment (Carpenter and Hayden 1987; Caspi 1995; Daly 1996; Elwood and Gipps 1999; Feinstein and Symons 1999; Harker 2000; Mael, et al. 2005; Salomone 2003; Smithers and Robinson 2006; Spielhofer, et al. 2004; Steedman 1983; Woodward, et al. 1999). A recent systematic review of the international English-language research

evidence on single-sex schooling (Mael, et al. 2005) states that although the majority of studies support single-sex schooling for both boys and girls, the evidence is equivocal. A particular concern has been the fact that single-sex schooling is linked to other characteristics of the schools, and of the students attending these schools, and it is not always easy to take this into account adequately (Smithers and Robinson 2006).

Very few studies have examined the longer term outcomes of single-sex and coeducational schooling. Riordan (1990) compared postsecondary test scores for seniors in single-sex and coeducational Catholic high schools in the US, and found results favouring single-sex schools for both boys and girls. Marsh (1989a) examined the rates of participation in education and unemployment two years after high school graduation. Controlling for background variables, there were no statistically significant differences in these outcomes between co-educational and single-sex schools

The pros and cons of mixed and single-sex schooling thus remain a topic of abiding interest, and deeply-held opinions thrive in the absence of sufficient research evidence. Consequently policy is being framed and practice instigated which may well be counter-productive.

The dataset used in the current study has important advantages in addressing these questions. First of all, it allows us to address the issue of comparing like with like. Single-sex schooling was quite common for this cohort, rather than being the preserve of a particular social or religious group. In addition, our rich longitudinal data allows us to control for a wide range of characteristics of the children prior to their entry to secondary school. Furthermore, rather than just examining attainment within compulsory schooling, we are able to examine educational attainment at later ages, in a variety of subject disciplines.

Research Questions

What impact does attending a single-sex as compared to a coeducational school have on the following outcomes?

- At age 16 (1974)
    - Overall examination attainment at O level (national school-leaving exams)
    - Attainment in specific subject areas: maths and sciences/ English and languages.
- At age 18 (1976)
    - Overall examination attainment at A level (national exams designed for college-track students)
    - Attainment in specific subject areas
- At age 33 (1991)
    - The likelihood of having a university degree
    - The likelihood of having no qualifications
    - The subject area of the highest qualification

- At age 42 (2000)
    - Basic skills – literacy and numeracy.
- At age 46 (2004)
    - Participation in educational classes
    - Gaining new qualifications

Data and Methods

The National Child Development Study (NCDS) is a longitudinal study of a single cohort born in Britain in the week of 3-9 March 1958. The cohort members have been followed-up throughout their lives, most recently in 2004 when they were 46 years old.

The initial sample was designed to be nationally representative of all children in Britain, and achieved a sample size of 17,414 (Shepherd, 1995). By the third follow up (sweep 3), when the children were aged 16, 14,761 respondents remained in the study. Hawkes and Plewis' (2006) examination of attrition and non-response in the NCDS finds few significant predictors of attrition, wave non-response, and missing education data, thus supporting the assumption of ignorable non-response. Neither parental education nor social class were significant predictors of non-response. The distribution of educational qualifications gained by the cohort members by age 33 was closely in line with other data sources (Dale and Egerton 1997).

The NCDS cohort experienced a state secondary education system that was in transition from the tripartite system to the comprehensive system. Under the tripartite system, children sat an exam at age 11 (called the eleven-plus) which determined whether they would attend an academically selective Grammar or Technical school, or a Secondary Modern school, designed for the majority of students. Comprehensive schools were intended to replace this selective system with all-ability schools. Fifty-eight % of the NCDS respondents attended Comprehensive schools, but 11% still attended Grammar and Technical schools, 22% attended Secondary Modern schools, and 6% attended Private and Direct Grant schools. Private schools are fee-paying schools. Direct Grant schools were fee-paying, but had a proportion of state-funded places. Henceforth, we refer to Grammar and Technical schools as 'Grammar schools', and Private and Direct Grant schools as 'Private schools'. We exclude from our analyses the small proportion of students who attended schools classified as special or 'other'. We also exclude respondents lacking in information on school sector or school sex at age 16, leaving us with a sample of 12 320. Single-sex schooling was far more common than it is today. The proportion of students at single-sex schools ranged from 78% at private schools to 13% at Comprehensives. Taken as a whole, a quarter of the cohort attended single-sex schools at age 16. This provides an advantage for our analysis, as, in school systems where single-sex schooling has become the preserve of a small minority, this makes it very difficult to compare like with like (Baker, et al. 1995).

Previous studies of the effects of single-sex schooling have been criticised for inadequate controls for prior attainment and family background. Given the concentration of single-sex schools in the private and selective sectors, it is important to control for such sources of selectivity. The NCDS gives exceptionally rich

information on various aspects of the respondents, their schools and their parents, allowing crucial confounding variables to be controlled. The parents were interviewed at the first three data collection exercises of the study, providing information on social background, parents' age on leaving full-time education, and other characteristics.

Data were also collected directly from the children through tests and questionnaires administered at school at the ages of 7, 11 and 16. Extensive information on examination results was collected directly from the schools. From the age of 16 onwards, the respondents themselves were interviewed.

The NCDS cohort took a range of tests at ages 7 and 11, allowing us to condition of prior attainment in an unusually fine-grained way. These are shown in table 1. For a descriptive report on the test results and examination results achieved by the NCDS students, see Steedman (1980, 1983a and b). There are some gender differences in the mean scores of boys and girls. For example, at age 11, boys have a substantively slight, but statistically significant, advantage in mathematics, and girls are somewhat ahead in both verbal and non-verbal reasoning.

Table 1: Test scores at 7 and 11

	Range		**Male**	**Female**
Age 7 (1965)				
Problem Arithmetic	0-10	Mean (%)	**52.2*** **	50.0
		N	7645	7253
		Std. Deviation	25.0	24.8
Southgate Reading - test of word recognition and comprehension	0-30	Mean (%)	74.8	**81.0*** **
		N	7674	7257
		Std. Deviation	24.8	22.3
Copying designs - test of perceptuo-motor ability	0-12	Mean (%)	**58.8** **	58.1
		N	7635	7236
		Std. Deviation	16.7	16.7
Draw-a-man - designed to test general mental and perceptual ability	0-53	Mean (%)	44.4	**45.6*** **
		N	7530	7118
		Std. Deviation	13.4	13.3
Age 11 (1969)				
Mathematics	0-40	Mean (%)	**42.0***	41.1
		N	7255	6874
		Std. Deviation	26.5	25.2
Reading Comprehension	0-35	Mean (%)	45.5	45.8
		N	7257	6876
		Std. Deviation	18.7	17.2
Verbal Reasoning	0-40	Mean (%)	52.6	**57.8*** **
		N	7256	6878
		Std. Deviation	23.7	22.8
Non-verbal Reasoning	0-40	Mean (%)	51.9	**52.5***
		N	7256	6878
		Std. Deviation	19.2	18.9

In preliminary analyses, the predictors of attendance at a single-sex school have been modelled, and little difference was found in the prior characteristics of students

at single-sex and co-educational schools within each school sector (Comprehensive, Grammar, Secondary Modern and Private). The only other important predictor of single-sex schooling is region. This suggests that the danger of spurious results due to differences between the pupil populations of single-sex and co-educational schools is minimal, provided that school sector and region are controlled. This finding may seem surprising, but makes sense in the context of schooling at the time, long before the 'parental choice', school diversity and accountability agendas arrived in Britain. Catchment area rules were strong during this period, and there was therefore relatively little scope for parental choice of school within the state sector. In principle, parents could have moved home in order to be near the school of their choice. Although this is common practice now (Gewirtz, et al. 1995; Gibbons and Machin 2006), the NCDS children started secondary school in 1969, in a very different context. There were no 'league tables' of school examination results at this time, and school quality was not perceived to be very variable within each school sector. In addition, only 46% of the cohort members were living in owner-occupied properties in 1969, and 42% were in council housing, and therefore would not have been able to move easily.

It should be noted that, although we have both individual-level and school-level data, we are not able to identify whether students attended the same school as other members of the sample. The sample is not clustered, with students being sampled within schools. Instead, the sample consists of all children born in Britain in the relevant week. It is very likely therefore that many schools would be represented by a single sample member. It is therefore neither possible nor necessary to apply a multilevel statistical model to these data. A further limitation is that, due to the small numbers of ethnic minority individuals included in the NCDS, it is not possible to conduct analyses according to ethnic group.

Finally, it is important to acknowledge Steedman's (1983) analyses of the NCDS pupils' academic attainment at age 16, which compared single-sex and co-educational schools. Steedman's analyses examined the chances of attaining particular combinations of subject passes[1], whereas we focus here on attainment in sex-stereotyped disciplines, and on later outcomes.

Analyses

Our examination of academic attainment at O- and A-level is limited to schools in England and Wales, since Scotland had different qualifications.

Attainment at 16

There are several schools of thought on the question of single-sex schooling and attainment, each implying certain hypotheses.

The conservative view: Traditional arguments against coeducational schooling made much of the 'distractions' of the opposite sex, and of innate differences between boys and girls (Cowell 1874). The implication of these arguments is that single-sex schooling will benefit *both* boys and girls. Some more recent arguments in favour of single-sex schooling have been similarly essentialist, claiming that boys and

girls have fundamentally different brains and correspondingly different 'learning styles' (Gurian, et al. 2001). Although these new essentialist accounts imply that both boys and girls will benefit from being taught separately, they often stress the benefits for boys, and suggest that single-sex schooling could help close the gender gap in educational attainment (Hoff Sommers 2000). This is an interesting development, given the previous consensus that co-education was best for boys.

The 'progressive' view: The progressive school movement and Dale (1969, 1971, 1974) both stressed the advantages of co-education for boys. They argued that boys would be civilised through contact with girls, and would therefore achieve more academically. Dale stressed that the advantage of coeducational schooling for the boys was not at the expense of the girls, who would do equally well academically in either single-sex or co-educational schools.

A feminist view: Some feminists have argued that girls lose out in a co-educational environment, in terms of attention and resources. It follows from this that girls will benefit from single-sex schooling. However, if boys are privileged within co-educational settings, it might be predicted that they will fare less well in single-sex settings than they do in co-education.

Behaviour: Related to the feminist argument is the view that male rowdiness and immaturity creates an environment in which teachers have to focus more on discipline, and less on learning. On this view, the more boys there are in a school, the less good the learning environment will be, for both sexes. Thus, girls should benefit from single-sex schooling, and boys should be disadvantaged by it, because there will be more trouble-makers in an all-boys school.

Overall Exam Passes

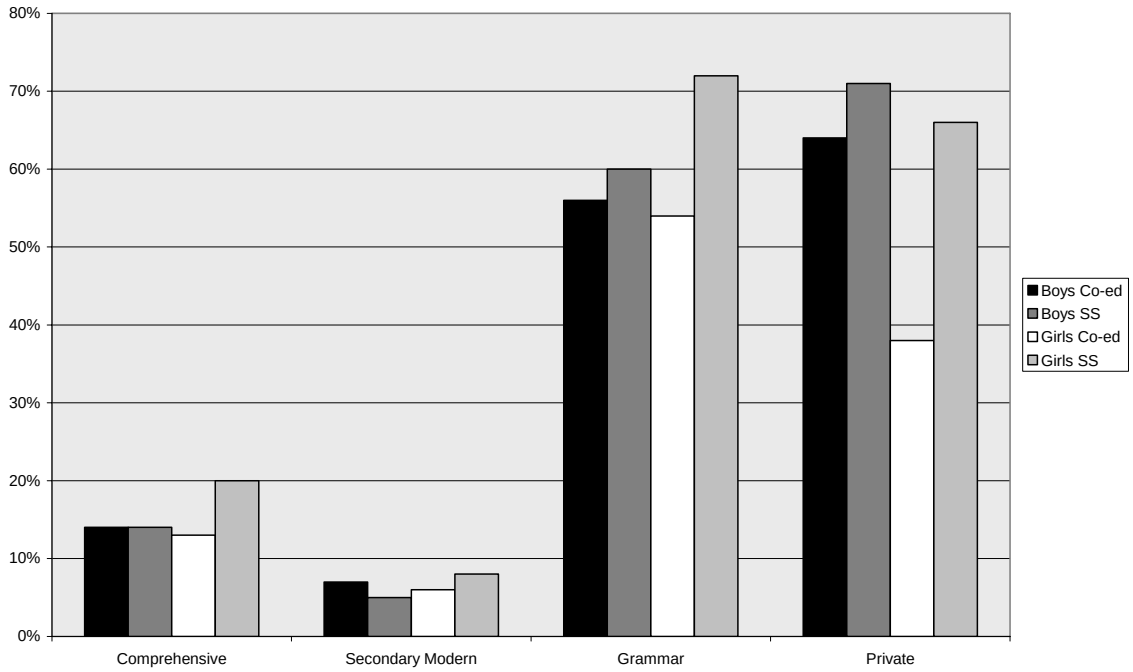
In Britain, pupils sat public examinations at age 16, the legal school-leaving age. Separate exams were set for different subjects, and the most able students would have sat exams in around eight subjects. There were two sets of public examinations: O (Ordinary) levels were intended for the most academically able, and CSEs (Certificate of Secondary Education) for the less able. O level grades ranged from A-G, with A-C grades being deemed a pass. A top grade CSE- grade 1 – was deemed equivalent to a grade C at O level.

The raw figures suggest an enormous advantage for single-sex schools in examination attainment at age 16 in 1974. We start by examining the chances of getting five or more passes at O level A-C/ CSE1, because this benchmark, though high, has been historically important in Britain, representing the hurdle students have needed to clear to be likely candidates for A level and subsequent university entrance. 15% of co-ed boys achieved 5 or more passes at this level, compared to 37% of single-sex boys. For girls, the gap was even wider: 14% of co-educated girls achieved 5 or more passes, compared to 42% of single-sex educated girls. On average, 24% of girls and 22% of boys achieved 5 or more passes, so girls were at a slight overall advantage compared to boys in the sample as a whole, but a slight disadvantage in the coeducational sector.

However, these raw differences are extremely misleading, given the concentration of single-sex schools within the private and selective sectors. Once school sector is

taken into account, the difference in exam results between single-sex and co-educational schools appears more modest.

Figure 1: 5+ Olevel A-C/CSE1 passes (1974)



Within the comprehensive sector, there was no difference in the proportion of boys at co-ed and boys-only schools gaining 5+ good GCE passes (14% in both cases). However, while girls at co-ed comprehensives fared slightly worse than their male peers (with 13% getting 5+ good passes), girls at single-sex comprehensives were substantially more likely to perform at this benchmark (20%). This corresponds to an odds ratio of 1.7 for girls in single-sex comprehensives compared to girls in co-ed comprehensives.

In order to control for a range of possible confounding variables, we have modelled this outcome using binary logistic regression.

Variables included in the model:

Model 1:

- School sector
- School sex
- Pupils' sex
- Region – data collected at age 16. This is included as a control variable, as it is a predictor of attending a single-sex school.
- Fathers' social class – age 11. Seven category version of the Hope-Goldthorpe scale. In the case of missing values on this variable (2 278 cases) we imputed the value from information on the father's social class at the two

previous sweeps of the study, which left us with 355 cases with missing information on this variable. Missingness on this variable often predicts equally negative or even more negative outcomes than even the lowest social class category, therefore it is likely that data is missing 'Not at Random' (Rothon 2007). These cases are treated as a separate category.

- Parental educational level – age at which parent left full-time education, mothers' or fathers' age, whichever is highest (2 657 missing values). These cases are treated as a separate category.
- Test scores at age 7 and 11, as shown in table 1 (transformed into Z scores). We impute missing values on each of the test scores from the full set of test scores, using the Expectation-Maximization algorithm (Schafer 1997).

In table 2, we show the results of a binary logistic regression, where the outcome is gaining five or more A-C passes at O level, contrasted with getting four passes or fewer. We ran separate models for girls and boys, in order to investigate the possibility of gender-specific effects or interactions. In general, the pattern of associations between the background variables and the chances of gaining 5+ A-C grades was similar for both sexes.

Table 2: Binary Logistic Regression, 5+ A-C/ CSE1 passes

	GIRLS				BOYS			
	P	Exp(B)	95.0% C.I.		P	Exp(B)	95.0% C.I.	
			Lower	Upper			Lower	Upper
SCHOOL SECTOR	.000				.000			
Private	.000	2.125	1.490	3.032	.000	5.447	3.796	7.814
Grammar & tech	.000	2.174	1.688	2.801	.000	2.364	1.792	3.119
Sec Mod	.000	.534	.399	.715	.000	.547	.409	.732
Comprehensive								
SINGLE-SEX	.000	1.947	1.482	2.559	.838	1.033	.755	1.414
Co-ed								
REGION	.018				.634			
North Western	.001	.489	.318	.750	.050	.651	.424	1.000
North	.012	.538	.331	.874	.295	.779	.489	1.243
East,West Riding	.457	.843	.537	1.322	.692	.916	.594	1.414
North Midlands	.164	.717	.448	1.146	.615	.890	.565	1.402
East	.003	.506	.324	.790	.119	.703	.452	1.095
London Sth. East	.011	.589	.393	.884	.169	.756	.507	1.126
South	.154	.712	.447	1.136	.214	.740	.460	1.190
South West	.075	.653	.408	1.045	.096	.671	.420	1.074
Midlands	.218	.756	.484	1.180	.208	.747	.475	1.176
Wales								
FATHER'S CLASS	.000				.000			
Missing	.000	4.351	2.620	7.225	.001	2.557	1.493	4.381
emp, manag 1	.014	1.798	1.125	2.874	.018	1.820	1.108	2.987
emp, manag 2,	.000	2.352	1.643	3.366	.001	1.860	1.304	2.654
professional	.000	3.053	1.967	4.738	.000	3.708	2.408	5.711
own account	.039	1.793	1.029	3.123	.068	1.681	.962	2.937

	GIRLS				BOYS			
	P	Exp(B)	95.0% C.I.		P	Exp(B)	95.0% C.I.	
			Lower	Upper			Lower	Upper
non-manual	.008	1.605	1.135	2.271	.001	1.787	1.265	2.525
skilled manual	.019	1.449	1.063	1.975	.397	1.144	.838	1.561
semi and unskilled manual								
PARENTS' AGE ON LEAVING EDUCATION	.000				.000			
Missing	.675	1.062	.803	1.404	.121	1.246	.943	1.646
19+	.000	2.225	1.593	3.108	.000	2.758	1.954	3.893
17-18	.001	1.594	1.216	2.091	.002	1.526	1.163	2.002
16	.249	.848	.641	1.122	.929	.987	.737	1.322
15 or less								
SINGLE-SEX*Test age 11	.021	.732	.562	.953	.020	.748	.586	.954
Arithmetic age 7	.263	1.065	.953	1.191	.517	1.039	.925	1.168
Reading age 7	.050	1.232	1.000	1.518	.120	1.145	.965	1.358
Draw-a-man age 7	.173	1.071	.970	1.183	.049	1.106	1.001	1.223
Copy-designs age 7	.949	1.003	.903	1.115	.486	1.039	.933	1.157
Verbal age 11	.981	.997	.809	1.230	.009	.761	.621	.933
Nonverbal age 11	.014	1.250	1.047	1.494	.000	1.447	1.220	1.718
Reading age 11	.000	2.403	1.992	2.900	.000	1.935	1.676	2.232
Maths age 11	.000	2.127	1.809	2.501	.000	2.685	2.237	3.224
Constant	.000	.076			.000	.065		
N	47771	Df=33			4962	Df=33		
Chi 2	2346.258	P=0.000			2389.227	P=0.000		

The students' test scores in reading and maths at age 11 were highly predictive of attainment at 16+, alongside the fathers' social class and the parents' age at leaving full-time education. As is well established, children with 'professional' fathers had the highest levels of educational attainment. Students at private and grammar schools were substantially more likely to gain 5+ good GCE passes, compared to students at Comprehensives, while students at Secondary Moderns were less likely to. The private school advantage was stronger for boys, which may be due to the fact that many of the oldest and most prestigious private schools were boys' schools. Controlling for all of these factors, girls who attended single-sex schools had 1.9 times the odds of gaining 5+ passes than girls at coeducational school – a substantial difference. In contrast, for boys, there was no significant effect of attending a single-sex school.

We tested for interactions between school-sex and school-sector and social class, but these terms were not statistically significant. However, we found a significant negative interaction between single-sex schooling and test scores at age 11. This is shown in table 2 as SINGLE-SEX*Test age 11. However, in the case of girls the significant interaction found is between single-sex schooling and the reading test score at age 11, whereas for boys we found a significant interaction with the maths test score at age 11. This may suggest a relative advantage of single-sex schooling for academically weaker students, and a relative disadvantage for academically

stronger students. It also suggests that girls who are relatively weak readers and boys who are relatively weak at maths gain an advantage from single-sex schooling.

Since the benchmark of five or more A-C passes was only achieved by a minority of this cohort, we also examined attainment at lower levels (analyses available on request). Girls were more likely than boys to gain at least one A-C pass (50% compared to 44%). However, single-sex schooling was not significantly linked to academic outcomes at this level for either boys or girls. A positive impact of single-sex schooling for girls only becomes apparent at the level of two or more passes. While this could be interpreted as meaning that single-sex schooling had a greater impact for more able girls, recall that we found a negative interaction between prior attainment and single-sex schooling for girls.

Exam subject passes

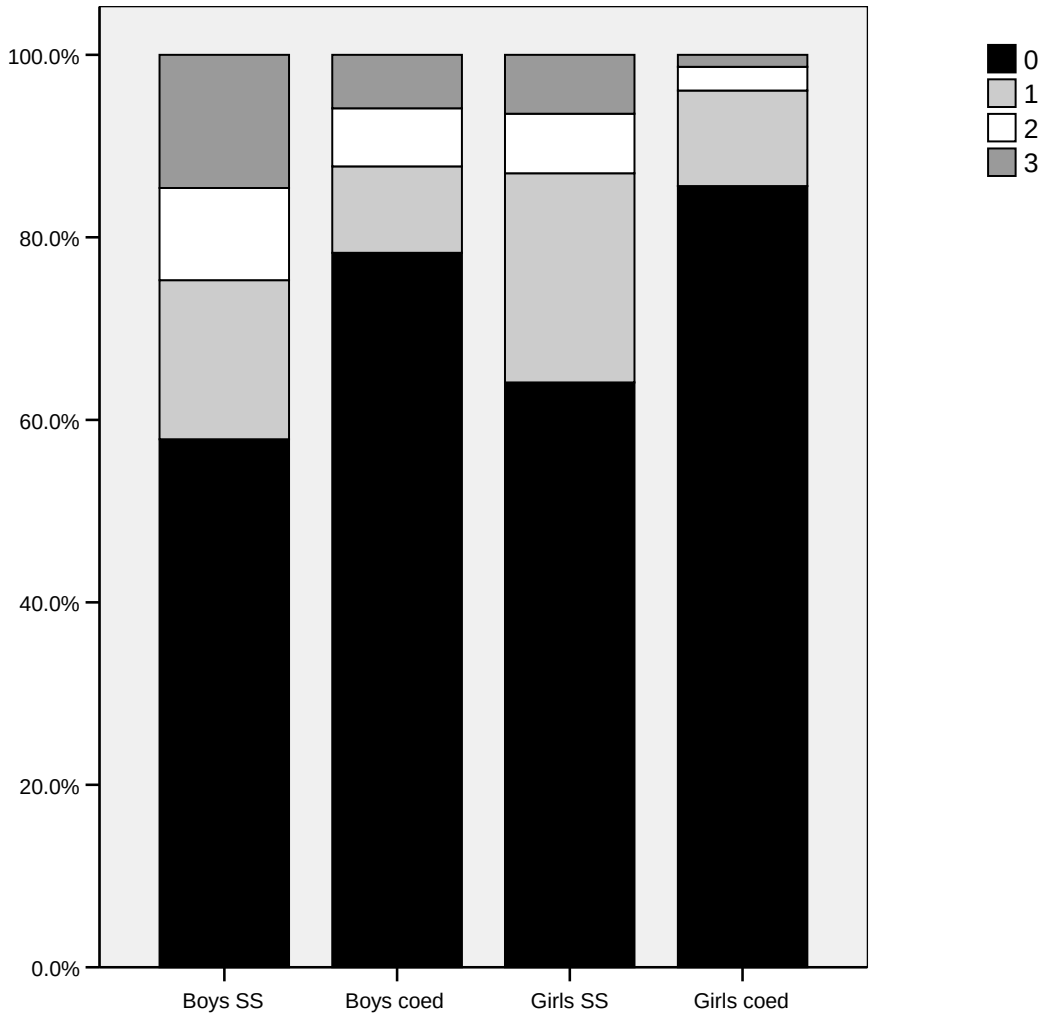
During the 1970s, there were concerns that girls' schools lacked the facilities and staff needed to teach physical sciences. Part of the 'progressive' case for co-education was that gender subject segregation would decrease in co-educational schools, as both sexes would have access to the same curriculum and facilities. On this view, girls should have been more likely to take maths and sciences, and boys should be more likely to take English and modern languages, in co-educational rather than single-sex schools.

Nevertheless, there have been concerns over the years that, instead of promoting attainment in gender-atypical subjects, co-educational schools actually enforce gendered norms of behaviour more powerfully than single-sex schools do. On this view, we would expect boys and girls to be more likely to take gender atypical subjects in single-sex than in co-educational schools.

We examined whether single-sex schooling was associated with the likelihood of gaining passes in specific subject disciplines. In general, a higher proportion of girls achieved passes in English and modern languages, while a higher proportion of boys achieved passes in maths, physics and chemistry. Thus, these groups of subjects can be seen as gender-typed, with languages being seen as 'female' and 'hard sciences' (excluding biology) being seen as 'male'.

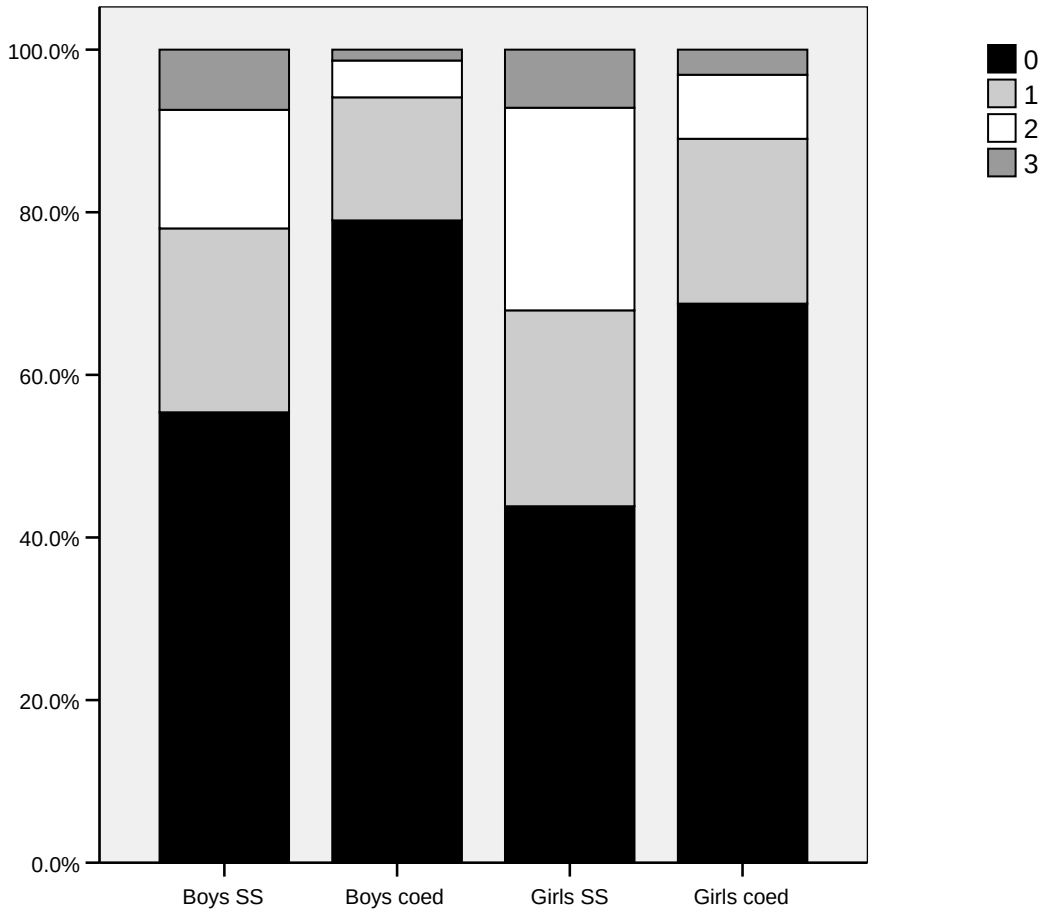
Figure 2 shows the number of exam passes in maths, physics and chemistry gained by the subset of boys and girls at co-ed and single-sex schools who gained at least one pass in any subject at O-level/CSE1. Figure 3 shows the number of passes in English, French, and an additional modern language gained by boys and girls at co-ed and single-sex schools. It appears that boys and girls at single-sex schools gained more passes in both of these subject groupings. However, we have to bear in mind that, as well as being highly gendered subject groupings, 'hard' sciences and modern languages are also prestigious subjects, which students at the selective schools would be expected to gain more passes in. Regression analysis controlling for school sector and other factors shows a different picture.

Figure 2: Number of O-level/CSE1 passes in maths, physics and chemistry by age 16 (1974)



*cohort members with at least one O-level/CSE1 pass in any subject. N=5055.

Figure 3: Number of O level/CSE1 passes in English, French and an additional modern language by age 16 (1974)



*cohort members with at least one O-level/CSE1 pass in any subject. N=5055.

Because the number of passes is an ordered outcome, we investigated the appropriateness of using ordinal regression. However, the proportional odds assumption was violated, making a partial proportional odds model more appropriate. The partial proportional odds model permits some covariates to be modelled with the assumption of proportional odds, while allowing others to have odds ratios which vary by cut-off point (Lall, et al. 2002). We use gologit2 (Williams 2006).

Because this paper includes analyses of a large number of outcomes, we present summaries of the findings, rather than showing them in full. This is due to considerations of space. We show only the parameters for boys (contrast=girls), girls' schooling and boys' schooling (contrast=co-ed). However, the full list of variables listed earlier under 'model 1' is included. This is the case for all the models presented henceforth.

The number of passes in maths, physics and chemistry ranges from 0-3. This outcome is modelled in table 3. The first panel contrasts 0 passes with 1, 2 and 3 passes, the second panel contrasts 0 and 1 with 2 and 3, and the third panel contrasts 0, 1 and 2 with 3. Positive coefficients indicate that higher values on the explanatory variable

make it more likely that the respondent will be in a higher category of O level passes than the current one, while negative coefficients indicate that higher values on the explanatory variable increase the likelihood of being in the current or a lower category.

Table 3 shows that boys were more likely than girls to gain a higher number of science passes. While the size of the effect varies across the panels, it is large and positive for each of them. Girls who attended girls' schools were likely to achieve more science passes than co-educated girls, and the parallel lines assumption was not violated for this variable, hence the estimates are constant across panels (odds ratio=1.4). In the case of boys' schooling, the estimates are negative for each panel, but only the second category is statistically significant. Boys at boys' schools were more likely than coeducated boys to achieve 0 or 1 science pass as opposed to 2 or 3.

Table 3: Science O level passes, summary of partial proportional odds model

	Gender (Male)	95% CI			Girls SS	95% CI			Boys SS	95% CI		
	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P
0	2.5	2.2	3.1	0.000	1.4	1.1	1.6	0.003	0.9	0.8	1.2	0.649
1	5.2	4.3	6.4	0.000	1.4	1.1	1.6	0.003	0.7	0.6	0.9	0.003
2	4.8	3.7	6.2	0.000	1.4	1.1	1.6	0.003	0.8	0.7	1.1	0.199
N=4994 Chi2=1641.54 P=0.0000												

Table 4: Language O level passes, summary of partial proportional odds model

	Gender (Male)	95% CI			Girls SS	95% CI			Boys SS	95% CI		
	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P
0	0.4	0.3	0.5	0.000	1.1	0.9	1.4	0.400	1.1	0.9	1.4	0.283
1	0.4	0.3	0.5	0.000	1.3	1.1	1.8	0.007	1.4	1.1	1.8	0.003
2	0.4	0.3	0.5	0.000	0.7	0.5	0.9	0.012	1.7	1.3	2.4	0.001
N=4994 Chi2= 1724.45 P=0.0000												

Turning to the model for English and modern languages, shown in table 4, boys gained substantially fewer passes than girls in these subjects. Boys in boys' schools were significantly more likely than co-educated boys to get two or three language passes. For girls in girls' schools, the pattern is more complex, with a positive coefficient for the second panel, and a negative one for the third. Girls in single-sex schools were more likely to gain at least one language pass, but less likely to gain two or three.

Overall, the results confirm that girls did better in maths and science, and boys did better in languages, at single sex schools. That is to say, co-education was associated with increased gender differentiation in subject-specific attainment.

Attainment at 18

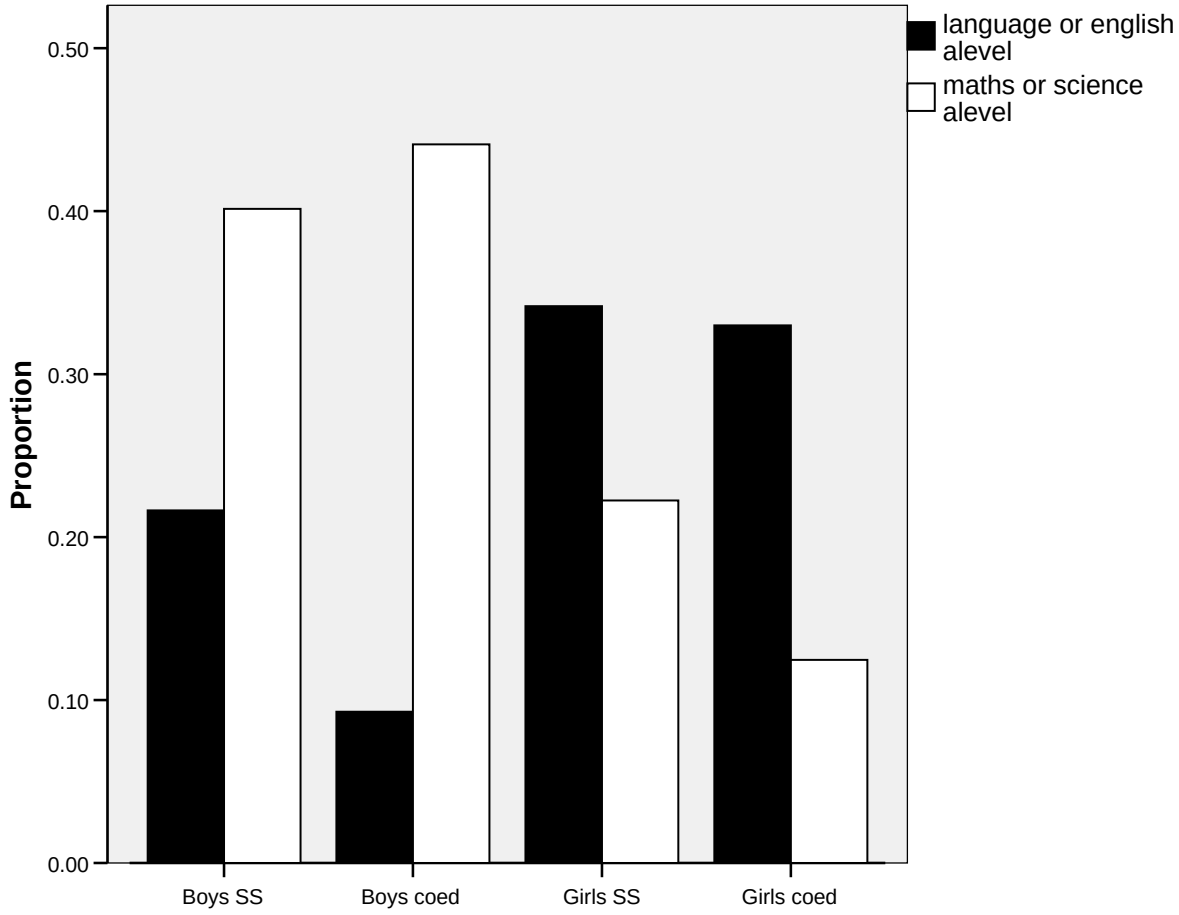
A minority of students stayed on at school from 16 to 18, and studied for 'A' (Advanced) Level exams.

14.6 % of boys and 14.3% of girls gained one or more A-level passes (at grades A to E) by 1976. Binary logistic regression analysis (shown in table 5, under ‘A level 1+’) shows that there was no significant impact of single-sex schooling for either boys or girls. However, there were substantial differences in the *subjects* that boys and girls passed at A-level at single-sex and co-educational schools. Our analyses regarding A level passes and subjects are also summarised in Table 5. As stated above, these summaries just show the parameters for gender and single-sex schooling, although the full set of controls is included in each model.

Table 5: Attainment at A level, summary of binary logistic regression analyses

	Gender (Male)	95% CI			Girls SS	95% CI			Boys SS	95% CI				
	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	N	Chi2
A level 1+														
Model 1	1.2	1.0	1.4	0.137	1.1	0.9	1.4	0.393	0.9	0.7	1.2	0.504	9733	3146.585
A level language														
Model 1	0.2	0.1	0.3	0.000	0.7	0.5	1.0	0.72	2.2	1.4	3.4	0.001	1456	213.684
Model 2	0.3	0.2	0.5	0.000	0.7	0.4	1.1	0.096	1.5	0.9	2.5	0.101	1456	406.059
Model 3	0.3	0.2	0.6	0.000	0.7	0.4	1.0	0.069	1.2	0.7	2.1	0.432	1456	494.475
A level science														
Model 1	7.4	4.9	11.1	0.000	1.6	1.0	2.5	0.050	0.5	0.4	0.8	0.001	1456	347.720
Model 2	3.4	2.1	5.5	0.000	1.4	0.8	2.4	0.253	0.6	0.4	0.9	0.013	1456	698.660
Model 3	2.5	1.5	4.4	0.000	1.4	0.7	2.6	0.306	0.3	0.4	1.3	0.271	1456	945.069

Figure 4: Students A level passes according to subject by age 18 (1976)



*Including only students who achieved at least one A level pass, n=1711.

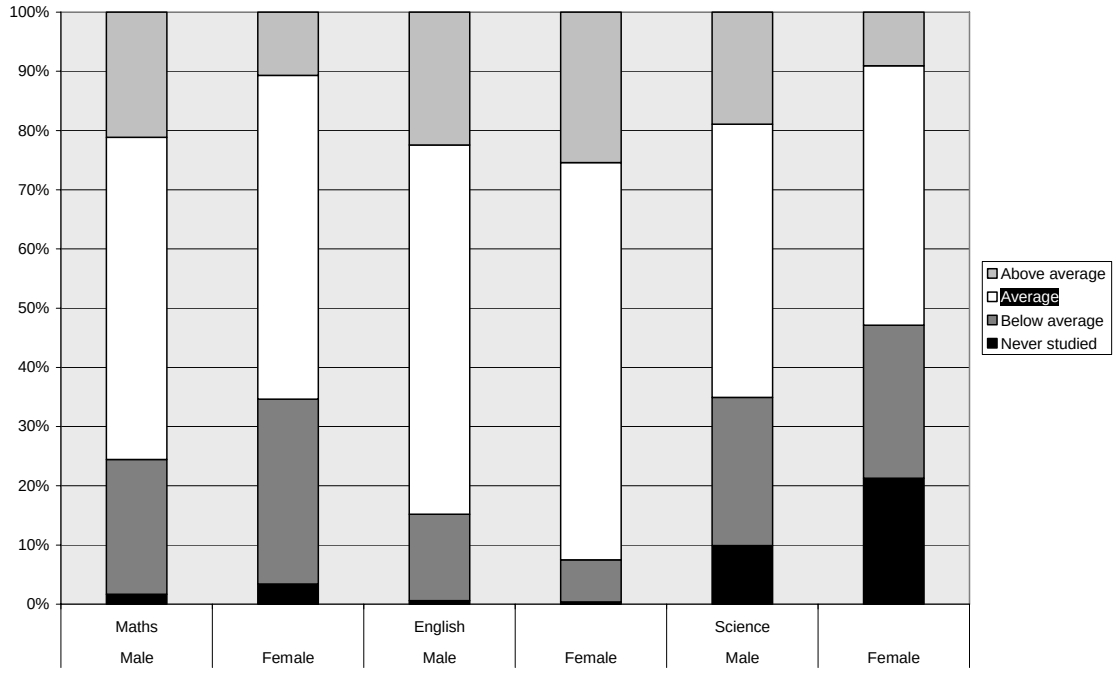
Of those students who gained at least one A level pass, 42% of boys and 17% of girls gained one pass in maths, physics or chemistry. 34% of girls and 15% of boys gained at least one pass in English or a modern language. Figure 4 shows girls from single-sex schools were more likely than co-educated girls to get at least one A-level in maths, physics or chemistry. Boys at single-sex schools were slightly less likely than co-educated boys to get any A-levels in these subjects. Girls from both co-educational and girls' schools had similar chances of getting an A-level in English or a modern language. Boys from boys' schools were more likely than co-ed boys to get an A-level in these subjects.

The pattern shown in these tables is confirmed by the results of binary logistic regression analyses, summarised in Table 5. Boys from boys' schools had 2.2 times the odds of boys at coeducational schools of getting an English or a modern language A-level. Girls were significantly more likely (Exp(B) = 1.6), and boys significantly less likely (Exp(B)=0.5), to get an A-level in maths, physics or chemistry if they had attended a single-sex school.

We add two additional models to these analyses (models 2 and 3 – shown in Table 5). Model 2 includes the number of O level/CSE1 passes in maths, physics and chemistry, and in English and modern languages. This allows us to examine the

extent to which differences in academic attainment at 18+ were based on differences at 16+, or were above and beyond these initial differences. Model 3 includes students' academic self-concepts in maths science and English – i.e. how good they thought they were at these academic subjects - at age 16. Figure 6 shows the distribution of self-concept at age 16, which was highly gendered, with boys having relatively high self-concepts in maths and science, and girls in English. In previous work (Sullivan forthcoming) we have shown that self-concept was more gendered in the coeducational schools. Here, we investigate whether self-concept mediated the effect of single-sex schooling on A level subject specialisation.

Figure 5: Academic self-concept at age 16 (1974)



The number of A-C passes the student gained in 'hard sciences' at 16+ was highly predictive of the likelihood of gaining a 'hard science' A level, whereas the number of passes in languages was not a significant predictor of this outcome. In this model, the odds ratio for boys compared to girls is reduced from 7.4 to 3.4. The single-sex effect is reduced to statistical insignificance in this model.

In model 3, self-concept was highly predictive, even having controlled for examination attainment in the previous model. High self-concept in maths and science increased the odds of achieving a 'hard science' A level, whereas high self-concept in English reduced them. This mediated the male advantage to some extent, though it was still significant. The estimate for boys' only schooling was reduced to insignificance in this model.

Turning to the chances of getting an A level pass in English or a modern language, the number of A-C passes in English and languages at 16+ was positively linked to the chances of gaining an A level pass in these subjects, while science A-C passes at 16+ were a negative predictor of achieving an A level in English or a language.

Controlling for these 16+ exam results mediated the effect of being male to some degree, and also reduced the boys'-only school coefficient to insignificance.

Model 3 shows the effect of including self-concept in the model. Having above average self-concept in English was a positive predictor of gaining an A level in English or modern languages, while above-average self-concept in science was a negative predictor. The effect of being male is mediated slightly in this model, but is still highly significant.

So, the link between single-sex schooling and gendered subject attainment at age 18 was mediated by academic attainment and self-concept at age 16.

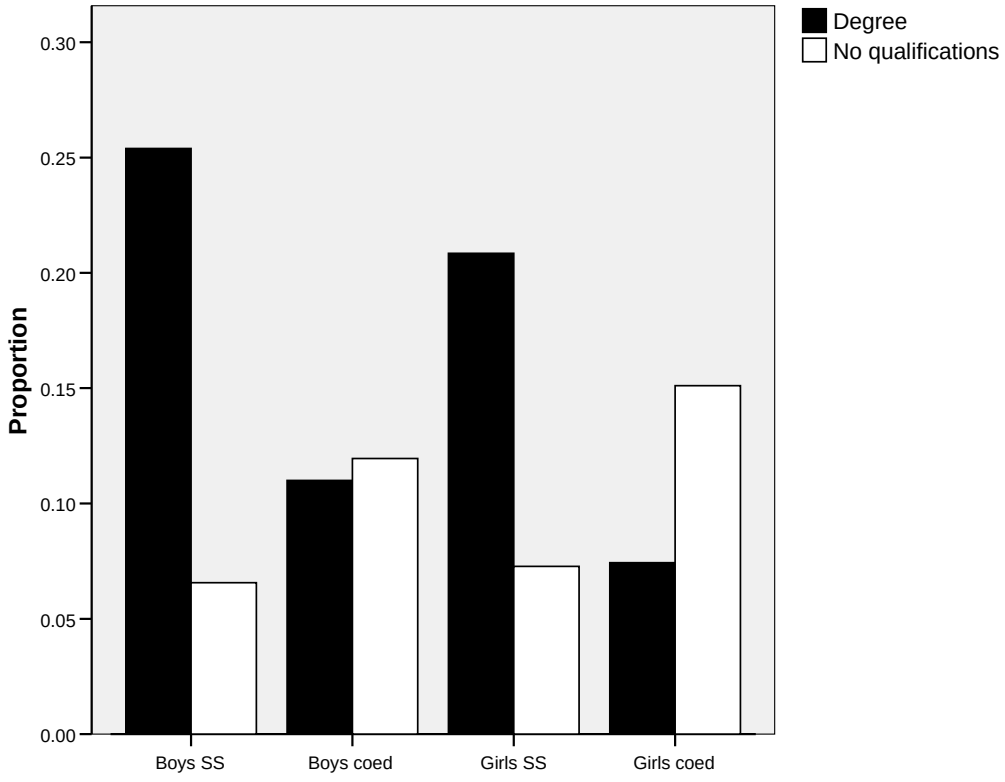
Post-school Qualifications

Henceforth, we use the whole sample, including Scotland.

Qualifications by age 33

11% of the cohort women and 14% of the men had been awarded a degree by 1991, when they were aged 33. A quarter of men who had attended boys' schools compared to 11% of coeducated men, and 21% of girls' school women compared to 7% of coeducated women received degrees (see Figure 6). But this apparent advantage of single-sex schooling is in fact entirely due to the association of single-sex and selective schooling, and there is no significant difference once school sector is controlled.

Figure 6: Qualifications by age 33 (1991)



At the opposite end of the spectrum of qualifications, 11% of the cohort men and 14% of the women had no qualifications by age 33. Again, an apparent differential in favour of single-sex schooling is accounted for by controlling for school sector. Table 6 summarises the results of our analyses of outcomes at age 33.

Table 6: Qualifications at age 33, summary of binary logistic regression analyses

	Gender (Male)	95% CI			Girls SS	95% CI			Boys SS	95% CI				
	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	N	Chi2
Degree														
Model 1	1.5	1.2	1.8	0.000	1.2	0.9	1.5	0.236	1.0	0.9	1.5	0.921	8615	2098.999
No qualifications														
Model 1	0.7	0.6	0.8	0.000	1.0	0.8	1.4	0.771	0.9	0.6	1.3	0.568	8615	1711.360
'Male' qualification														
Model 1	9.0	7.2	11.3	0.000	1.9	1.4	2.6	0.000	1.0	0.8	1.3	0.898	3442	700.861
Model 2	8.0	6.3	10.0	0.000	1.9	1.4	2.6	0.000	1.0	0.8	1.3	0.857	3442	744.297
Model 3	7.5	6.0	9.4	0.000	1.9	1.4	2.6	0.000	1.0	0.8	1.3	0.872	3442	775.175
'Female' qualification														
Model 1	0.1	0.1	0.1	0.000	0.7	0.6	1.0	0.019	1.3	1.0	1.8	0.053	3442	748.918
Model 2	0.1	0.1	0.2	0.000	0.8	0.6	1.0	0.023	1.4	1.0	1.9	0.041	3442	778.841
Model 3	0.1	0.1	0.2	0.000	0.8	0.6	1.0	0.034	1.3	1.0	1.8	0.097	3442	806.564

We went on to investigate the possibility that the subject area of the highest qualification gained was related to single-sex schooling. Because the cell sizes for each individual subject area were small, we did not examine the chances of a qualification in a particular subject area, but instead grouped subjects according to whether they were ‘male-dominated’, ‘female-dominated’ or ‘integrated’, ‘integrated disciplines’ being defined as those with no more than 60% of one sex. (Coding frame due to Dale and Egerton (1997). See appendix for the coding used.)

Figure 7: Sex composition of highest qualification by age 33 (1991)

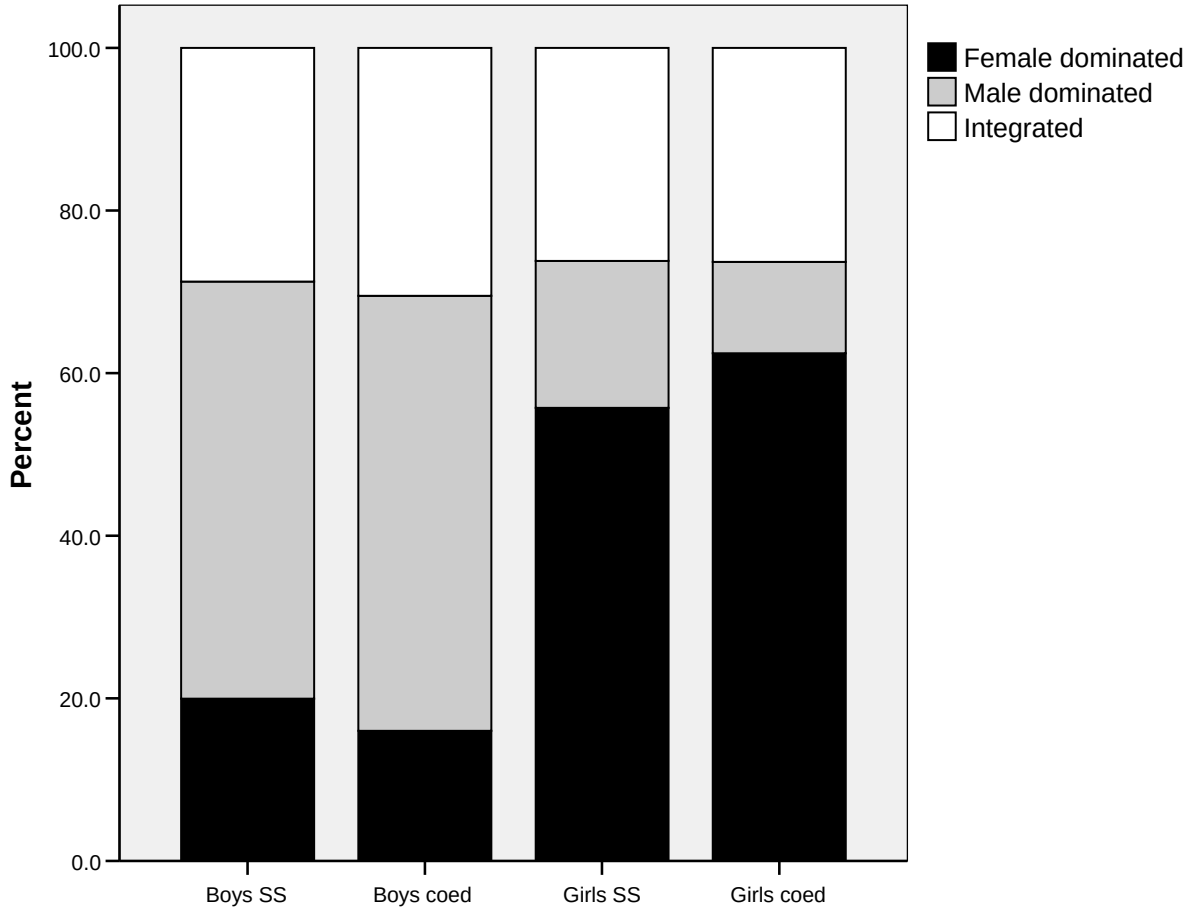


Figure 7 shows that women who had attended girls’ schools were more likely than co-educated women to have male-typed highest qualifications; and men who went to boys’ schools were more likely than co-educated men to have female-typed qualifications. Having said this, single-sex schooling by no means eliminates the hugely gendered pattern of subject specialism. More than half of the girls’ school women had female-typed qualifications, and more than half of the boys’ school men had male-typed qualifications.

Regression analyses confirm that, other things equal, women were significantly more likely to study male-dominated subjects, and less likely to study female-dominated subjects if they had attended single-sex schools. The increased odds of gaining a female-typed qualification for men who had attended boys’ schools did not quite reach statistical significance (p=0.053).

We investigated the possibility that exam passes at 16+ and self-concept may have influenced the chances of gaining male-dominated and female-dominated qualifications, as we did for A level subject passes. Model 2 shows that 'hard science' O levels are a positive predictor, and language O levels a negative predictor, of attaining male-dominated qualifications by age 33. The differential in odds in favour of men is reduced from 9.0 to 8.0 in this model. However, the relatively high odds of women who had been to single-sex schools, compared to co-educated women, gaining male-dominated qualifications were not reduced in this model.

Model 3 includes self-concept at age 16. Self-concept in maths and science were positively linked, and self-concept in English negatively linked, to the likelihood of gaining a male-dominated qualification. The effect of being male is only slightly reduced in this model, and the effect of girls-only schooling is not changed.

Turning to female-dominated qualifications, model 2 shows that having three language passes is positively linked to gaining a female-dominated qualification, while having three 'hard science' passes is negatively linked to this outcome. However, the odds for men compared to women; and for single-sex women compared to co-educated women are not changed in this model. The odds for single-sex men compared to co-educated men actually increase slightly in this model, gaining statistical significance.

Model 3 shows the effect of including self-concept at age 16 in the model. Although self-concept in maths, science and English are all significant, and work in the expected directions, this does not mediate the sex effect. The effect of single-sex schooling for girls is marginally mediated in this model.

Overall then, the effect of single-sex schooling on the gender-type of the highest qualifications the cohort members gained by age 33 could not be accounted for by the effects of single-sex schooling on attainment at 16-plus and on self-concept.

Basic Skills at age 42

In 2000, the cohort members were asked whether they could read and understand magazine and newspaper text. Only 4% of men and 3% of women responded that they could not read these materials, or only with difficulty. This is approximately in line with other estimates of elementary literacy (Parsons and Bynner 2005; Williams, et al. 2003). They were also asked whether they could work out change from £10. Only 2% of both men and women responded that they could not do so, or could only do so with difficulty. This is well below assessments of below basic numeracy in the national surveys of adult basic skills requiring a battery of different tests (Williams, et al. 2003)[2]. Of course, self-reports of basic skills must be treated with caution, as people have been found to have an 'optimistic bias' in rating their own abilities, and self-assessments are distorted by factors such as gender (Marsh, 1989). However, neither of these outcomes was linked to single-sex schooling.

Table 7: Outcomes at age 42 and 46, summary of binary logistic regression analyses

	Gender (Male)	95% CI			Girls SS	95% CI			Boys SS	95% CI				
	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	Exp (B)	Lower	Upper	P	N	Chi2
Illiteracy – cannot easily read a newspaper or magazine	1.3	0.9	1.7	0.123	1.3	0.7	2.1	0.413	1.3	0.8	2.2	0.244	8299	159.542
Innumeracy – cannot easily work out change	1.0	0.7	1.5	0.867	1.1	0.6	1.8	0.797	0.7	0.3	1.3	0.231	8774	135.977
Work Training	1.4	1.3	1.6	0.000	0.9	0.8	1.1	0.465	0.9	0.8	1.1	0.355	7442	137.501
Courses for interest	0.8	0.7	0.9	0.000	1.0	1.2	0.8	0.868	0.9	0.8	1.7	0.595	7449	194.419
New qualifications - vocational	0.7	0.6	0.8	0.000	1.1	0.9	1.3	0.599	1.0	0.8	1.3	0.787	7454	84.972
New qualifications - academic	0.5	0.4	0.7	0.000	0.9	0.6	1.2	0.418	0.8	0.5	1.3	0.302	7454	126.865

Lifelong learning at age 46

The cohort members were last surveyed in 2004, when they were aged 46. This sweep of the survey had a particular focus on questions of lifelong learning, and respondents were asked whether they had attended any work-related training courses, or any courses for interest or leisure during the last four years. They were also asked whether they had gained any vocational or academic qualifications during this period. Women were more likely to have taken courses for leisure or interest (24% compared to 19% of men), and men were more likely to have taken courses for work (37% compared to 29% of women). Women were more likely than men to have gained new qualifications, whether vocational or academic (27% compared to 19% of men). However, as Table 7 shows, none of these measures of lifelong learning was related to having attended a single-sex or co-educational secondary school.

Conclusions

This paper has provided a longitudinal analysis of the effects of single-sex schooling on academic outcomes, controlling for students' family background characteristics as well as their prior test scores. Our findings relate to a time when single-sex schooling was widespread, and when most parents had little choice over which type of school their child would attend. Thus, we can be relatively confident that our results are not simply driven by differences in the types of children who attended single-sex and coeducational schools; a difficulty which has dogged previous studies.

An understanding of the educational trajectories of this generation of men and women, who have been tracked into their maturity and middle-age, is relevant for understanding the gendered patterns of their lives, in the labour market and elsewhere. In this paper, we have limited our focus to the academic outcomes of single-sex versus coeducational schooling. Of course, much of the debate regarding single-sex schooling had been concerned with affective, psychological, social and economic outcomes. In future work, we will investigate whether single-sex schooling was linked to these wider outcomes for the men and women of the 1958 cohort as they progressed through the lifecourse.

Our conclusions can be summarised as follows:

- Girls at single-sex schools were substantially more likely than their co-educated peers to achieve a high level of examination success at age 16, but boys were neither significantly advantaged nor disadvantaged in terms of overall examination attainment by attending single-sex schools.
- There was no significant impact of single-sex schooling on the level of later educational attainments for either sex.
- Single-sex schools were associated with attainment in gender atypical subject areas for both boys and girls.

Our results certainly do not support the 'progressive' view that co-education is good for boys and neutral for girls. The fact that single-sex schooling was neutral, rather than negative, for boys may be seen as surprising. Since Dale, the view that boys do

worse in boys-only schools has been widely accepted. The idea that boys' schools must be particularly difficult environments seems intuitively plausible, given that boys tend to present more disciplinary problems than girls. And this view is supported by research showing that the more males there are in a co-educational class, the worse both sexes fare academically (Lavy and Schlosser 2007). So how did the boys' schools attended by the 1958 cohort manage to achieve very similar academic results to their coeducational counterparts? It is possible that a boys-only environment actually reduced the peer pressure on boys to act-up, or that boys-only schools were particularly effective at dealing with boys' behaviour. Unfortunately, the data available to us do not allow us to get under the skin of this issue, which merits further investigation.

The fact that girls performed better at O level in single-sex schools supports the feminist case that mixed schooling disadvantaged girls. However, the advantage of single-sex schooling only emerged at relatively high levels of attainment at 16. Half of the sample achieved no A-C passes, and the odds of achieving any passes at all were not improved by attending a single-sex school. It is important to remember that schools in 1970s Britain still held very low expectations for the educational attainment of the majority of the population. In this context, it may be that some single-sex girls' schools promoted an ethos of high academic attainment which provided a substantial advantage, but only to a minority of girls.

The level of qualifications gained post-16 was not linked to single-sex or co-educational schooling for either men or women, and neither were basic skills or lifelong learning in adult life. In the case of the women, this is surprising, as one might have expected the single-sex girls' advantage at 16 to be sustained to some extent. It may be that the advantages of single-sex schooling are strongly linked to the particular context of adolescence and compulsory schooling, with its associated behavioural issues, brutal social hierarchies, and intense peer-group pressures (Coleman 1961). Co-ed girls whose performance at age 16 was lower than it might have been in a single-sex school may have been able to catch up later on. It is also possible that the generally low aspirations for girls' and women's post-compulsory education during the 1970s prevented single-sex school girls from capitalising on their early gains. Although nearly half of graduates born in 1958 had been to single-sex schools (46 per cent versus 22 per cent of the rest), this simply reflected their socially and academically selective nature, not any particular educational benefit of single-sex schooling.

Girls at girls' schools were more likely to gain maths and science A-levels, and boys at boys' schools to gain A-levels in English and modern languages, compared with those in co-educational schools. In addition, women who went to girls' schools were more likely than co-educated women to gain post-school qualifications in male-dominated disciplines. This confirms the view that single-sex environments can actually reduce the tendency of students to behave according to gender-typical stereotypes or norms. But why should this be? Marsh's 'Big-Fish-Little-Pond' theory may be relevant here. Marsh and Hau (2003) argue that academic self-concept is determined by students' frame of reference, such that students with high attaining peers will be more likely to consider themselves 'below average' than students of the same prior ability who are surrounded by lower-attaining peers – the 'Big-Fish-Little-

Pond' (BFLP) effect. In previous work (Sullivan forthcoming), we found that the gender gap in self-concept in maths and sciences and English was stronger in the co-educational sector than in the single-sex schools. However, we also found no substantial differences in average test scores in maths and English between boys and girls prior to entry to secondary school. We therefore argued that students may be using as a frame of reference, not only the *actual* abilities of their peers, but a view of their abilities which is itself influenced by sex-stereotypes. So, a boy who believes that boys are better than girls at maths will rate his own abilities in maths as lower if he is in a single-sex setting, and hence comparing himself to other boys. In a mixed setting, he will be more likely to assume that he is 'above average', since he underestimates the girls.

Given the link between academic self-concept and single-sex schooling, we wished to examine whether self-concept at age 16 mediated the impacts of gender and single-sex schooling on the fields of study of post-16 qualifications. Interestingly, the effects of single-sex schooling on subject-specific attainment at A level were mediated both by subject-specific attainment at O level, and by academic self-concept at age 16. This seems to indicate the importance of the impact of single-sex schooling on these early outcomes. However, the effect of single-sex schooling on the chances of gaining male or female dominated post-school qualifications were largely not mediated in this way, leaving a direct effect that could not be explained in our models.

There are of course other possible mechanisms which may promote gender-atypical fields of study within single-sex schools. Several related mechanisms may be at work, at the level of the peer group, the classroom, the teacher and the school. 1. *The peer group:* As well as the Big-Fish-Little-Pond explanation, a further account that operates at the level of the peer group is the view that gendered norms of behaviour are more flexible or less rigidly enforced within single-sex settings. A single-sex environment may make it less likely that students will perceive particular academic subjects as being 'for' a particular sex. While, in a co-educational school, a girl taking physics, for example, would have found herself in a minority in the class, this would not apply in a single-sex environment. A further potential contributing factor is that children may hold more prescriptive stereotypes regarding the opposite sex than regarding their own sex (Guttentag and Bray 1976). 2. *Pupil-teacher classroom interactions:* While it has been suggested that that boys tend to dominate co-educational maths and science lessons, much less attention has been given to girls' and boys' behaviour in co-educational English and modern languages lessons. Neither is it clear to what extent these sorts of classroom interactions actually affect academic attainment or subsequent course-taking. 3. *The teacher:* The teachers who chose to work in single-sex schools were relatively likely to be of the same sex as the students. It has been suggested that female science teachers may achieve particularly good results with girls, and male language teachers with boys. However, current research findings in this area are very mixed (Dee 2007; Ehrenberg, et al. 1995; Nixon and Robinson 1999; Sokal, et al. 2007). 4. *The school:* It is possible that some single-sex schools may have had a deliberate ethos of promoting success in gender-atypical subject areas for their students. This would be reflected in the curriculum and in the advice given to students regarding subject options and careers. However, there is no evidence that single-sex schools made gender-atypical subjects

more available to their students than coeducational schools in general (Bone 1983), and our own findings also fail to indicate this. Twenty-one percent of the girls in our sample stated, at age 16, that they had never studied science – and we found that single-sex schooling was not a significant predictor of this outcome (Sullivan, forthcoming).

It is difficult to draw simple policy conclusions from these findings. When the 1958 cohort were 16, a quarter of their age-group were in single-sex schools. But the advance of comprehensivisation went hand in hand with a massive decline in single-sex secondary schooling within the state sector. By 2004, the proportions of full-time students in maintained secondary schools in England attending single-sex schools had fallen to 13% for girls and 10% for boys (DfES 2004). Single-sex schooling is more prevalent in the private sector, but is declining even there. So, do our findings support the case for greater provision of single-sex schooling within the state sector today? This question is complicated by the parental choice agenda. There is still a demand for single-sex schooling for girls, especially among parents from certain minority ethnic groups. But single-sex schooling is generally seen by parents as bad for boys. This has led to problems for Local Education Authorities that have maintained some single-sex provision. For example, London has a distinct tradition of single-sex schooling within the state sector, but fewer boys' schools than girls' schools have survived. In Inner London, 52% of girls attend girls' schools, and 27% of boys attend boys' schools. Within co-educational schools, 59% of students are boys. So, parental choice of school leads to a sort of collective action problem, whereby individually rational choices add up to a situation that few would regard as socially optimal. Under these circumstances, advocating greater single-sex provision for girls is problematic, as single-sex schooling for some means male-dominated co-educational schooling for others. Policymakers considering the expansion of single-sex provision need to be aware of these unintended consequences.

Nevertheless, our findings have implications for co-educational as well as single-sex schools. In the context of the overwhelming policy focus during the last three decades on boys' 'underachievement', girls' relatively high achievement is seen as a problem rather than a success. Broader gender issues are forgotten: notably, the issue of the ways in which both girls and boys may be trammelled by sex-stereotypes during their school years, which set them on divergent pathways in their later lives and careers. Teachers are no longer encouraged to think about gender equity in general terms, but simply in terms of 'boys' underachievement'(Mahony and Hextall 2000).

The British birth cohort surveys of 1946, 1958 and 1970 have documented the changing relative educational achievements of males and females, alongside changes in the role of women within the labour market and the wider society (Makepeace et al 2003). It is not widely recognised that, in terms of overall educational qualifications at 16, girls were fractionally ahead of boys even in 1974, when the 1958 cohort were 16. This is despite the fact that many of the parents and teachers of that generation would not have thought that academic qualifications were as important for girls as they were for boys. Girls' achievement at 16 was in spite of their subordinate status, and boys still achieved higher levels of post-compulsory qualifications. Girls' marginal average advantage at the 5+ A-C benchmark was

entirely driven by girls in girls' schools, as co-educated girls were slightly less likely to achieve this benchmark than co-educated boys.

The gap between boys and girls in academic attainment at 16 opened up in the late 1980s, and has subsequently been an enormous political issue in Britain, as it has also been elsewhere. It is plausible to infer that this gap would be even larger had it not been for the decline in single-sex schooling. Yet it is important to point out that, if we can extrapolate from our findings, an increase in the provision of single-sex schooling would have improved girls' academic attainments, but not at the expense of the boys, as boys in boys' schools did just as well as co-educated boys. Having said this, it seems that an attainment gap in favour of girls is unacceptable to policymakers regardless of the fact that it is driven by the increased attainments of girls rather than a decline in boys' attainments. Of course, we acknowledge that one cannot necessarily draw inferences regarding current patterns of attainment from our findings, as the effects of single-sex schooling are historically contingent (Ewing 2006), and contemporary single-sex schools may differ from their 1970s equivalents in relevant ways. However, many of the issues faced by boys and girls in co-educational schools in the 1970s have not gone away. In particular, girls continue to be underrepresented in maths and science, and boys in English and modern languages.

There is currently a tendency to see girls' relatively low participation in 'masculine' subjects such as maths and sciences, and boys' low participation in 'feminine' subjects such as English and modern languages, as driven simply by personal 'choice' and 'ability', in an unproblematic way. Essentialist views on gender which attribute such observed gender differences to differences in the male and female brain are currently in vogue. Our study shows that the huge gender differentiation in the subject areas of qualifications gained by our cohort members certainly could not be accounted for by the very small gender differences observed in their prior test scores. Finally, the fact that coeducation has exacerbated the gendered nature of students' attainments, not just at school, but in terms of their post-school qualifications, suggests that gendered norms regarding education are not immutable, and can be influenced by the context of schooling.

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NOTES

1. Steedman (1983) presents a summary of the outcome of logistic regressions where the dependent variables at age 16 are gaining exam passes in: 1. *both* English and maths; 2. *both* a science and French; 3. *all of* maths, English, French and a science. This modelling strategy examines subject combinations which could be seen as 'gender balanced' rather than gender stereotyped. These analyses were published as a report to the Equal Opportunities Commission.
2. 5% were reported to be at entry level 1 in numeracy, and 16% at level 2 by the 'Skills for Life' survey. These tests are more demanding than simply working out change from £10, so are not strictly comparable to the self-reports used by NCDS.

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