

Academic Self-concept, Gender and Single-sex Schooling

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Abstract

This paper assesses gender differences in academic self-concept for a cohort of children born in 1958 (the National Child Development Study). We address the question of whether attending single-sex or co-educational schools affected students' perceptions of their own academic abilities (academic self-concept). Academic self-concept was found to be highly gendered, even controlling for prior test scores. Boys had higher self-concepts in maths and science, and girls in English. Single-sex schooling reduced the gender gap in self-concept, while selective schooling was linked to lower academic self-concept overall.

Introduction

The aim of this paper is to examine the link between gender, school contexts and academic self-concept. Do girls rate their abilities in maths and science more highly if they are in a girls-only school? And do boys rate their abilities in English and modern languages more highly if they are in a boys-only school? The impacts of parental social class and education and selective schooling on self-concept are also examined.

Self-concept refers to a person's self-perceptions, and academic self-concept refers to a person's beliefs about their own academic abilities (Shavelson, et al., 1976). This is distinct from, but linked to, self-esteem, which refers to general pride in one's self (Silber and Tippett, 1965). Self-concept is also linked to self-efficacy, which is the belief in one's own ability to do something or to achieve a desired effect. Thus, academic self-concept can be seen as a specific form of self-confidence. If we compare individuals with the same level of academic ability, some will have more positive perceptions of their own abilities than others. This matters, because high self-concept is positively associated with learning, and a degree of over-confidence promotes educational attainment as well as success in other domains (Cairns and Cairns, 1995). Academic self-concept is multidimensional, meaning that it varies across different academic subjects (Marsh, 1993).

Men have more confidence in their own capacities than women in many areas, including the evaluation of their own academic abilities (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).

Research has suggested that schools contribute to the construction of these subjects as masculine, both through the content of the curriculum and the way it is packaged, and through gendered interactions between teachers and students, and between students themselves (Kelly, 1985). Less attention has been given to the question of boys' and girls' self-confidence in 'feminine' subjects (Mael, 1998). However, where gender differences in verbal self-concept have been found, these have typically favoured girls (Skaalvik and Skaalvik, 2004).

Mathematics is generally viewed as a 'masculine' domain, while reading is seen as 'feminine' (Eccles, et al., 1983). Students increasingly reject the *explicit* gender-stereotyping of subjects (Archer and Macrae, 1991, Taylor and Mardle, 1986, Whitehead, 1996). Nevertheless, even if an individual rejects explicit gender stereotypes such as 'boys are better than girls at maths', her assessment of her own abilities may still be deflated by her exposure to the biased judgements and expectations of others (Correll, 2001). Perceived gender stereotypes have been found to exacerbate 'maths anxiety' among girls, reducing the likelihood that female students will choose maths and physical science options at school and college (Chipman, et al., 1992, LeFevre, et al., 1992, Spencer, et al., 1999).

The study of self-concept has been largely confined to social psychology. However, social scientists as a whole could benefit from considering the role that self-beliefs have in decision-making, and the implications of this for educational and career trajectories, and especially for understanding gender differentials in these trajectories. Despite girls' increased educational attainment, the gender gap in fields of study in

further and higher education remains, and this is likely to be partly due to the persistence of gendered self-concepts.

Schooling and Frame of Reference

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. Therefore, Marsh argues that selective schooling and 'gifted and talented' programs deflate the academic self-concepts of the selected students.

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. At any given level of maths attainment, my attainment in English will be negatively associated with my maths self-concept. Jonsson (1999) uses 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 finds 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 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 from both sides. 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 (Byrne, 1978, DfES, 1975, Elwood and Gipps, 1999, Francis, et al., 2003, Marsh and Yeung, 1998, Ormerod, 1975). Stables (1990) found that the polarisation of interest in physics and modern languages between the sexes in English Comprehensive schools was greater in mixed schools than in single-sex schools. However, Spielhofer (2004) 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 students in mixed schools. Studies focusing on single-sex classes within co-educational schools also provide mixed results (Jackson and Smith, 2000, Marsh and Rowe, 1996, Shapka and Keating, 2003, Van de gaer, et al., 2004).

A recent systematic review of the international English-language research evidence on single-sex schooling (Mael, et al., 2005) found only four published studies of single-sex schooling and self-concept that met the criteria of the review, which specified that statistical controls must be included to account for individual differences (Lee and Bryk, 1986, Marsh, 1991, Marsh, et al., 1988, Riordan, 1990). Of these studies, only Marsh et. al. (1988) examined self-concept in different academic subjects, rather than just general self-concept. This study examined the transition of two high schools from single-sex to co-educational status, and found an increase in general self-concept for both boys and girls after the transition to co-education, but sex differences in specific areas of self-concept were unaffected by the transition.

Mael et. al.'s review demonstrates that, to date, there has been a lack of firm evidence on the question of single-sex schooling and gendered academic self-concept, and no British studies using statistical controls to account for individual differences. The current study addresses the impact of gender on academic self-concept for a cohort born in Britain in 1958, and whether single-sex and selective schooling had any impact on self-concept for boys or girls.

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. An understanding of the paths the 1958 cohort were set on in childhood and adolescence is relevant for understanding the highly gender-segregated labour market situation this generation has experienced (and is experiencing still).

Research Questions and Hypotheses

This section relates the research questions to hypotheses which either arise in, or can be inferred from, the relevant theoretical and empirical literatures.

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. Girls may be expected 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, 2006b).

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

If the gender gap in maths self-concept is explained by relative advantage in maths, then, 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 will reduce the gender gap. The converse will be true for any gender gap in English self-concept – i.e. attainment in maths will be negatively associated with English self-concept, controlling for prior English attainment, and including maths attainment in the model will reduce the gender gap.

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

According to Marsh's 'Big-Fish-Little-Pond' (BFLP) model, students at academically selective schools should suffer deflated self-concepts. 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, if anything, have somewhat higher self-concepts than students at comprehensives. However, during the 1960s and 70s, many comprehensives were former secondary moderns that still had neighbouring grammar schools, so the difference in intake between secondary moderns and comprehensives 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?

We can derive various hypotheses from competing accounts in this area:

- *Big-Fish-Little-Pond*

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 self-concept in English. The converse should be true for girls: single-sex schooling should raise girls' self concept in maths, but reduce self-concept in English.

However, 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), then students must 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.

- *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) 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, although it may apply especially to stereotypically 'feminine' subjects, which, in mixed schools, are typically 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,

again, across subject areas, but perhaps especially in stereotypically ‘masculine’ subjects.

- *Curriculum*

Advocates of co-education have generally argued that single-sex schools tend to offer a narrower curriculum than mixed schools (or at least did so in the past), and that girls’ schools in particular did not necessarily have the resources to offer a full curriculum in areas such as science. If girls’ schools put less emphasis on ‘masculine’ subjects, and provided an inferior curriculum in these areas, this might be expected to reduce girls’ academic self-concept in these subjects. Similarly, boys’ academic self-concepts in ‘feminine’ subjects might be reduced by single-sex schooling.

Data

The National Child Development Study (NCDS) is a longitudinal study of a single cohort born in England and Wales in the week of 3-9 March 1958. The cohort members have been followed-up throughout their lives, most recently in 2000 when they were 42 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. Differential attrition is always a concern with longitudinal studies. However, 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.

The NCDS did not over-sample ethnic minorities. Due to the small numbers of ethnic minority individuals included in the NCDS, it is not possible to conduct analyses broken down according to ethnic group. This is unfortunate given suggestions in the US literature that single-sex schooling is particularly beneficial for some minority ethnic groups (Riordan, 2002).

The NCDS cohort experienced a state secondary education system that was in transition from the tripartite system to the comprehensive system. 58% of the NCDS respondents attended Comprehensive schools, but 11% still attended grammar and technical schools, and 22% attended secondary modern schools. 6% attended private and direct grant 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’.

Steedman (1980, 1983a, 1983b) provides a summary of the test results and examination results achieved by students at each of these types of school. 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. This provides an advantage for our analysis, as the issue of selection bias is likely to be more extreme in school systems where single-sex schooling has become the preserve of a small minority (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 selection bias. 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 fact that the NCDS is 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. In preliminary analysis, 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). This suggests that the danger of spurious results due to selection bias is minimal.

Analysis

First, differences in boys' and girls' self concept are described. Second, gender differences in test scores and teacher assessments of the children's abilities are described. Self-concept is then modelled using binary and multinomial logistic regression.

Gender and self-concept

At age 16, the students were asked to rate their own aptitude in maths, English, science, art, music, practical subjects, and sports and games. Table 1 reports their

responses to the question *'for each of the following subjects, we would like you to say roughly how good you think you are at it compared with other people of your age: never studied, below average, average, above average'* for maths, English and science. Note that these responses were collected using an anonymous self-completion questionnaire, hence there was no external pressure to give a 'socially acceptable' response.

Table 1

As expected, boys had a higher estimation of their abilities in mathematics – 21% of boys, compared to 11% of girls considered themselves to be 'above average' in maths. The measure of maths self-concept used here has elsewhere been shown to predict the likelihood of pursuing a career in science, engineering or technology (Schoon, et al., 2006).

About twice as many boys as girls (19% compared to 9%) assessed themselves as 'above average' in science. Just as strikingly, 21% of girls and 10% of boys stated that they had never studied science.

Girls had a higher estimation than boys of their abilities in English. The gender gap in the 'above average' category was relatively small (22% of boys compared to 25% of girls), but about twice as many boys as girls considered themselves 'below average' (15% compared to 7%).

Test Scores

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

The NCDS cohort took the following tests at ages 7 and 11.

Age 7:

- Southgate Reading Test (Southgate, 1962) - a test of word recognition and comprehension.
- Copying Designs Test - an assessment of perceptuo-motor ability.
- Drawing-A-Man Test (Goodenough, 1926) – designed to test general mental and perceptual ability.
- Problem Arithmetic Test (Pringle, et al., 1966).

Age 11:

- General Ability Test (Douglas, 1964) - containing verbal and non-verbal subscales.
- Reading Comprehension Test - constructed by the National Foundation for Educational Research in England and Wales (NFER).
- Arithmetic/Mathematics Test - constructed by NFER.

Age 16:

- Reading Comprehension Test - the same test as used at 11
- Mathematics Test - devised at the University of Manchester.

Table 2 shows the mean percentage scores for boys and girls in each of these tests.

The significance of the difference in means is tested using one-way ANOVA.

Following the usual convention for denoting p values, * indicates ≤ 0.05 , ** ≤ 0.01 ,

*** ≤ 0.001 .

At age 7, girls did better than boys in reading, but boys did slightly better than girls in maths. Girls scored slightly higher than boys in drawing, but boys scored slightly higher in copying designs. By age 11, there was no difference between boys and girls in their reading test scores. There was a very small, but statistically significant ($p=0.03$) gap in favour of boys in maths. Girls achieved higher scores than boys in verbal reasoning and very slightly higher scores in non-verbal reasoning ($p=0.05$). At age 16, there was no gap between boys and girls in reading, but boys performed slightly better than girls in the maths test.

Table 2

Statistical significance does not imply substantive importance, and, when using very large datasets such as NCDS, it is not unusual for small effects to achieve statistical significance. So, while there were differences between boys and girls in the test scores they achieved, these gaps were modest, and cannot account for the much larger gender gaps in self-perception. This is in line with comprehensive review evidence showing small differences in maths test scores between males and females (Halpern, 2000).

Teachers' Assessments

The cohort members' primary school teachers were asked to give their assessment of the children at ages 7 and 11. Teachers' assessments may provide a source of information on aspects of students' abilities which are not measured by the survey test scores. The tests of maths and reading comprehension included in NCDS are multiple choice tests. Students' performance is affected by the nature of the assessment, and boys have a relative advantage in multiple-choice tests, while girls do better in tests requiring longer written answers (Gipps and Murphy, 1994). The reading test is particularly problematic as a proxy for ability in English, since it is a test only of reading comprehension, not of writing ability. The child's teacher, having seen their written work, will arguably be able to provide a more accurate assessment of the child's overall ability in English than that provided by the test score. However, teacher assessments may also reflect biases against particular categories of students. The teachers were asked to rate the child's number work, reading and book use, oral ability, creativity, and general knowledge. Tables 3 and 4 show the teachers' responses to these items broken down according to the sex of the child.

Table 3 and 4

At age 7, boys were rated only slightly more highly than girls in number work. At age 11, there was little difference in teachers' assessments of boys and girls in number work, as about 25% of both girls and boys were judged to be above average or exceptional. This finding is surprising, in that it seems to conflict with previous evidence suggesting that teachers underestimate girls' abilities in mathematics

(Fennema, et al., 1990, Li, 1999, Stobart, et al., 1992, Tizard, et al., 1988). However, our figures relate to primary school teachers, so we cannot rule out the possibility that secondary school teachers may have formed lower assessments of girls' abilities in maths.

Girls were judged to be better than boys at reading and book-use at both 7 and 11. At age 11, 35% were assessed as above average or exceptional compared to 26% of boys. Girls were also rated more highly in oral ability at both ages. Boys' general knowledge was deemed superior to that of girls – 29% of boys were judged to be above average or exceptional compared to 23% of girls. Girls' creativity was rated slightly more highly than boys'.

Models: Maths and English

Self-concept in Maths and English was modelled using binary logistic regression. The 'below average' and 'average' categories were grouped together and treated as the contrast category (=0), contrasted with 'above average' (=1). The 'never studied' category was excluded and modelled separately. The results of supplementary analyses using multinomial logistic regression, treating the 'below average' category as the contrast category, are summarised in table 7. (The reason for using binary logistic rather than multinomial regression for the main presentation of findings is that multinomial regression produces too many parameter estimates to present easily)¹.

The models are as follows:

Model 1

Social background:

- 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 Goldthorpe scale.
- Parental educational level – age at which parent left full-time education, mothers' or fathers' age, whichever is highest.
- Family structure – same two parents at ages 0-16 contrasted to other family structures.
- Number of siblings – age 11.
- Position in the birth order – age 11. These family variables are included as controls, as they are linked to academic attainment, and may be linked to self-concept.

Prior test scores in cognate areas at ages 7 and 11. I.e. where maths self-concept is the outcome, maths and non-verbal test scores (including draw-a-man and copying designs) are included in model 1. Where English self-concept is the outcome, reading and verbal test scores are included in model 1.

Model 2

Test scores in contrasting areas are added to the model.

Model 3

Includes teacher ratings of the child's abilities in reading, creativity, oral skills, and number (at age 7), and book use, oral skills, general knowledge and number (at age 11).

Model 4

Includes school sector and single-sex schooling – data collected from the school at age 16. We also test for an interaction between these two variables. However, since we found no significant interaction terms in the analyses, these are omitted from the models shown.

The four nested models are shown only for maths and English self-concept. However, a summary of the final model is shown for maths, English and science.

Dummies for missing data are included for all variables in each analysis.

Maths self-concept

Table 5

Logistic regression predicts the log odds than an observation will have an indicator equal to one (which in this case means 'above average'). $\text{Exp}(B)$ represents the odds ratio for each parameter. Odds are calculated as the probability of an event occurring

divided by the probability of that event not occurring: $p/(1-p)$. The odds ratio is the odds for a particular category divided by the odds for a contrast category. An odds ratio of 1 implies that the outcome is equally likely for both categories. An odds ratio of less than 1 implies that the outcome is less likely for the parameter in question than for the contrast parameter. For example, 21.51% of boys and 11.06% of girls said they were 'above average' at maths. Thus, the odds of this outcome for boys are $0.2151/(1 - 0.2151) = 0.2740$. The odds for girls are $0.1106/(1-0.1106) = 0.1244$. This gives us an odds ratio of $0.2740/0.1244 = 2.2026$. Note that the interpretation of this is not intuitive – it is *not* the case that boys are 2.20 times more likely than girls to say that they are above average at maths; 21.51% is slightly less than twice 11.06%.

Model 1 shows that scores in arithmetic at age 7 and maths and non-verbal reasoning at age 11 were positively associated with self-concept. Neither the 'copying designs' score nor the 'draw-a-man' test were significant. The length of parents' education was positively associated with maths self-concept, whereas the social class variable was not significant in this model. Single and step-parent families were associated with lower self-concept, but sibship size and order were not significant. Even controlling for these variables, boys had significantly higher self-concepts than girls. $\text{Exp}(B)$ for boys is 2.35, which means that the odds of giving the response 'above average' at maths were 2.35 times higher for boys than for girls, controlling for all the other variables in the model. This shows that the statistical controls included in this model have made little difference to the raw gender gap (in fact it is slightly increased).

Model 2 introduces the students' test scores in reading at 7 and 11 and verbal reasoning at 11. As predicted by Marsh, an increase in the reading and verbal

reasoning scores was associated with a lower likelihood of high maths self-concept. However, the sex parameter was only very slightly reduced in this model. The odds ratio in favour of boys is 2.20 – almost identical to the ‘raw’ gender gap, without controls.

Model 3 includes teachers’ ratings of the students’ abilities at age 7 and 11. The number work ratings were positively associated with maths self-concept. In line with Marsh, the book use rating at age 11 was significantly associated with a lower likelihood of high maths self-concept. The other teacher ratings were not statistically significant at the 0.05 level. Sex and parental education remained highly significant in this model, thus these apparent effects were not accounted for by differences in the teacher assessments according to sex or parental education.

Model 4 introduces school sector and single-sex schooling. The private and grammar school parameters are negative, in line with Marsh’s prediction that an academically selective environment should lower self-concept, but only the grammar school parameter is statistically significant.

Single-sex schooling was associated with lower maths self-concept for boys – $\exp(B)$ 0.82. The association between single-sex schooling and higher maths self-concept for girls was not statistically significant, although a statistically significant effect was found in supplementary analysis treating the ‘below average’ parameter as the contrast.

English Self-concept

Table 6

Model 1 includes students' reading and verbal reasoning test scores. The reading test scores were positively associated with English self-concept, but verbal reasoning was actually a significantly negative predictor of self-concept in this model (this was reversed in subsequent models). Fathers' class was non-significant, but the length of parental education was positively associated with English self-concept, and being the firstborn child was significantly positive. The odds of a boy stating that he was 'above average' at English were 0.84 the odds for a girl.

Model 2 introduces the maths and non-verbal test scores. The maths and non-verbal reasoning test scores were significantly negative predictors of English self-concept, in line with Marsh. However, the 'draw-a-man' test score was significantly positive, while the copying designs test score was non-significant. The odds of a boy compared to a girl having above average self-concept were increased slightly in this model to 0.89.

Teacher assessment ratings are introduced in model 3. Teachers' assessments of reading, book use and creativity were positively associated with English self-concept. The sex effect was reduced to insignificance in this model, and the effect of parental education was reduced slightly but remained significant.

The sex effect regained statistical significance once school sector and single-sex schooling were controlled for in model 4. This model shows that, in line with the

BFLP model, attendance at a private or grammar school was negatively associated with English self-concept.

Boys had higher English self-concepts at boys' schools, while girls' English self-concepts were lower at girls' schools. This is in line with BFLP where students hold sex-stereotyped views about ability in English. No significant interaction was found between single-sex schooling and school sector.

Final Model: Maths, English, Science

The results of the final model for maths, English and Science (using multinomial logistic regression), and the results for the 'never studied' outcome are summarised in table 7. Due to space constraints, only the significance level and sign for key parameters of interest are reported: sex, parents' education, class, school sector and single-sex schooling. In each case, the contrast parameters are as reported in the previous regressions – e.g., in the case of school sector, the contrast parameter is the Comprehensive sector.

Table 7

In the final model, boys were less likely than girls to say they had never studied maths or science. Of those who had studied these subjects, boys had higher self-assessments than girls in maths and science. Girls were more likely than boys to see themselves as above-average in English.

Higher levels of parental education and social class were generally associated with exposure to a wider curriculum, and with higher self-concept. The effect of parental education was stronger and more consistent than the effect of social class. The children of graduates had higher self-concept in maths, English and science, and were more likely to have studied maths and science.

Students at grammar schools were more likely to have studied science in comparison to students at comprehensives. Private and grammar schooling was associated with lower self-concept in maths, English and science. Secondary modern schooling was positively associated with a self-assessment of 'average' in maths and English.

Girls-only schooling was associated with raised self-concept in maths and science, but reduced self-concept in English. Boys-only schooling was associated with raised self-concept in English. Neither girls-only nor boys-only schooling were associated with the chances of having studied English, maths or science.

In order to give a more intuitive sense of the meaning of the effect sizes shown earlier, table 8 shows the proportions of boys and girls responding 'above average' (as opposed to average or below) in maths, science and English. For English, the students are subdivided according to whether they came into the top, middle or bottom third in the reading test at age 11. For maths and science, the students are categorised according to their maths test scores at age 11. For each subject, prior attainment was a key factor determining students' self-concept. The effect of gender was also substantial.

Table 8

Looking at students in the top third of the test score distribution – those we would probably class as ‘above average’ – 43% of girls in co-educational schools, compared to 33% of boys, classed themselves as above average in English. (Recall from the explanation on pages 22-23 that this is equivalent to an odds ratio of 1.5). In single-sex schools the gender gap was actually reversed. 41% of boys compared to 36% of girls classed themselves as ‘above average’. This pattern was repeated for the middle and bottom thirds of the ability distribution.

In maths, boys had higher self-concepts than girls in both the single-sex and the co-educational sector. However, the gap was smaller in the single-sex schools. In the top third of the test-score distribution, 23% of girls at co-educational schools and 29% of girls at single-sex schools rated themselves as above average, while 41% of boys rated themselves as above average in both sectors.

The pattern for science was similar to that for maths. In the top third of the test score distribution, 15% of girls at co-educational schools, and 21% of girls at single-sex schools rated themselves as above average. The figures for boys (32% and 30% respectively) were not much different between sectors.

So, in English, single-sex schooling reverses the gender effect on self-concept. In maths and science, single-sex schooling merely moderates the gender effect.

Conclusions

Clearly, the self-assessments of boys and girls in the 1958 cohort were sex stereotyped. There were also clear differences in the curriculum that boys and girls had been exposed to. Girls were twice as likely as boys to say that they had never studied science.

The impact of gender on academic self-concept was substantial. Girls' relatively low self-concepts in maths and science could not be explained by the hypotheses we were able to test here, as the gender gap was robust to controls for both non-verbal and verbal test scores, and teacher assessments. Alternative explanations for gender differences in academic self-concept include socialisation by parents, peers, and the media, and gender biases in the curriculum and the way it is delivered (Eccles, 1987, Jacobs, et al., 2005, Kelly, 1985, Linver and Davis-Kean, 2005). On the other hand, boys' disadvantage in English self-concept was reduced to insignificance by controlling for the full raft of test scores and teacher assessments. However, the boys' disadvantage was significant for co-educated boys, even including these controls.

Social class was linked to academic self-assessment, but the effect of parental education was stronger and more consistent than that of parental social class. In general, controlling for prior attainment, the children of parents who had some further or higher education were more self-confident than the children of parents with only compulsory schooling. This may help to account for the relatively ambitious academic options pursued by children from educationally advantaged backgrounds.

The effects of prior attainment were generally in line with Marsh's Internal/External frame of reference model. So, maths test scores were positively associated with maths self-concept, while English test scores were negatively associated with maths self-concept (and vice versa for English self-concept). However, the positive effects of attainment in cognate subjects were generally much stronger than the negative effect of attainment in contrasting subjects. The gender effects were robust to controls for attainment in contrasting academic areas, so gendered self-concepts cannot be explained in terms of boys' and girls' relative advantage in maths or English respectively.

The effects of school sector were generally in line with Marsh's 'BFLP' model. Where there were effects of school sector on academic self-concept, it was generally the case that the academically selective schools were negatively associated with self-concept. School sector was also linked to the curriculum that the students had been exposed to. Grammar school students were more likely than comprehensive school students to have studied science.

Girls at single-sex schools were less likely to see themselves as 'below average' in maths and science, and less likely to see themselves as above average in English than girls at co-educational schools. Boys at single-sex schools were more likely to see themselves as above average at English. So, to the extent that single-sex schooling affected academic self-concept, it generally promoted a gender-atypical self-concept – i.e. the parameters for single-sex schooling for each sex were in the opposite direction from the sex effect for that sex. This is in line with Marsh's BFLP model, assuming

students have gender-stereotypical beliefs about boys' and girls' abilities in different academic subjects. It is also in line with the theory that gender norms are enforced less strictly within single-sex schools, since this theory produces the same hypotheses. These results do not support theories that predict that self-concept will simply be higher (or lower) in general at single-sex schools, across subject areas (because the overall environment is more (or less) 'girl-friendly' or 'boy-friendly'). There were no significant interactions between school sector and single-sex schooling, suggesting that the effect of single-sex schooling did not depend on the selectivity of the institution.

The effects of school sector and single-sex schooling on academic self-concept may be seen as, in a sense, artefactual. For example, the greater tendency of students at private and grammar schools to see themselves as 'below average' can be seen simply as an accurate response to the fact that, controlling for their own prior ability, they are more likely to be below average compared to their peers at an academically selective school. This raises the question of whether the school sector effects on self-concept would remain once the students were taken out of the school frame of reference. Once at university, for example, would students from selective schools feel more or less self-confident compared to students from Comprehensives? Would the impact of single-sex schooling on academic self-concept remain once students had moved on to a co-educational setting? These questions are outside the scope of the current paper. However, in future work, the links between academic self-concept in youth and subsequent educational choices will be analysed.

Of course, the effects of particular school structures are historically contingent. Changing expectations of women's socio-economic role have had a substantial impact on schooling since the 1958 cohort were at secondary school, and girls' academic attainment has improved relative to boys'. Due to the introduction of the national curriculum in 1988, both single-sex and co-educational schools now provide a much less gendered curriculum to boys and girls, at least up to the age of 14. However, girls' very academic success has been used to justify policies and practices which discriminate against them within coeducational schools (Charlton, et al., 2007). In addition, many of the issues faced by boys and girls in co-educational and single-sex 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. For the 1958 cohort, the less gendered self-concept found in the single-sex schools did not appear to be driven by curricular differences – girls at single-sex and co-educational schools were equally likely to report that they had never studied science, for example. Instead we have suggested two mechanisms to explain the gap between co-educational and single-sex schools; students using a gender-stereotyped frame of reference to judge themselves against their peers, and/or gendered norms of behaviour being particularly strongly enforced within co-educational schools. To the extent that these mechanisms still operate today, we would still expect to find a link between single-sex and co-educational schooling and gendered self-concept. Contemporary research examining this issue is called for.

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 LEAs 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. The imbalance of provision is more extreme in certain boroughs. In Islington, boys make up 71% of the co-ed secondary school population (Whatford, 2005). 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.

Recently, some co-educational schools have experimented with single-sex classes. Younger and Warrington (2006) point out that, while such classes can be used to counter gender stereotypes, this depends on the context in which single-sex classes are introduced. Where the aim of single-sex classes is primarily to raise boys' attainment, and especially where these classes are introduced as part of a backlash against

‘feminised’ schooling, they may be implemented in ways that reinforce gender stereotypes and disadvantage girls. Younger and Warrington give an example of a school which transferred a highly competent (female) maths teacher to the boys’ class, because the boys were seen as harder to control, leaving the girls with a less competent (male) teacher. This example suggests that we cannot necessarily draw inferences regarding single-sex classes from research on single-sex schooling.

Nevertheless, we think that our findings have implications that could be taken on board within co-educational schools. The gender gap in orientations towards different academic subjects is sometimes seen as being either genetic, or at least is so deep-seated that it is unlikely to be amenable to intervention (Smithers and Robinson, 2006). That co-educational schooling exacerbates students’ gendered perceptions of their own abilities highlights the fact that gendered perceptions of academic disciplines should not be treated as ‘natural’ and unproblematic. Rather, this is something that needs to be challenged within schools. Yet, since the late 1980s, such gender issues have actually been removed from teacher education (Mahony and Hextall, 2000).

Girls’ relative lack of confidence in their abilities in maths and science is particularly worrying. The belief that the under-representation of girls and women in maths and sciences is due to a ‘natural’ inferiority in these fields is still widely held (see for example the recent comments of Harvard president Lawrence Summers). There is a danger that this area of disadvantage for girls and women will be neglected due to the perception that girls are now outperforming boys across the board. It has been asked,

since girls are now doing so well, who cares that they don't 'choose' physics (Smithers, 2006)?

It would be wrong to assume that girls' increased academic attainment must have led to increased self-confidence relative to boys. Parallel analyses conducted on the British Cohort Study 1970 (Sullivan, 2006a) show no sign of a decrease in the gender gap in self-concept. Recent findings from a small-scale English study also show that girls still have less confidence in their general academic abilities than boys (Sullivan, 2006b). Research continues to show that academic self-concept remains highly gendered (Marsh, et al., 2005, Schilling, et al., 2006). Notwithstanding the fact that girls outperform boys at GCSE in general, and girls' GCSE maths performance is equal to that of boys, girls' lower self-confidence has implications for their educational attainment. For example, girls are less likely than boys to be entered into the higher tier for GCSE maths, and this is likely to be due at least in part to girls' greater anxiety about the risk of failure (Elwood, 2005, Stobart, et al., 1992).

The labour market returns to degrees in maths, science and related subjects remain higher than returns to degrees in arts, social sciences and education for both sexes (Conlon and Chevalier, 2003). The fact that women are less likely to be qualified in maths, sciences and technical subjects continues to contribute to the labour market disadvantage faced by women, as it did for the women of the 1958 cohort (Cheung, 1997, Machin, et al., 2003). Furthermore, analysis of the cohort members' rates of pay as adults suggests that women's lower pay, even in full-time jobs could not all be explained by male advantages in educational attainments and labour market experience (Dolton, et al., 2002, Makepeace, et al., 2004). Indeed for the 1970 cohort

members employed full-time at age 30, the women would have been better paid than the men if it were not for unequal rates of pay for given human capital characteristics (Joshi, et al., 2007). There are various reasons why this unequal treatment may persist, including discrimination and gender segregation in the labour market, but it is also likely that differential self-concept could help explain why, in later years, the male cohort members were more likely to seek or be successful in obtaining better pay and position in the labour market. Babcock and Laschever (2003) argue that women's relatively low opinion of themselves, combined with the double bind of the social norm against 'pushiness' in women, makes women less likely than men to bargain effectively for higher pay.

The fact that these cohort members have been followed up into adulthood will enable us to analyse gender differences in adult behaviour and achievement. In particular, extensions of this work will examine the link between the gender gap in self-concept and subsequent gender gaps in academic subject specialisation and labour market outcomes, and whether any impacts of single-sex schooling on these outcomes are mediated by self-concept.

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Bibliography

- ARCHER, J. and MACRAE, M. (1991) Gender Perceptions of School Subjects, *British Journal of Educational Psychology* 61. 99-103.
- BABCOCK, L. and LASCHEVER, S. (2003) *Women Don't Ask: Negotiation and the Gender Divide* (Princeton, Princeton University Press).
- BAKER, D. B., RIORDAN, C. and SCHAUB, M. (1995) The effects of sex-grouped schooling on achievement: the role of national context, *Comparative Education Review* 39. 468-82.
- BYRNE, E. (1978) *Women and Education* (London, Tavistock Publications).
- CAIRNS, R. B. and CAIRNS, B. D. (1995) *Lifelines and Risk: Pathways of Youth in Our Time* (Cambridge, Cambridge University Press).
- CHARLTON, E., MILLS, M., MARTINO, W. and BECKETT, L. (2007) Sacrificial Girls, *British Educational Research Journal* 33, (4). 459-78.
- CHEUNG, S.-Y. (1997) Meritocracy Revisited: A Disaggregated Approach to the Study of Educational and Occupational Attainment in Britain, in: (University of Oxford, D.Phil. Thesis).
- CHIPMAN, S., KRANTZ, D. and SILVER, R. (1992) Mathematics Anxiety and Science Careers among Able Women, *Psychological Science* 3. 292-5.
- COLWILL, N. (1982) *The New Partnership: Women and Men in Organisations* (Mayfield).
- CONLON, G. and CHEVALIER, A. (2003) *Does it Pay to Attend a Prestigious University?* Centre for the Economics of Education, Working Paper.
- CORRELL, S. J. (2001) Gender and the Career Choice Process: The Role of Biased Self-Assessments, *American Journal of Sociology* 106, (6). 1691-730.
- DALE, R. (1969) *Mixed or Single-sex School? Volume I* (London, Routledge and Kegan Paul).
- DALE, R. (1971) *Mixed or Single-sex School? Volume II* (London, Routledge and Kegan Paul).
- DALE, R. (1974) *Mixed or Single-sex School? Volume III* (London, Routledge and Kegan Paul).
- DFES (1975) *Curricular Differences for Boys and Girls* HMSO,
- DFES (2004) *Statistics of Education: Schools in England* (London, HMSO).

- DOLTON, P., JOSHI, H. and MAKEPEACE, G. (2002) Unpacking unequal pay between men and women, *CLS Cohort Studies Working Paper 2*.
- DOUGLAS, J. W. B. (1964) *The Home and the School* (London, MacGibbon and Kee).
- ECCLES, J., ADLER, T. F., FUTTERMEN, R., GOFF, S. B., KACZALA, C. M. and MEECE, J. L. (1983) Expectations, values, and academic behaviours, in: SPENCE, J. T. *Achievement and achievement motivation* (San Francisco, Freeman).
- ECCLES, J. S. (1987) Gender roles and achievement patterns: An expectancy value perspective, in: REINISH, J. M., ROSENBAUM, L. A. and SAUNDERS, S. A. *Masculinity/femininity: Basic Perspectives* (New York, Oxford University Press).
- ELWOOD, J. (2005) Gender and Achievement: what have exams got to do with it?, *Oxford Review of Education* 31, (3). 373-93.
- ELWOOD, J. and GIPPS, C. (1999) *Review of Recent Research on the Achievement of Girls in Single-sex Schools* (London, Institute of Education).
- FENNEMA, E., PETERSON, P. P., CARPENTER, T. P. and LUBINSKI, C. A. (1990) Teachers' Attributions and Beliefs about Girls, Boys and Mathematics, *Educational Studies in Mathematics* 21. 55-61.
- FRANCIS, B., HUTCHINGS, M., ARCHER, L. and MELLING, L. (2003) Subject Choice and Occupational Aspirations among Pupils at Girls' Schools, *Pedagogy, Culture and Society* 11, (3). 425-42.
- GIPPS, C. and MURPHY, P. (1994) *A fair test? : assessment, achievement and equity* (Milton Keynes, Open University Press).
- GOODENOUGH, F. L. (1926) *The measurement of intelligence by drawings* (New York, World Book Company).
- HALPERN, D. F. (2000) *Sex differences in cognitive abilities* (Mahwah, N.J., Erlbaum).
- HAWKES, D. and LEWIS, I. (2006) Modelling Non-Response in the National Child Development Study, *Journal of the Royal Statistical Society, A*. 169. 479-91.
- JACKSON, C. and SMITH, I. D. (2000) Poles apart? An exploration of single-sex and mixed-sex educational environments in Australia and England, *Educational Studies* 26. 375-91.
- JACOBS, J. E., DAVIS-KEAN, P., BLEEKER, M., ECCLES, J. and MALANCHUK, O. (2005) "I can but I don't want to": The Impact of Parents, Interests and Activities on Gender differences in Math, in: KAUFMAN, J. and GALLAGHER, A. *Gender Differences in Mathematics* (New York, Cambridge University Press).

- JOFFE, L. and FOXMAN, D. (1988) *Attitudes and Gender Differences* (Slough, NFER-Nelson).
- JONSSON, J. O. (1999) Explaining Sex Differences in Educational Choice: An Empirical Assessment of a Rational Choice Model, *European Sociological Review* 15, (4). 391-404.
- JOSHI, H., MAKEPEACE, G. and DOLTON, P. (2007) More or less unequal? Evidence on the pay of men and women from the British Birth Cohort Studies, *Gender, Work and Organization* 14, (1). 37-51.
- KELLY, A. (1985) The Construction of Masculine Science, *British Journal of Sociology of Education* 6, (2). 133-54.
- LEE, V. E. and BRYK, A. S. (1986) Effects of single-sex secondary schools on student achievement and attitudes, *Journal of Educational Psychology* 78. 381-95.
- LEFEVRE, J., KULAK, A. and HEYMANS, S. (1992) Factors Influencing Selection of University Majors Varying in Mathematical Content, *Canadian Journal of Psychology* 24. 276-89.
- LI, Q. (1999) Teachers' Beliefs and Gender Differences in Mathematics. A Review, *Educational Research* 41, (1). 63-76.
- LINVER, M. R. and DAVIS-KEAN, P. E. (2005) The Slippery Slope: What Predicts Math Grades in Junior High and High School?, *New Directions for Child and Adolescent Development* 110. 49-64.
- MACHIN, S., PUHANI, S. and PUHANI, P. (2003) Subject of Degree and the Gender Wage Differential: Evidence from the UK and Germany, *Economics Letters* 79. 393-400.
- MAEL, F., ALONSO, A., GIBSON, D., ROGERS, K. and SMITH, M. (2005) *Single-Sex Versus Coeducational Schooling: A Systematic Review* (Policy and Program Studies Service, US Department of Education).
- MAEL, F. A. (1998) Single-Sex and Coeducational Schooling: Relationships to Socioemotional and Academic Development, *Review of Educational Research* 68, (2). 101-29.
- MAHONY, P. and HEXTALL, I. (2000) *Reconstructing Teaching: standards, performance and accountability* (London, Routledge Falmer).
- MAKEPEACE, G., DOLTON, P. and JOSHI, H. (2004) Gender earnings differentials across individuals over time in British Cohort Studies 1991 and 2000, *International Journal of Manpower* 25, (3/4). 251-63.

MARSH, H. W. (1989) Sex-Differences in the Development of Verbal and Mathematics Constructs - the High-School and Beyond Study, *American Educational Research Journal* 26, (2). 191-225.

MARSH, H. W. (1991) Public, Catholic Single-Sex, and Catholic Coeducational High-Schools - Their Effects on Achievement, Affect, and Behaviors, *American Journal of Education* 99, (3). 320-56.

MARSH, H. W. (1993) The Multidimensional Structure of Academic Self-Concept: Invariance over gender and age, *American Educational Research Journal* 30, (4). 841-60.

MARSH, H. W. and HAU, K. T. (2003) Big-fish-little-pond effect on academic self-concept - A cross-cultural (26-country) test of the negative effects of academically selective schools, *American Psychologist* 58, (5). 364-76.

MARSH, H. W. and HAU, K. T. (2004) Explaining paradoxical relations between academic self-concepts and achievements: Cross-cultural generalizability of the internal/external frame of reference predictions across 26 countries, *Journal of Educational Psychology* 96, (1). 56-67.

MARSH, H. W. and ROWE, K. J. (1996) The effects of single-sex and mixed-sex mathematics classes within a coeducational school: A reanalysis and comment, *Australian Journal of Education* 40, (2). 147-61.

MARSH, H. W., SMITH, I. D., MARSH, M. and OWENS, L. (1988) The Transition from Single-Sex to Coeducational High-Schools - Effects on Multiple Dimensions of Self-Concept and on Academic-Achievement, *American Educational Research Journal* 25, (2). 237-69.

MARSH, H. W., TRAUTWEIN, U., LUDTKE, O., KOLLER, O. and BAUMERT, J. (2005) Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering, *Child Development* 76, (2). 397-416.

MARSH, H. W. and YEUNG, A. S. (1998) Longitudinal structural equation models of academic self-concept and achievement: Gender differences in the development of math and English constructs, *American Educational Research Journal* 35, (4). 705-38.

ORMEROD, M. B. (1975) Subject preferences and choice in co-education and single sex secondary schools, *British Journal of Educational Psychology* 45. 257-67.

PRINGLE, M. F. K., BUTLER, N. and DAVIE, R. (1966) *11, 000 Seven Year Olds* (London, Longman).

RIORDAN, C. (1990) *Girls and boys in school: Together or separate?* (New York, Teachers College Press).

RIORDAN, C. (2002) What do we know about the effects of single-sex schools in the private sector? Implications for private schools., in: DATNOW, A. and HUBBARD,

- L. *Gender in Policy and Practice: Perspectives on single-sex and co-educational schooling* (London, Routledge Falmer).
- SCHILLING, S. R., SPARFELDT, J. R. and ROST, D. H. (2006) Gender differences in subject-specific self-concepts, *Zeitschrift Fur Padagogische Psychologie* 20, (1-2). 9-18.
- SCHOON, I., ROSS, A. and MARTIN, P. (2006) Careers in Science, Engineering, Technology (SET) and Health: His and Her Story. paper given at ESRC Social Science Week, Cambridge.
- SEXTON, P. C. (1969) *The Feminized Male: classrooms, white collars, and the decline of manliness* (New York, Random House).
- SHAPKA, J. D. and KEATING, D. P. (2003) Effects of a girls-only curriculum during adolescence: Performance, persistence, and engagement in mathematics and science, *American Educational Research Journal* 40, (4). 929-60.
- SHAVELSON, R. J., HUBNER, J. J. and STANTON, G. C. (1976) Validation of construct interpretations, *Review of Educational Research* 46. 407-41.
- SHEPHERD, P. (1995) *The National Child Development Study: An Introduction to its Origins and the Methods of Data Collection* (NCDS User Support Group, Working paper 1).
- SILBER, E. and TIPPETT, J. S. (1965) Self-esteem: Clinical assessment and measurement validation, *Psychological Reports* 16. 1017-71.
- SKAALVIK, S. and SKAALVIK, E. (2004) Gender Differences in Math and Verbal Self-Concept, Performance Expectations, and Motivation, *Sex Roles* 50, (3 - 4). 241-52.
- SMITHERS, A. (2006) Does it matter that mainly boys do physics? *Independent* 6th July.
- SMITHERS, A. and ROBINSON, P. (2006) *The Paradox of Single-sex and Co-educational Schooling* Centre for Education and Employment Research University of Buckingham,
- SOUTHGATE, V. (1962) *Southgate group reading tests: manual of instructions* (London, London University Press).
- SPENCER, S. J., STEELE, C. M. and QUINN, D. M. (1999) Stereotype Threat and Women's Math Performance, *Journal of Experimental Social Psychology* 35, (1). 4-28.
- SPIELHOFER, T., BENTON, T. and SCHAGEN, S. (2004) A study of the effects of school size and single-sex education in English schools, *Research Papers in Education* 19, (2). 133-59.

- STABLES, A. (1990) Differences between Pupils from Mixed and Single-Sex Schools in their Enjoyment of School Subjects and in their Attitudes to Science and to School, *Educational Review* 42, (3). 221-30.
- STEEDMAN, J. (1980) *Progress in Secondary Schools* (London, National Children's Bureau).
- STEEDMAN, J. (1983a) *Examination Results in Selective and Non-Selective Schools* (London, National Children's Bureau).
- STEEDMAN, J. (1983b) *Examination Results in Selective and Non-selective Schools, Volume 2 - Appendices* (London, National Children's Bureau).
- STOBART, G., ELWOOD, J. and QUINLAN, M. (1992) Gender Bias in Examinations: how equal are the opportunities?, *British Educational Research Journal* 18, (3). 261-76.
- SULLIVAN, A. (2006a) Academic self-concept, Gender and Single-sex Schooling in the 1970 Cohort, *CLS Working Paper, London: Centre for Longitudinal Studies* 2006, (2).
- SULLIVAN, A. (2006b) Students as rational decision-makers: the question of beliefs and attitudes, *London Review of Education* 4, (3). 271-90.
- TAYLOR, M. T. and MARDLE, G. D. (1986) Pupils' Attitudes Towards Gender Roles, *Educational Research* 28, (3). 202-9.
- TIZARD, B., BLATCHFORD, P., BURKE, J., FARQUHAR, C. and PLEWIS, I. (1988) *Young Children at School in the Inner City* (Hove, Lawrence Erlbaum Associates).
- VAN DE GAER, E., PUSTJENS, H., VAN DAMME, J. and DE MUNTER, A. (2004) Effects of single-sex versus co-educational classes and schools on gender differences in progress in language and mathematics achievement, *British Journal of Sociology of Education* 25, (3). 307-22.
- WHATFORD, C. (2005) *Secondary School Places Planning in London* (London, London Challenge).
- WHITEHEAD, J. M. (1996) Sex Stereotypes, Gender Identity and Subject Choice at A level, *Educational Research* 38, (2). 147-60.
- WILGENBUSCH, T. and MERRELL, K. W. (1999) Gender differences in self-concept among children and adolescents: A meta-analysis of multidimensional studies, *School Psychology Quarterly* 14, (2). 101-20.
- YOUNGER, M. and WARRINGTON, M. (2006) Would Harry and Hermione have done Better in Single-Sex Classes: A review of single-sex teaching in co-educational schools in the United Kingdom, *American Educational Research Journal* 43, (4). 579-620.

¹ Ordinal regression was found to be inappropriate in this instance, as the assumption of parallel lines was invalid. The test of parallel lines tests the assumption that the slope coefficients are the same across response categories.