Dr Alice Sullivan
CLS

# Academic self-concept, gender and single-sex schooling in the 1970 British Cohort Study

## Introduction

Men have more confidence in their own abilities than women in many areas, including the evaluation of their own academic abilities, or 'academic self-concept' (Colwill, 1982). Boys are especially likely to rate their abilities more highly than girls in subjects that are perceived as 'masculine' such as mathematics and the sciences (Joffe and Foxman, 1988, Marsh, 1989, Marsh and Yeung, 1998, Wilgenbusch and Merrell, 1999). This gender difference emerges at an early age, and has been observed among primary school children (Tizard et. al. 1988, Parsons et. al. 1976). Although there is a consensus in the literature that self-concept declines as children get older, there have been mixed findings on the effect of students' age on the gender gap. Some studies have found that the gender gap in self-concept increases during adolescence, while others have found that the gap is either constant or diminishes somewhat during the secondary school years (Eccles, 1987, Jacobs, et al., 2002). This paper addresses the question of whether gender had an impact on academic self-concept for a cohort of 16-year olds born in 1970, and whether single-sex and selective schooling had any impact on self-concept for boys or girls. We are able to use previously unanalysed data from the 1986 sweep of the longitudinal British Cohort Study 1970 (BCS70).

This paper builds on an analysis of the 1958 National Child Development Study (NCDS) addressing the same research questions (Sullivan, unpub.). This earlier analysis of the 1958 cohort found that boys had higher self-concepts in maths and science, while girls had higher self-concepts in English. The gender gap in self-concept was smaller for pupils at single-sex schools than for those at co-educational schools. Pupils at academically selective schools had lower self-concepts overall, controlling for a range of pupil characteristics. In extending this analysis to a second birth cohort, this paper will be able to test whether the results from the 1958 cohort still apply to the 1970 cohort, and to examine any changes that have occurred over this period.

## Schooling and frame of reference

Marsh (2003) has put forward the view that academic self-concept is determined by students' frames 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' effect). Therefore, Marsh argues that selective schooling and 'gifted and talented' programs deflate the academic self-concepts of the selected students. However, Catsambis, Mulkey and Crain (2001) found that being in a high ability science track in the US

was associated with raised self-concept for girls, but lower self-concept for boys (for 15 to 17 year olds).

As well as comparing themselves to others, students also have an internal frame of reference (the 'Internal/External frame of reference model') (Marsh and Hau, 2004). So, to decide whether I consider myself good at maths, I compare my ability at maths to my ability in other subjects, such as English. Given a certain level of maths attainment, my attainment in English will be negatively associated with my maths self-concept. Jonsson (1999) has used a similar concept of 'relative advantage' to examine girls' lower rates of participation in maths and sciences, despite roughly equal levels of prior attainment in maths. The point is that girls' high attainment in English could prevent them from pursuing maths and sciences, even though their maths and science attainment is equal to that of their male peers. However, Jonsson found that relative advantage only accounts for a small proportion of the sex difference in subject choice in Sweden.

## Single-sex schooling

It has been argued (from different perspectives) that single-sex schooling affects students' self-esteem in general and/or their academic self-concept and sense of efficacy in sex-atypical subjects. The British liberal consensus (Dale, 1969, 1971, 1974) that co-educational schooling was healthier for both sexes, and allowed greater opportunities for both boys and girls to study a sex-atypical curriculum, has been challenged. Feminists have argued that girls' interests are sacrificed in mixed schools, where teachers favour boys and girls suffer sexual harassment. Conversely, the anti-feminist argument that the 'feminised' co-educational environment is bad for boys, as they need male teachers as role models, and have different learning styles from girls (Sexton, 1969), has become newly fashionable due to the moral panic over 'failing boys'.

Concerns have been 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).

Previous empirical findings on the questions of single-sex schooling and self-esteem, self-concept, and participation in gender-atypical subjects, have been mixed. Cairns (1990) found that 16 year old boys and girls at single-sex Grammar schools in Northern Ireland had higher self-esteem than their peers at co-educational schools, but there was no such difference between single-sex and co-educational Secondary Modern schools. Stables (1990) found that the polarisation of interest in physics and modern languages between the 12 to 13 year old boys and girls in English Comprehensive schools was greater in mixed schools than in single-sex schools. (Spielhofer, et al., 2002) found that both boys and girls in single-sex schools in England and Wales were more likely to take physics, chemistry or biology GCSE than pupils in mixed schools.

Studies focusing on single-sex classes within co-educational schools also provide mixed results. Marsh and Rowe (1996) found that an intervention providing single-sex classes for 12 to 14 year olds in Australian co-educational schools had little effect on maths achievement and attitudes, and there was a positive effect of mixed-sex classes on attitudes to gender equality. Shapka and Keating (2003) assessed an

intervention providing single-sex classes within co-educational public schools for 14 to 15 year olds in the US, and found that girls in single-sex classes did not differ significantly from girls in mixed classes in terms of maths anxiety and perceived maths competence, but nevertheless did have higher levels of maths and science attainment, and took a greater number of maths and science classes. Jackson and Smith's (2000) study of 11 to 13 year olds in England and 11 to 15 year olds in Australia found that self-concept was higher in mixed-sex classes, for both sexes. Nevertheless, girls expressed a preference for the single-sex classes, while boys were less favourable towards them.

## Research questions and hypotheses

The extant literature cited above suggests the following research questions.

1) *Are boys' and girls' academic self-concepts in different subject areas sex stereotyped?*

There is a substantial literature that suggests we should expect to find that boys have higher academic self concepts in 'masculine' subject areas such as mathematics, controlling for prior attainment. In contrast, girls have generally been found to have higher 'verbal self-concepts' than boys.

2) *Are other characteristics of students, such as parental social status, linked to academic self-concept?*

There is evidence that lower social class status and parental education are associated with lower expectations of academic success, controlling for prior attainment (Correll, 2001, Sullivan, 2006).

3) *Is the gender gap in self-concept mediated by relative advantage in sex-typical areas?*

If the gender gap in self-concept is explained by relative advantage in a given area, then, when modelling maths self-concept, not only will attainment in English be negatively associated with maths self-concept (controlling for prior maths attainment), but including English attainment in the model should reduce the gender gap. The converse should be true for any gender gap in English self-concept.

4) *Does school sector affect students' academic self-concept in different subject areas?*

According to Marsh's 'big-fish-little-pond' model, students at academically selective schools should suffer deflated self-concepts. One would expect this effect to apply across the board, rather than in specific subject areas. In this case, students at private and Grammar schools should have lower self-concepts than students at Comprehensives (controlling for prior attainment), while students at Secondary Modern schools should have somewhat higher self-concepts than students at Comprehensives. However, during the 1960s and 70s, many Comprehensives were simply renamed Secondary Moderns, so the gap between these sectors was small.

An alternative hypothesis would suggest that being accepted to an academically selective school means that the child is labelled as academically able, while being rejected means the child is labelled as academically inferior. If students internalise these labels, students at academically selective schools should have inflated self-concepts.

5) *Does single-sex schooling affect students' academic self-concept in different subject areas?*

*Big-Fish-Little-Pond (henceforth BFLP)*
If boys had higher levels of prior attainment in maths, and girls in English, then we could extend the BFLP model to apply to single-sex schools: single-sex schooling should deflate boys' self-concept in maths, but inflate their self-concept in English. The converse should be true for girls: single-sex schooling should raise girls' self concept in maths, but reduce their self-concept in English.

But, what if there are no substantial differences in average test scores in maths and English between boys and girls prior to entry to secondary school, but this pattern of effects is found (i.e. single-sex schools deflate self-concept in sex typical subjects and inflate it in sex a-typical subjects)? This would suggest 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. For example, 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.

*Gender norm enforcement*
Some advocates of single-sex schooling suggest that gendered norms of behaviour are more strictly enforced in mixed settings *for both sexes.* So, it is harder for girls to show interest and ability in maths and sciences, and for boys to show interest and ability in English and modern languages, in mixed settings than in single-sex settings. Mixed sex peers (and perhaps also teachers in mixed schools) may punish demonstrations of gender-atypical interest and ability through expressions of social disapproval, etc. If gendered norms are more strongly enforced in mixed schools, then we would expect that girls' self-concept in 'masculine' subjects, and boys' self-concept in feminine subjects, will be higher in single-sex schools. We can call this the 'gender norm enforcement' model. The gender norm enforcement model's predictions are in line with those of the BFLP model.

*Role models, learning styles and peer groups*
Advocates of single-sex schooling for boys have argued that co-educational schooling damages boys' self-esteem, partly because women teachers cannot act as adequate role models or authority figures for boys. In this case, we would expect boys' academic self-concept to be increased by single-sex schooling. This should apply across subject areas, but may apply especially to stereotypically 'feminine' subjects, which, in mixed schools, are most often taught by women.

Advocates of single-sex schooling for girls have argued that girls' self-esteem is better fostered in a single-sex environment, as boys tend to dominate in a mixed environment, especially when it comes to maths and sciences. The lack of female teachers in these subjects in mixed schools is also seen as relevant. In this case, we would expect girls' academic self-concept to be increased by single-sex schooling, especially in stereotypically 'masculine' subjects.

Unfortunately, we do not have data on the sex of the teachers at the BCS70 schools. However, we do know that girls' schools tended to be dominated by female teachers, and boys' schools by male teachers. Schools census data for 1986 (available from the National Digital Archive of Datasets) shows that boys' schools had on average 80 percent male teachers, and girls' schools 82 percent female teachers. Mixed schools had on average 54 percent male and 46 percent female teachers. Ninety-nine percent of head teachers of boys' schools were male, and 93 percent of heads of girls' schools were female. At mixed schools, 89 percent of head teachers were male and just 11 percent were female. If same-sex role models matter, then girls may have suffered from the lack of female role models in senior positions at mixed schools.

## Data

The British Cohort Study of 1970 (BCS70) is a longitudinal study of a single cohort born in Britain in a particular week in 1970. Data have so far been collected at six time points: shortly after birth, at age 5, 10, 16, 26 and 30. In the last sweep (age 30) there was contact with just over 11,000 cohort members (just under 11,000 excluding immigrants). This paper uses information taken from the cohort members, their families and schools, when the cohort members were aged 5, 10 and 16.

Information on co-education was previously only available at age 10 for BCS70, since the dataset collected from schools at 16 was incomplete and had been lost. This project has cleaned the 1986 schools data, and united it with the BCS dataset. There was a teachers' strike when the age 16 survey was being carried out in 1986. Therefore, this dataset only covers 4150 cases. However, the proportions attending schools within each sector are broadly representative, albeit with a slight under-representation of Private and Secondary Modern pupils, as shown by table 1.

Table 1: Representativeness of Data

| | BCS70 1986 Britain | | BCS70 1986 England | | Statistics of Education England 1984* |
|---|---|---|---|---|---|
| | Frequency | % | Frequency | % | % |
| Comprehensive | 3590 | 87 | 2355 | 85 | 83 |
| Grammar | 154 | 4 | 139 | 5 | 3 |
| Secondary Modern and Technical | 134 | 3 | 95 | 3 | 6 |
| Private | 166 | 4 | 123 | 4 | 7 |
| Special | 106 | 3 | 56 | 2 | 2 |
| Total | 4150 | 100 | 2768 | 100 | 100 |

**Statistics of Education* figures for 15 year olds in secondary schools in 1984, published 1986. 1984 figures are used because equivalent figures for 1985 were not available. Figures for 15 year olds are more reliable than figures for 16 year olds, due to disproportionate drop-out rates at Comprehensive and Secondary-Modern schools. These figures are for England only, equivalent figures for Scotland and Wales were not available.

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 selection bias. The BCS70 gives exceptionally rich

information on various aspects of the respondents, their schools and their parents. This enables us to control for crucial confounding variables. The fact that the cohort studies are longitudinal enables one to study self concept at 16 in the light of previous, rather than contemporaneous test scores, teacher assessments and characteristics of family background. We have modelled the predictors of attendance at a single-sex school, and have found that, although there were strong regional differences in the provision of single-sex schooling, *within* each school sector (Comprehensive, Grammar, Secondary Modern and Comprehensive) students at single-sex and co-educational schools appeared similar in terms of their prior personal and family characteristics (Leonard et. al., 2005). We are therefore reassured that the danger of spurious results due to selection bias is modest.

## Analysis

We begin by describing differences in boys' and girls' self concept at age 16. We then assess whether these differences correspond to gender differences in test scores. We go on to model self-concept using binary logistic regression, in order to test the hypotheses outlined in the previous section.

### Self-assessed abilities

The 1970 cohort were asked about their self-assessed academic abilities at age 16, prior to their terminal examinations. We show frequencies only for those cases where schools information was available. However, the distribution of frequencies for the entire cohort was similar to that for the sub-sample used here. These responses were collected using a self-completion questionnaire, completed in private, hence there was no external pressure to give a 'socially acceptable' response.

Table 2 shows the cohort members' responses to the statements 'I am clever' and 'I am good at exams'. Strikingly, 27 percent of boys compared to 15 percent of girls responded that the statement 'I am clever' 'applies very much' to them. Nearly twice as many boys as girls (19 percent compared to 11 percent) said that the statement 'I am good at exams' 'applies very much' to them. This is despite the fact that girls' examination performance at O level and CSE was actually better than that of boys for this cohort.

Table 2: General Academic Self-concept

| | I am clever | | | | I am good at exams | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | Boys | | Girls | |
| | Count | % | Count | % | Count | % | Count | % |
| Applies very much | 359 | 27 | 238 | 15 | 261 | 19 | 180 | 11 |
| Applies somewhat | 897 | 66 | 1141 | 71 | 853 | 63 | 1060 | 66 |
| Does not apply | 101 | 7 | 239 | 15 | 248 | 18 | 376 | 23 |
| Total | 1357 | 100 | 1618 | 100 | 1362 | 100 | 1616 | 100 |

Table 3 shows the students' responses to the questions 'Are you good at mathematics?' and 'Are you good at spelling?'. More than half of the boys (53 percent) compared to 35 percent of the girls responded that they were good at mathematics. There is no clear gender gap in self-concept in spelling (other than that girls were more likely than boys to say that they did not know whether they were good at spelling). It is unfortunate that the 1970 cohort were not asked about their self-concept in English – spelling is a limited proxy.

Table 3: Subject Specific Self-concept

| | Are you good at Mathematics? | | | | Are you good at spelling? | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | Boys | | Girls | |
| | Count | % | Count | % | Count | % | Count | % |
| Yes | 694 | 53 | 552 | 35 | 730 | 55 | 827 | 52 |
| No | 366 | 28 | 676 | 43 | 623 | 28 | 383 | 24 |
| Don't know | 253 | 19 | 357 | 23 | 228 | 17 | 385 | 24 |
| Total | 1313 | 100 | 1585 | 100 | 1321 | 100 | 1595 | 100 |

## Test scores

We can compare the gender gap in students' self-assessments with the gender gap in their performance in tests administered by the cohort studies.

At age 5, the BCS children took tests in reading, vocabulary (the English-Picture-Vocabulary-Test), copying designs, the draw-a-man test, and the profile test (completing a picture of a face). At age 10, they took tests in maths and reading, and also in 'word definitions', 'word similarities', non-verbal reasoning (the 'matrices' test), and 'recall of digits'. At age 16, they took tests in vocabulary and spelling. Table 4 shows the mean percentage test results for girls and boys. At age 5, girls gained higher scores in reading, but boys did better on vocabulary. Girls outperformed boys on the draw-a-man test, but there was no significant difference between boys and girls in copying designs of the profile test. At age 10, boys had a slight advantage in maths, but the other non-verbal tests (non-verbal reasoning and recall of digits) show a slight advantage for girls. Girls scored higher than boys in reading, but boys had the advantage in 'word definitions' and 'word similarities'. At age 16, girls gained slightly higher scores than boys in both vocabulary and spelling. Further information on the tests taken by the 1970 cohort can be found in the user guides (Butler, et al., 1995, Goodman and Butler, 1995, Institute of Child Health, 1975).

Table 4: BCS70 test scores for boys and girls at ages 5, 10 and 16

| | | | Boys | Girls |
|---|---|---|---|---|
| Age 5 | Reading | Mean | 5.7 | 7.3*** |
| | | N. | 756 | 948 |
| | | Std. Deviation | 10.0 | 10.9 |
| | Vocabulary | Mean | 61.7*** | 57.5 |
| | | N. | 1821 | 1837 |
| | | Std. Deviation | 26.0 | 24.2 |
| | Draw-a-man | Mean | 43.9 | 47.9*** |
| | | N. | 1827 | 1849 |
| | | Std. Deviation | 14.4 | 13.1 |
| | Profile | Mean | 42.2 | 41.1 |
| | | N. | 1857 | 1868 |
| | | Std. Deviation | 26.3 | 25.0 |
| | Copying designs | Mean | 59.8 | 60.5 |
| | | N. | 1857 | 1868 |
| | | Std. Deviation | 25.8 | 24.2 |
| Age 10 | Maths | Mean | 63.8** | 62.2 |
| | | N. | 1661 | 1743 |
| | | Std. Deviation | 17.2 | 16.0 |
| | Reading | Mean | 60.3 | 63.5*** |

| | | | | |
|---|---|---|---|---|
| | | N. | 1663 | 1747 |
| | | Std. Deviation | 21.0 | 19.6 |
| | Word definitions | Mean | 38.5*** | 35.0 |
| | | N. | 1642 | 1727 |
| | | Std. Deviation | 17.4 | 16.5 |
| | Word Similarities | Mean | 62.3*** | 60.7 |
| | | N. | 1641 | 1728 |
| | | Std. Deviation | 13.2 | 12.2 |
| | Non-verbal reasoning | Mean | 55.2 | 58.0*** |
| | | N. | 1646 | 1726 |
| | | Std. Deviation | 19.2 | 18.9 |
| | Recall digits | Mean | 65.9 | 66.9* |
| | | N. | 1645 | 1733 |
| | | Std. Deviation | 12.5 | 12.1 |
| Age 16 | Vocabulary | Mean | 46.1 | 48.6*** |
| | | N. | 1668 | 1863 |
| | | Std. Deviation | 24.0 | 21.6 |
| | Spelling | Mean | 79.5 | 83.5*** |
| | | N. | 1364 | 1636 |
| | | Std. Deviation | 11.1 | 9.4 |

So, while there were differences between boys and girls in the test scores they achieved, these gaps were not always in the direction that would be predicted by sex-stereotypes, as boys did better on tests of vocabulary, word definitions and word similarities, while girls did better on non-verbal reasoning. More importantly, these gender gaps are very slight, and cannot account for the much larger gender gaps in self-perception at age 16. This is in line with comprehensive review evidence showing few differences in maths test scores between males and females (Halpern, 2000).

## Modelling Self-concept

### Maths

We model self-concept in maths using binary logistic regression, with 'applies very much' contrasted to any other non-missing response (no or don't know). The explanatory variables were entered in four stages as follows:

Model 1: Sex, region, fathers' social class, parental educational level, family structure, number of siblings and position in the household. Prior maths and non-verbal test scores at ages 5 and 10.
Model 2: Model 1 + verbal test scores.
Model 3: Model 2 + teacher rating of the child's ability in general knowledge (age 10)
Model 4: Model 3 + school sector and single-sex schooling.

Due to space constraints, only the sex parameter and the school parameters are shown in Table 5, but the other parameters are referred to in the text. The full parameter estimates are shown in Appendix Table A1.

Table 5: Maths Self-concept at age 16, results from logistic regression

| **I am good at Maths** | | | | |
|---|---|---|---|---|
| | Model 1 *Includes background Controls and non-verbal scores* | Model 2 *Includes verbal scores* | Model 3 *Includes teacher ratings* | Model 4 *Includes school sector* |
| | Exp (B) | Exp (B) | Exp (B) | Exp (B) |
| Sex=Boy | 2.292*** | 2.355*** | 2.302*** | 2.474*** |
| Private School | | | | 0.628* |
| Grammar | | | | 0.854 |
| Secondary Modern | | | | 1.147 |
| Boys school | | | | 0.856 |
| Girls school | | | | 1.252 |
| Model Chi square | 477.399*** | 505.924*** | 521.584*** | 534.161*** |
| Change in log likelihood | 477.399*** | 28.525*** | 15.660*** | 12.577 |
| N | 2898 | 2898 | 2898 | 2898 |

Model 1 in table 5 shows that boys are significantly more likely to agree with the statement 'I am good at maths' than girls, controlling for the background controls and prior attainment in maths and non-verbal tests. The copying designs test result (age 5) and the maths and matrices test results (age 10) are significantly positive. Of the background variables, only family structure is significant - having the same two parents from birth to 16 is the reference group, and having a different family structure from this is negative.

Model 2 introduces the verbal test results. Of these, only the age 10 reading score is significant – it is negative as expected. However, the gender effect remains roughly constant in this model. This does not support the view that 'relative advantage' in English deflates girls' self-concept in maths.

In model 3, we introduce the teacher's assessment of students' general knowledge. An 'above average' assessment is significantly positive. The gender parameter remains approximately constant in this model.

We tested for several interactions between sex and other variables in the model. We thought it was possible that boys and girls would be affected differently by their prior test attainment, the teacher assessment, the number of children in the household and their own position in the birth order, or by family structure or parents' education. However, none of these interaction terms were significant.

Model 4 shows that single-sex status is not significant. School sector is insignificant overall, although the private school parameter is marginally significant. There was no significant interaction between single-sex status and school sector. The model fit does not improve significantly in this model compared with the previous model.

## ‘I am clever’

We treat the statement ‘I am clever’ as binary, with ‘applies very much’ (=1) contrasted to ‘applies somewhat’ and ‘does not apply’ (=0). All test scores are introduced into the model in model 1, rather than separating verbal and non-verbal test scores as we did when modelling maths self-concept. This is because the statement ‘I am clever’ reflects self-concept in general, rather than the specific verbal or nonverbal dimensions of self-concept. For the full set of results, see Appendix Table A2.

Table 6: ‘I am clever’ at age 16, results from logistic regression

| **I am clever** | | | |
|---|---|---|---|
| | Model 1 *Includes background controls and all test scores* | Model 2 *Includes teacher ratings* | Model 3 *Includes school sector* |
| | Exp (B) | Exp (B) | Exp (B) |
| Sex=Boy | 2.192*** | 2.124*** | 2.138*** |
| Private School | | | 0.983 |
| Grammar | | | 1.079 |
| Secondary Modern | | | 1.096 |
| Boys school | | | 0.840 |
| Girls school | | | 1.105 |
| Model Chi square | 424.655*** | 453.413*** | 454.699*** |
| Change in log likelihood | 424.655*** | 28.757*** | 1.286 |
| N | 2975 | 2975 | 2975 |

Model 1 in table 6 includes background controls and students’ test scores at ages 5 and 10. In this model, boys are significantly more likely than girls to agree that the statement ‘I am clever’ applies very much to them. The tests of reading and copying designs at age 5, and of maths, reading and word-definitions at age 10, are significantly positively associated with this outcome. Parents’ education is significantly positive, but social class is not. Of course, social class and education are correlated, so, as an additional test, we entered the two variables into the model sequentially. This confirmed that parental education improved the model fit, while parental social class did not.

Model 2 includes the teacher’s assessment of the child’s general knowledge. Teachers rated boys’ general knowledge as superior to that of girls, with 34 percent of boys judged as above average or better, compared to 28 percent of girls. The teacher’s assessment is significant and positive for individuals judged to be ‘above average’. We also find a negative interaction between the boys’ parameter and a positive teacher assessment. This is consistent with the view that boys are less affected than girls by teachers’ assessments of their abilities. However, the main effect for gender is barely reduced in this model.

We found no significant interaction between sex and the number of children in the household, position in the birth order, family structure or parents' education. In order to assess whether prior attainment had different effects on self-concept for boys and girls, we introduced the interaction terms sex*maths and sex*reading, using the age 10 scores. (Given that 11 tests for prior ability are used in the model, we did not want to introduce interactions for all of them). The interaction between sex and maths test scores was not significant, but there was a significant negative interaction between the male parameter and the reading test score, suggesting that the link between prior reading attainment and self-concept is weaker for boys than for girls.

Model 3 introduces school sector and single-sex schooling, neither of which is significant. The model fit is not significantly improved by the inclusion of these school-sector variables.

### Exams and spelling

We ran the same models presented above on the two further self-assessed ability measures on spelling and exams (tables available from the author on request). There were no school sector or single-sex effects in either case. Boys were significantly more likely to rate themselves as good at exams than girls (including all controls), but there was no significant difference between boys and girls in their self-assessed ability at spelling.

## Conclusions

Our first research question was '*Are boys' and girls' academic self-concepts in different subject areas sex stereotyped?'* The figures presented here provide evidence of a substantial gender gap in self-concept. Boys were more likely to agree with the statements 'I am clever' and 'I am good at exams', and to say they were good at mathematics, even after controlling for a range of other factors. This is in line with our expectations that boys would have higher self-concepts than girls, both in general and in stereotypically 'masculine' subjects such as maths.

These results show continuity with parallel analyses that have been carried out using NCDS (Sullivan, unpub.). While the difference in the response categories does not allow a direct comparison between the two cohorts, there is certainly no clear evidence of a decline in sex-stereotyping in terms of self-assessed mathematics ability.

We also asked whether parental social status was linked to self-concept. The children of graduate parents were more likely to believe that they were clever, controlling for prior attainment and other characteristics. However, parental education and social class had no significant impact on maths self-concept for this cohort of children.

Is the gender gap in self-concept mediated by relative advantage in sex-typical areas? If girls' low self-concept in maths was due to a relative advantage in other skills such as verbal reasoning and reading, then controlling for these test scores should have reduced the gender gap in maths self-concept. As this was not the case, we cannot support the 'relative advantage' hypothesis regarding gender and self-concept.

A key aim of this paper was to assess whether single-sex schooling and school sector had an impact on academic self-concept at age 16. According to Marsh's 'big-fish-little-pond' model, students at academically selective schools should suffer deflated self-concepts. However, this analysis showed no significant effect of school sector on self-concept. Neither did we find any significant effect of single-sex schooling on boys' or girls' self-concepts in any subject area. This is in contrast to the parallel analyses carried out using the 1958 cohort, which found that the gender gap in self-concept was larger for 16 year old students at co-educational schools than for students at single-sex schools, and that self-concept was lower at selective schools, after controlling for a range of prior characteristics. The lack of significant school sector and single-sex effects for the 1970 cohort could be attributed to any one of three factors (or to a combination of these).

1. The lack of significant effects may be due to the smaller sample size of the 1970 cohort, and the smaller proportions of students in this cohort attending single-sex and selective state schools.
2. We also need to bear in mind that the questions answered by the 1958 and 1970 cohort members were not identical, and therefore are not directly comparable.
3. The nature and role of single-sex schooling may have changed during the period in question.

**Acknowledgements**

This paper arises from an ESRC funded project, 'Single-sex and co-educational schooling: Lifecourse consequences?' (RES-000-22-1085), and I am grateful to my colleagues on this project, Heather Joshi and Diana Leonard. Thanks also to Chris Baker, Jane Elliott, Shirley Dex and Nikos Tzavidis for their useful comments.

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# Appendix

Table A1: Full parameter estimates for Table 5 ‘Good at Maths’

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Sig | Exp(B) | Sig | Exp(B) | Sig | Exp(B) | Sig | Exp(B) |
| **Sex(Male)** | .000 | 2.292 | .000 | 2.355 | .000 | 2.302 | .000 | 2.474 |
| Female | | | | | | | | |
| **Region** | .569 | | .513 | | .466 | | .712 | |
| Missing | .314 | 1.234 | .361 | 1.214 | .249 | 1.279 | .402 | 1.200 |
| North West | .494 | 1.147 | .447 | 1.169 | .295 | 1.243 | .542 | 1.139 |
| North | .184 | 1.301 | .188 | 1.306 | .130 | 1.362 | .270 | 1.259 |
| Midlands | .042 | 1.462 | .038 | 1.485 | .021 | 1.560 | .068 | 1.434 |
| East Anglia | .642 | 1.116 | .605 | 1.132 | .454 | 1.198 | .651 | 1.117 |
| South east | .138 | 1.318 | .098 | 1.369 | .060 | 1.433 | .186 | 1.301 |
| South west | .111 | 1.425 | .109 | 1.435 | .075 | 1.498 | .154 | 1.391 |
| Wales | .474 | 1.179 | .497 | 1.173 | .331 | 1.258 | .385 | 1.230 |
| Scotland | | | | | | | | |
| **Fathers’ class** | .341 | | .221 | | .268 | | .244 | |
| Missing | .184 | 1.298 | .103 | 1.381 | .139 | 1.343 | .151 | 1.332 |
| Professional/Managerial | .827 | 1.035 | .533 | 1.104 | .605 | 1.086 | .486 | 1.119 |
| Skilled manual/non-manual | .825 | .969 | .991 | .998 | .915 | .985 | .906 | .983 |
| Partly skilled/unskilled | | | | | | | | |
| **Parents’ age leaving education** | .032 | | .022 | | .029 | | .016 | |
| Missing | .010 | .744 | .013 | .751 | .013 | .748 | .011 | .742 |
| 19+ | .825 | .965 | .913 | 1.018 | .940 | .988 | .876 | 1.026 |
| 17-18 | .522 | 1.098 | .355 | 1.146 | .451 | 1.118 | .356 | 1.147 |
| 16 | .263 | .863 | .335 | .880 | .245 | .856 | .287 | .867 |
| 15 or less | | | | | | | | |
| **Household position** | .449 | | .333 | | .402 | | .478 | |
| missing | .465 | 1.133 | .366 | 1.168 | .374 | 1.165 | .483 | 1.129 |
| firstborn | .108 | 1.214 | .065 | 1.252 | .088 | 1.232 | .115 | 1.213 |
| second | .212 | 1.167 | .210 | 1.169 | .237 | 1.160 | .274 | 1.147 |
| Third+ | | | | | | | | |
| **Number of children** | .269 | | .392 | | .482 | | .509 | |
| missing | .074 | .659 | .113 | .689 | .196 | .735 | .246 | .758 |
| 1 | .579 | .895 | .930 | .982 | .891 | .972 | .999 | 1.000 |
| 2 | .076 | .754 | .201 | .813 | .177 | .803 | .212 | .815 |
| 3 | .275 | .840 | .361 | .863 | .323 | .852 | .369 | .863 |
| 4+ | | | | | | | | |
| **Family structure** | .003 | | .002 | | .003 | | .004 | |
| missing | .042 | .804 | .023 | .783 | .026 | .786 | .057 | .813 |
| other | .002 | .675 | .001 | .662 | .002 | .673 | .002 | .674 |
| Both parents throughout 0-16 | | | | | | | | |
| **Maths test score age 10** | .000 | 1.770 | .000 | 2.104 | .000 | 2.041 | .000 | 2.065 |
| **Non-verbal reasoning test score age 10** | .000 | 1.239 | .000 | 1.288 | .000 | 1.287 | .000 | 1.289 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Recall digits test score age 10** | .405 | .963 | .945 | .997 | .746 | .985 | .803 | .988 |
| Maths test missing (not) | .114 | 2.423 | .081 | 4.769 | .089 | 4.630 | .083 | 4.742 |
| Non-verbal score missing (not) | .179 | 2.015 | .244 | 1.897 | .208 | 1.992 | .209 | 1.992 |
| Recall digits score missing (not) | .009 | .207 | .040 | .138 | .038 | .137 | .037 | .139 |
| **Draw a man test score age 5** | .453 | 1.038 | .311 | 1.052 | .331 | 1.050 | .327 | 1.050 |
| **Copying designs test score age 5** | .009 | 1.137 | .003 | 1.160 | .008 | 1.144 | .006 | 1.150 |
| **Profile test score age 5** | .126 | .937 | .182 | .944 | .157 | .940 | .134 | .937 |
| Draw a man test 1 missing | .798 | | .995 | | .991 | | .993 | |
| Not missing | .855 | 1.117 | .999 | 1.001 | .983 | .987 | .945 | .956 |
| Not attempted | .805 | .882 | .933 | 1.048 | .923 | 1.056 | .966 | 1.024 |
| Not scorable | | | | | | | | |
| Draw a man test 2 missing | .510 | | .516 | | .624 | | .614 | |
| not missing | .510 | .789 | .516 | .789 | .624 | .835 | .614 | .831 |
| Not attempted | | | | | | | | |
| **Reading test age 5** | | | .181 | 1.053 | .214 | 1.050 | .133 | 1.061 |
| **Vocabulary test age 5** | | | .171 | .942 | .133 | .936 | .128 | .935 |
| Reading missing | | | .443 | | .446 | | .404 | |
| Not missing | | | .443 | .927 | .446 | .928 | .404 | .921 |
| missing | | | | | | | | |
| Vocabulary missing | | | .481 | | .470 | | .466 | |
| Not missing | | | .481 | 1.384 | .470 | 1.397 | .466 | 1.400 |
| Missing | | | | | | | | |
| **Reading test age 10** | | | .037 | .863 | .006 | .822 | .006 | .819 |
| **Word definitions test age 10** | | | .121 | .913 | .081 | .902 | .080 | .901 |
| **Word similarities test age 10** | | | .069 | .900 | .039 | .887 | .041 | .887 |
| Reading missing (not) | | | .174 | .326 | .123 | .275 | .117 | .271 |
| Word definitions missing (not) | | | .184 | 2.545 | .165 | 2.649 | .148 | 2.766 |
| Word similarities missing (not) | | | .993 | 1.007 | .958 | .956 | .878 | .880 |
| **Teacher assessment general knowledge** | | | | | .001 | | .001 | |
| Missing | | | | | .896 | 1.026 | .838 | 1.042 |
| Above average | | | | | .001 | 1.735 | .001 | 1.761 |
| Average | | | | | .127 | 1.256 | .139 | 1.248 |
| Below average | | | | | | | | |
| **School sector** | | | | | | | .276 | |
| Missing | | | | | | | .366 | .736 |
| Private | | | | | | | .045 | .628 |
| Grammar and technical | | | | | | | .460 | .854 |
| Secondary modern | | | | | | | .592 | 1.147 |
| Comprehensive | | | | | | | | |
| **School sex** | | | | | | | .086 | |
| Missing | | | | | | | .055 | .513 |
| Boys' school | | | | | | | .437 | .856 |
| Girls' school | | | | | | | .192 | 1.252 |
| Co-ed | | | | | | | | |
| Constant | .244 | .521 | .107 | .376 | .072 | .322 | .098 | .350 |

Table A2: Full parameters for table 6 ‘I am clever’

| | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| | Sig | Exp(B) | Sig | Exp(B) | Sig | Exp(B) |
| **Sex(Male)** | .000 | 2.192 | .000 | 2.124 | .000 | 2.138 |
| Female | | | | | | |
| **Region** | .934 | | .942 | | .932 | |
| Missing | .658 | 1.118 | .453 | 1.212 | .597 | 1.149 |
| North West | .552 | .862 | .784 | .933 | .640 | .885 |
| North | .636 | 1.122 | .510 | 1.175 | .603 | 1.140 |
| Midlands | .954 | .987 | .789 | 1.065 | .926 | 1.023 |
| East Anglia | .772 | 1.086 | .598 | 1.164 | .675 | 1.131 |
| South east | .830 | .952 | .967 | 1.009 | .815 | .945 |
| South west | .808 | 1.069 | .589 | 1.160 | .724 | 1.105 |
| Wales | .696 | .893 | .934 | .976 | .879 | .956 |
| Scotland | | | | | | |
| **Fathers’ class** | .358 | | .492 | | .482 | |
| Missing | .150 | 1.470 | .228 | 1.384 | .215 | 1.397 |
| Professional/Managerial | .100 | 1.423 | .152 | 1.364 | .154 | 1.363 |
| Skilled manual/non-manual | .087 | 1.419 | .137 | 1.359 | .132 | 1.364 |
| Partly skilled/unskilled | | | | | | |
| **Parents’ age leaving education** | .015 | | .033 | | .042 | |
| Missing | .329 | .865 | .269 | .848 | .264 | .846 |
| 19+ | .337 | 1.197 | .520 | 1.129 | .557 | 1.118 |
| 17-18 | .014 | 1.522 | .034 | 1.440 | .041 | 1.423 |
| 16 | .822 | 1.037 | .880 | .975 | .858 | .971 |
| 15 or less | | | | | | |
| **Household position** | .089 | | .187 | | .180 | |
| missing | .648 | .906 | .657 | .908 | .682 | .915 |
| firstborn | .216 | 1.202 | .315 | 1.163 | .300 | 1.170 |
| second | .483 | .897 | .513 | .903 | .519 | .904 |
| Third+ | | | | | | |
| **Number of children** | .863 | | .876 | | .880 | |
| missing | .988 | .996 | .900 | 1.039 | .925 | 1.029 |
| 1 | .536 | 1.174 | .549 | 1.169 | .566 | 1.162 |
| 2 | .499 | 1.156 | .523 | 1.148 | .521 | 1.149 |
| 3 | .907 | 1.025 | .960 | 1.011 | .952 | 1.013 |
| 4+ | | | | | | |
| **Family structure** | .619 | | .683 | | .660 | |
| missing | .803 | .968 | .820 | .970 | .821 | .970 |
| other | .327 | .857 | .382 | .871 | .362 | .865 |
| Both parents throughout 0-16 | | | | | | |
| **Maths test score age 10** | .000 | 1.510 | .000 | 1.432 | .000 | 1.435 |
| **Non-verbal reasoning test score age 10** | .477 | 1.052 | .451 | 1.055 | .477 | 1.052 |
| **Recall digits test score age 10** | .119 | 1.091 | .283 | 1.063 | .277 | 1.064 |
| Maths test missing (not) | .643 | 1.712 | .660 | 1.686 | .622 | 1.796 |
| Non-verbal score missing (not) | .728 | .796 | .736 | .801 | .731 | .797 |
| Recall digits score missing (not) | .660 | .657 | .600 | .607 | .612 | .613 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Reading test age 10** | .081 | 1.173 | .385 | 1.085 | .416 | 1.079 |
| **Word definitions test age 10** | .000 | 1.320 | .000 | 1.297 | .000 | 1.297 |
| **Word similarities test age 10** | .314 | .930 | .164 | .905 | .159 | .903 |
| Reading missing (not) | .299 | .346 | .298 | .332 | .264 | .308 |
| Word definitions missing (not) | .190 | 3.649 | .155 | 4.182 | .155 | 4.192 |
| Word similarities missing (not) | .671 | .668 | .640 | .637 | .644 | .638 |
| **Reading test age 5** | .002 | 1.135 | .003 | 1.127 | .004 | 1.125 |
| Reading missing | .004 | | .005 | | .006 | |
| Not missing | .868 | 1.020 | .792 | 1.032 | .817 | 1.028 |
| missing | .001 | .139 | .001 | .145 | .002 | .148 |
| Mum says not capable | | | | | | |
| **Vocabulary test age 5** | .488 | 1.037 | .589 | 1.029 | .576 | 1.030 |
| Vocabulary missing | .008 | | .009 | | .009 | |
| Not missing | .008 | .287 | .009 | .286 | .009 | .286 |
| **Draw a man test score age 5** | .785 | 1.016 | .833 | 1.013 | .801 | 1.015 |
| **Copying designs test score age 5** | .016 | 1.159 | .044 | 1.132 | .041 | 1.135 |
| **Profile test score age 5** | .850 | 1.010 | .996 | 1.000 | .988 | .999 |
| Draw a man  test 1 missing | .317 | | .327 | | .354 | |
| Not missing | .317 | .475 | .327 | .480 | .354 | .497 |
| Draw a man test 2 missing | .967 | | .943 | | .955 | |
| not missing | .967 | .981 | .943 | 1.034 | .955 | 1.027 |
| Not attempted | | | | | | |
| **Teacher assessment general knowledge** | | | .000 | | .000 | |
| Missing | | | .320 | 1.311 | .349 | 1.291 |
| Above average | | | .001 | 2.206 | .001 | 2.186 |
| Average | | | .565 | 1.140 | .562 | 1.141 |
| Below average | | | | | | |
| **School sector** | | | | | .983 | |
| Missing | | | | | .644 | 1.193 |
| Private | | | | | .944 | .983 |
| Grammar and technical | | | | | .748 | 1.079 |
| Secondary modern | | | | | .792 | 1.096 |
| Comprehensive | | | | | | |
| **School sex** | | | | | .917 | |
| Missing | | | | | .664 | .840 |
| Boys' school | | | | | .650 | 1.105 |
| Girls' school | | | | | .668 | 1.096 |
| Co-ed | | | | | | |
| Constant | .569 | .683 | .315 | .494 | .320 | .495 |