Underachievement in the 1970 British Cohort Study

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Throughout this project I have not only learnt many technical skills related to SAS programming, using large data sets, modelling, and reporting results, I have also seen the knowledge, experience, and consideration required to ensure findings are valid and reliable. I have gained a more critical eye for research and a better understanding of how techniques learnt in the classroom are used in reality, providing useful context for my future studies. Meeting passionate researchers whose work informs government policy has shown me the potential for statistics research to create change. This has helped me appreciate the importance of basing such research on sound statistical techniques.

Summary

In a meritocratic society, talent and effort, rather than class, would be rewarded with economic and social success. Education is vital to this success, yet contrary to meritocratic ideals, and despite education policies aimed at providing equitable opportunities, able students are inevitably left behind (Fergusson & Woodward 2000, Blanden & Machin 2004, Carey 2015). Underachievement has personal and societal consequences, leading to depressed economic growth and productivity through underinvestment in human capital, lower average incomes, greater public spending on welfare and crime, and decreased tax revenues (Rumberger 1987, Belfield & Levin 2008). Providing second-chance education opportunities for able underachievers promotes the utilisation of untapped human resources and can break the cycle of disadvantage.

The present research supports the provision of second-chance training opportunities by investigating the extent of underachievement, common characteristics among underachievers and the effect of underachievement on adult outcomes. We find that socioeconomic status has a large and robust effect on educational achievement regardless of cognitive ability. We also find that rejection of school culture (demonstrated by alcohol use, poor engagement, truancy, poor sense of control over achievement, and peer deviance) and low personal and parental educational aspirations hinder the positive effect of cognitive ability on educational achievement. While we do not find any evidence of a specific effect of underachievement on adult outcomes, our findings show that educational achievement lead to improved economic, social and health outcomes in many cases.

Abstract

Background: Underachievement by able students represents under-utilisation of human resources. This has economic, social and health consequences for individuals and society.

Methods: Data from the BCS70 were used to measure cognitive ability at ages 5 and 10, and achievement (highest academic/vocational qualification) at age 30. Logistic regression was used to test health at age 16, and school and behavioural variables for mediation/moderation effects on the ability-achievement relationship. The effect of underachievement on adult economic, health and social outcomes was tested using a range of regression methods.

Results: The underachievement rate was 8.74–22.00%. Odds of underachievement were 2.385 (2.046–2.780) times greater for low SES individuals than for high SES individuals. Educational aspirations and school engagement moderated the ability-achievement relationship. Regardless of ability, high achievers had better adult outcomes for 14/22 variables.

Conclusions: Our results suggest that school engagement and training opportunities for able individuals are important to reduce the extent and effects of underachievement in later life.

The key aims of the analysis are:
1) To identify the extent to which young people of high ability do not go on to achieve highly in young adulthood.
2) To investigate the common characteristics of this group.
3) To demonstrate the social, economic, and health consequences of underachievement in young adulthood for the individual and society.

Method

Participants and data

Data were drawn from the first 30 years of the 1970 British Cohort study (BCS70) (N = 17,196, 51.8% male, 92% UK European). Participants were all children born within the UK during a week in 1970. Data were gathered from questionnaires and interviews completed by the subject, their parents, teacher and principal, cognitive ability testing, and medical examinations.

Measures

Cognitive ability. Cognitive ability testing occurred at ages 5 and 10. Age 5 ability was measured by the *English Picture Vocabulary Test (EPVT)* (a measure of language ability) (Vance, et al. 1989), the *Human Figure Drawing Test* (a measure of conceptual maturity) (Scott 1981) and the *Copying Designs Test* (a measure of non-verbal skills) (Parsons 2014). Factor Analysis supported unidimensionality (55% variance explained, Cronbach's Alpha = 0.60).

Age 10 cognitive ability was measured using the *Friendly Maths Test (Parsons 2014),* the *Shortened Edinburgh Reading Test (Parsons 2014)* and four subscales of the *British Ability Scales (BAS)* (word definitions, word similarities, recall of digits, and matrices) (Connelly 2013). Factor Analysis supported unidimensionality (61% variance explained, Cronbach's Alpha = 0.87).

Subjects with ability scores less than 70 at ages 5 (2.73%) and 10 (2.34%) were excluded. All mean scores were standardised to a mean of 100 and standard deviation of 15.

A mean of age 5 and 10 scores was taken to minimise measurement error. This was used to identify 'high' and 'low' ability individuals (where 'high' and 'low' simply indicate the subject's position relative to the cut-off). A dichotomous high/low ability variable was created for cutoff points at 110 and 105, and sensitivity checking was conducted.

Sensitivity checking on the use of the mean score was conducted by extracting the principle factor from tests used at age 5 and age 10 using PCA. The results were then tested using ability scores at age 5 and age 10 separately.

Achievement: *A*chievement level was the highest academic or vocational qualification achieved by age 30. For those missing qualification information at age 30, qualification information from age 26 was carried forward where available.

'High achievement' was defined as either NVQ level 3 (A-level attainment, equivalent to a post-secondary qualification) and above or NVQ level 4 (undergraduate degree) and above. A dichotomous achievement variable indicating high and low achievement was created for both cutoff points and sensitivity checking was conducted.

Achievement status: Four groups were created using 'high' and 'low' ability and achievement variables: low ability low achievers, low ability high achievers, high ability high achievers, and high ability low achievers (underachievers). Sufficient data was available to classify 57.25% of the total sample according to achievement status.

Childhood Socioeconomic Status (Childhood SES): The social class of the subject's father (or mother if father's information was missing) was coded according to the Registrar General's Social Class 1970 (RGSC) at birth, age 5, and age 10. High SES was defined as "skilled non-manual" jobs and above. Subjects were categorised according to whether they experienced high SES in all assessed time periods (24.89%), some time periods (17.90%), or no time periods (57.21%). Childhood SES information was available for 97.34% of the total sample.

Moderating and mediating variables: A wide range of potential mediating/moderating variables were identified from the literature. The variables considered can be grouped into physical health, mental health, social/emotional/behavioural difficulties (SEBD), school engagement and aspirations. Measures were selected from the data according to the number of responses, their quality, and their plausibility. Self-reported and objective measures were prioritised.

Adult outcomes: To investigate disparities in adult outcomes between achievement groups, information on income, employment, SES, education, mental health, and physical health was gathered from interviews and questionnaires conducted at age 30.

Statistical analysis

Common characteristics among underachievers were identified using logistic regression to test the effect of the mediators/moderators on achievement. The odds of high achievement were modelled on ability, SES, sex, and each mediator/moderator variable (v):

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 Ability + \beta_2 SES + \beta_3 Sex + \beta_4 v + \varepsilon$$

where β_0 is the intercept, β_1–β_4 are the coefficients and ε is an independent residual term. For variables with a significant effect on achievement, an interaction term was included in the adjusted regression to test for moderation effects on the ability-achievement relationship.

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 Ability + \beta_2 SES + \beta_3 Sex + \beta_4 v + \beta_5 Ability \times v + \varepsilon$$

where β_0 is the intercept, β_1–β_5 are the coefficients and ε is an independent residual term. To test the effect of achievement status on adult outcomes, each outcome was modelled on the categorical achievement status variable, while controlling for childhood or age 30 SES, gender, and equivalent age 16 scores (where available). Logistic regression was used for dichotomous outcomes, multinomial for categorical outcomes, negative binomial regression for count outcomes, and linear regression for continuous outcomes.

Results

Extent of underachievement: Depending on the cutoff points used, between 8.74 and 22% of the sample were identified as underachievers. Using NVQ Level 3, and 105 as the achievement/ ability cutoffs, the proportion was 14.54% of the sample.

SES: After adjusting for ability and gender, the odds of being an underachiever rather than a high ability high achiever were 2.385 (2.046–2.780) and 1.533 (1.284–1.829) times greater for those with all and some periods of low SES respectively, compared to subjects with all periods of high SES.

Gender: After adjusting for ability and SES, the odds of being an underachiever rather than a high ability high achiever were 1.173 (1.028–1.338) times greater for girls compared to boys.

Moderators of the ability-achievement relationship: Many variables across the five groups of mediators/moderators mediated the ability-achievement relationship after adjusting for SES and gender. Of more interest were variables which moderated the ability-achievement relationship. Moderation effects were alcohol consumption, General Health Questionnaire (GHQ) scores (Goldberg 1978), behavioural problems reported by teacher, school engagement scores, truancy, the CARALOC locus of control score (Gammage 1975), and personal/parental educational aspirations and expectations (see *Figures 1 & 2* in Appendix). These moderators formed two groups:
1) rejection of school culture; and
2) personal and parental educational aspirations.

We constructed and tested conceptual models for rejection of school culture and educational aspirations (see *Figure 3* in Appendix). When using school engagement scores to represent "rejection of school culture" we found a mediation effect on the ability-achievement relationship independent of covariates in the model. However, school engagement had no moderation effect on the relationship in the fully adjusted models, suggesting that the effect of school engagement on the ability-achievement relationship was acting through the other variables.

Adult outcomes: Most adult outcomes (including employment status, promotional prospects, police contact, job satisfaction, life satisfaction, smoking, exercise and current study) were split by achievement level, with high achievers showing higher odds of positive outcomes compared to low achievers. However, for some outcomes (social class, receiving welfare and net annual income) there was evidence of a positive effect of ability within achievement groups. In agreement with other research on BCS70 data, drug/alcohol use was split by ability level with high ability associated with greater drug/alcohol use. While achievement and ability influenced outcomes, there was no evidence of a specific effect of underachievement on adult outcomes. Further analysis is required to identify the extent to which the effect of ability on outcomes is moderated by achievement.

Discussion

This analysis found that SES had an important effect on ability and achievement, that school disengagement and low educational aspirations contributed to underachievement independent of SES, and that low achievement (but not underachievement specifically) had a negative effect on many adult outcomes. These findings are consistent with literature on the subject, but we found an unexpected association between higher GHQ scores (more mental distress) and greater odds of high achievement. More research is required to investigate this result.

A number of limitations affect the generalisability of the analysis. As the cohort was 92% UK European, generalisability to multicultural contexts such as New Zealand is limited. Age 16 data were affected by low response rates (68%) due to teacher strikes during the age 16 sweep, leading to underrepresentation of boys and low SES children. Correlation between age 5 and age 10 ability scores was lower than expected (0.512). Analysis of score discrepancies showed that changes in cognitive ability are influenced by SES and the ability to meet attendance, behaviour and engagement expectations at school. This suggests that the cognitive ability measure at age 10 may be biased by other factors, however sensitivity checking showed our results to be robust when changing the measurement of ability or the definition of 'high' ability and achievement.

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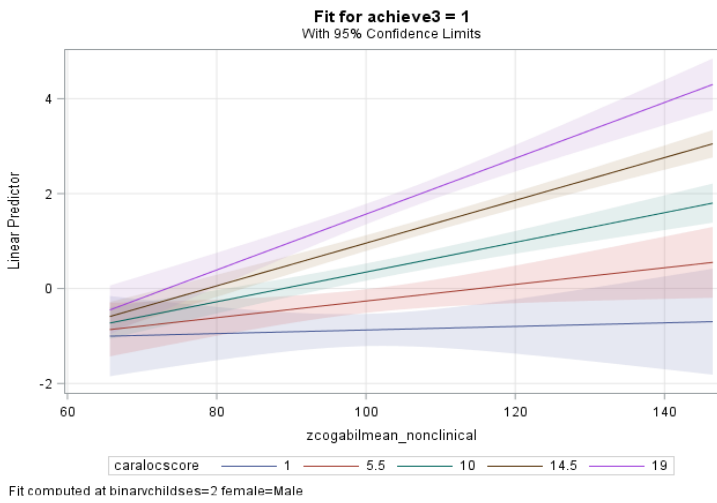
Appendix

Figure 1. Logs odds of high achievement by mean ability modelled at different levels of age 16 CARALOC locus of control score. Higher score indicates greater sense of control over achievement.
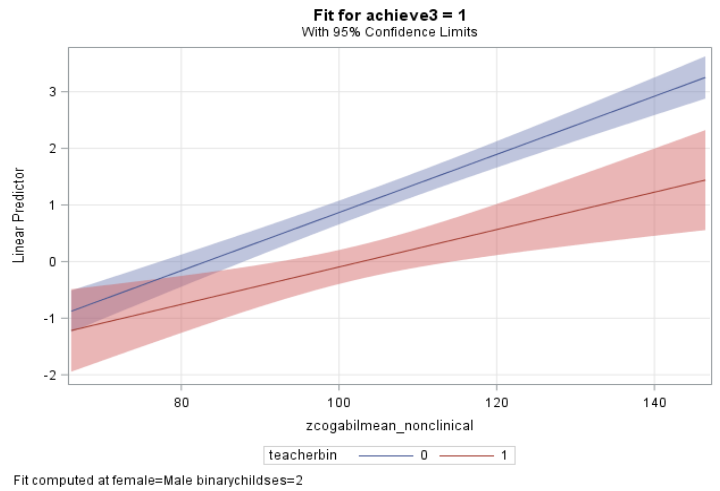

Figure 2. Logs odds of high achievement by mean ability modelled for those with (red) and without (blue) problem behaviour as indicated by their teacher at age 16.
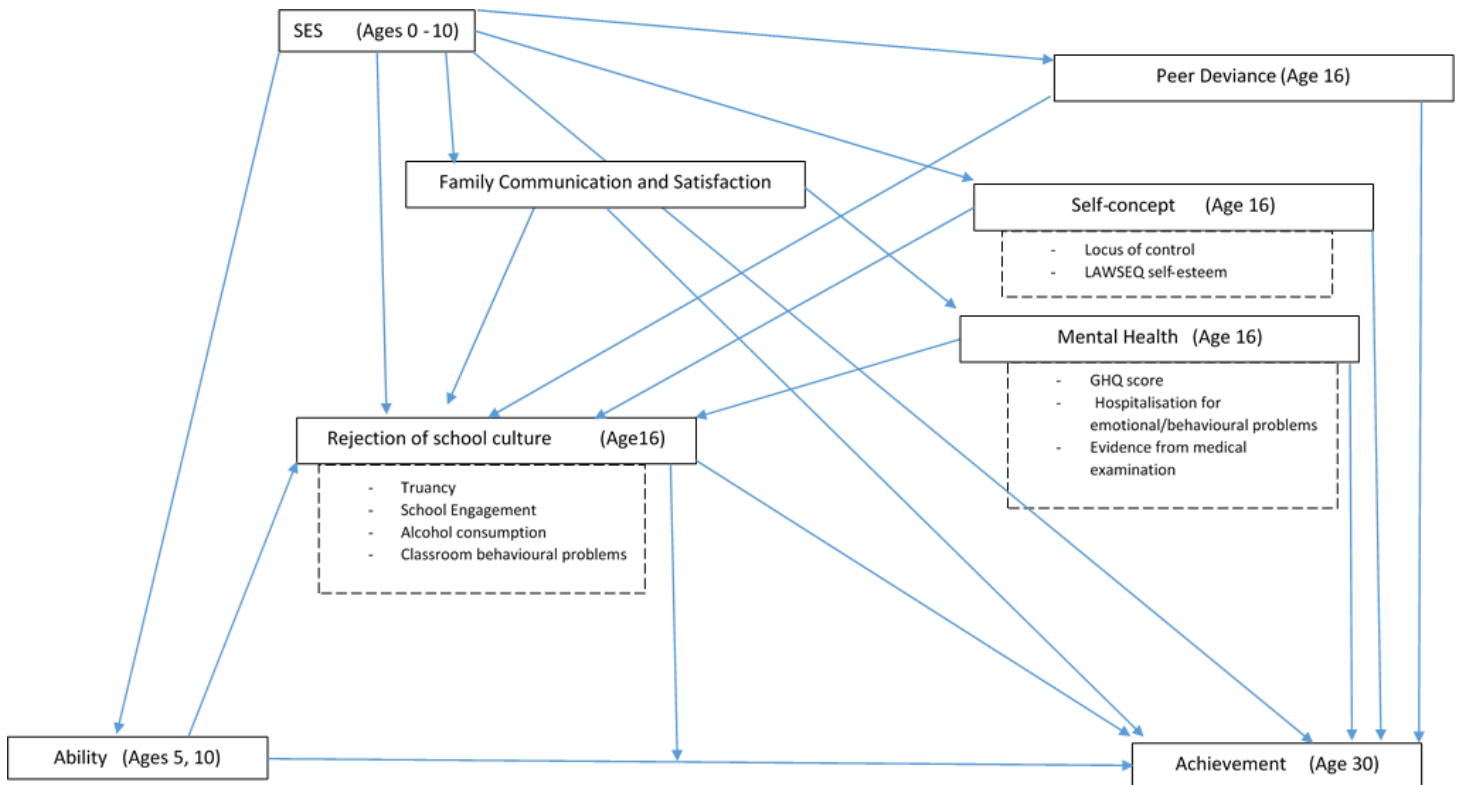

Figure 3. Conceptual model for the moderation effect of 'rejecting school culture' on the ability-achievement relationship.