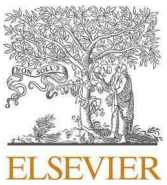
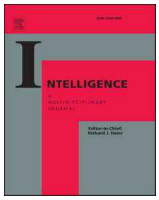
Intelligence 84 (2021) 101511



Contents lists available at ScienceDirect

Intelligence

journal homepage: www.elsevier.com/locate/intell



Are the effects of intelligence on student achievement and well-being largely functions of family income and social class? Evidence from a longitudinal study of Irish adolescents

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ARTICLE INFO

Keywords:
Intelligence
School tests
Family background
Household income
Social class

ABSTRACT

The paper examines the effects of socioeconomic background (SES) - measured by social class, family income and parental education - cognitive ability, and gender on a variety of key outcomes from a large longitudinal study based on a representative sample of thirteen-year-olds. The data analysed comprised 6216 children who participated in waves 1 to 3 of the *Growing Up in Ireland* (GUI) longitudinal survey. The outcome measures drawn from wave 3, when respondents were aged about seventeen, were: examination results and several cognitive measures, life difficulties, and quality of relationships. Three regression models were compared with and without, SES measures (occupational class, household income and parental education) and cognitive ability. On academic and cognitive attainments, cognitive ability at age 13 had substantially more explanatory power than the SES measures together. On measures of adolescent difficulties and on family relationships, cognitive ability was important, but gender and to a lesser extent, household income and parental education had some effects. Claims that class background and family income are of central importance for adolescent outcomes are not supported.

1. Introduction

1.1. The apparent benefits of cognitive ability on a variety of life outcomes

It has been amply demonstrated that intelligence is associated with a range of educational, labor market, crime, health and other social outcomes (Deary, 2012; Fergusson, Horwood, & Ridder, 2005; Herrnstein & Murray, 1994; Korenman & Winship, 2000). Silver (2019;1) argues that cognitive ability or intelligence is one of the few social science variables "consistently shown to influence a swath of human outcomes". This has been confirmed for friendship patterns (Boutwell, Meldrum, & Petkovsek, 2017), aggression (Kaukiainen et al., 1999), self-control (Meldrum et al., 2018), as well as in anti-social and criminal behavior (Mears & Cochran, 2013, Silver & Nedelec, 2018, Ttofi et al., 2016). In relation to pro-social and altruistic behavior, Guo et al. (2019) reported a link between IQ and positive outcomes, while Corgnet et al. (2016) found an association between intelligence and trusting behaviours. Wraw et al. (2018) reported that higher IQ in youth in a sample of over 5000 participants in the NLSY-79 (National Longitudinal Survey of Youth) independently predicted health behaviours in middle-age, about three decades later. The complex pathways between intelligence, and physical and mental morbidity as well as mortality, have also been explored (see Deary, 2009) within the new field of cognitive epidemiology.

Cognitive ability is most important in relation to educational outcomes. Walberg (1984, p. 23) computed an average correlation of 0.71 between various IQ measures and academic achievement. Deary, Strand, Smith, and Fernandes's (2007) large study of over 70,000 children in England estimated correlations around 0.7 between the latent ability trait, *g*, and total score or best 8 scores in the General Certificate for School Education. Duckworth, Quinn and Tsukayama (2012, p. 443) reported correlations of between 0.7 and 0.8 for IQ measured in grade 4, and grade 5 and 9 achievement tests. For New Zealand, the correlation between IQ at measured at ages 8 and 9 with academic performance at age 13 was 0.83 (Fergusson, Horwood, & Boden, 2008, p. 285). Kaufman, Reynolds, Liu, Kaufman, and McGrew (2012) calculated a mean correlation of 0.8 between latent factors of cognitive ability and student achievement.

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https://doi.org/10.1016/j.intell.2020.101511
Received 4 April 2020; Received in revised form 13 November 2020; Accepted 21 November 2020
Available online 25 December 2020

1.2. The intelligence critique

A recurring criticism of such studies is that they neglect the role played by socioeconomic background. A common argument is as follows: since socioeconomic background is the major influence on intelligence, then observed effects of intelligence are simply proxy effects for socioeconomic background. Therefore, if there were a more comprehensive or more accurate measure of socioeconomic background (SES) then the observed association with intelligence would disappear, or at least be substantially reduced (Hauser & Carter, 1995; Heckman, 1996, p. 1113; Korenman & Winship, 2000). This critique is partially correct: socioeconomic background can have some impact on intelligence. Obviously, severe economic deprivation is detrimental to cognitive development (Duncan, Brooks-Gunn, & Klebanov, 1994; Plomin & Deary, 2014). A substantial body of literature claims that there is a causal link between growing up in low income families and a range of negative impacts on children's lives beyond only academic achievement (e.g. Watson, Maitre and Whelan, 2012a,b). Low income is thought to have an impact on mental health, and emotional and behavioral outcomes (Duncan, Yeung, Brooks-Gunn, & Smith, 1998). Duncan et al. (1994) found that growing up in low income households was associated with greater levels of fear, anxiety and sadness, as well as bad temper and tantrums. Holzer, Schanzenbach, Duncan, and Ludwig (2008) linked childhood poverty with poorer self-regulation and attentional skills. Other studies conclude that children in low income families are more likely to display behavioral problems, problems in peer relations, as well as anti-social behavior and depression. Conduct problems and hyperactivity are linked to poorer economic circumstances (Richards, Garratt, & Heath, 2016).

1.3. Are there limits to "explaining intelligence away"?

The argument, however, that the effects of intelligence can be explained largely by socioeconomic background rests on several untenable assumptions. The first is that socioeconomic background is the major influence on intelligence. Two metastudies published in 1981 and 2016 indicate declining correlations between family socioeconomic status (SES) and offspring's intelligence from 0.33 to 0.22 (Harwell, Maeda, Bishop, & Xie, 2017, p. 208; White, 1982, p. 469). Proponents of the argument that intelligence effects are mere proxy effects for socioeconomic background disregard the significant correlation - ranging from 0.4 and 0.6 - between parents' abilities, and those of their biological children (Anger, 2012; Black, Devereux, & Salvanes, 2009; Grönqvist, Öckert, & Vlachos, 2017; Plomin, DeFries, Knopik, & Neiderhiser, 2013, p. 195). Furthermore, maternal ability is a more powerful predictor of children's test scores than SES (Carlson & Corcoran, 2001, p. 789). Anger and Heineck (2010) found that controlling for parental educational attainment and family background, there remained a 'very robust' link between the cognitive abilities of children and their parents, consistent with an "average correlation of 0.5 between parents and their offspring". (p. 1269).

The second untenable assumption is that genetics is not relevant in relation to intelligence. It is well-established that the heritability of intelligence is around 0.5 during childhood, increasing during adolescence (Bouchard Jr., 2013; Plomin & Deary, 2014). This finding is based on decades of twin and kinship studies. Genome-wide association tests (GWAS) have found genetic effects - identified by single-nucleotide polymorphisms (SNPs) – on intelligence, educational attainment and student achievement. (Allegrini et al., 2019; Lee et al., 2018). Hill et al. (2019) used multi-trait analysis of GWAS on a very large British sample to show that "the genes linked to differences in income are predominantly those that have previously been linked with intelligence, and that intelligence is one of the likely causal factors leading to differences in income" (p. 1).

This is linked to the final untenable assumption - that the effects of socioeconomic background are *causal*. They are likely, at least in part, to reflect the effects of parents' abilities. Strenze's (2007) meta-analysis found that an individual's intelligence measured during childhood or adolescence correlated with their later attainment in education (r = 0.56), occupational status (0.45) and family income (0.23). Rindermann and Ceci (2018) found that across 7 countries, and 19 sub-samples, that parental education was far more important than family wealth in predicting children's measured intelligence. Lemos, Almeida, and Colom (2011) conclude that the observed relationship between parents' education and intelligence is more likely to reflect the genetic transmission of intelligence rather than social processes typically associated with parent's education such as, more frequent reading to children, more books in the home, better parenting, more positive attitudes to education, etc.

There is a large body of prominent research and social commentary on student achievement that overlooks cognitive ability, and focuses on family income and socioeconomic background (Chmielewski, 2019; Chmielewski & Reardon, 2016; OECD, 2019; Reardon, 2011). The influential *Programme for International Student Assessment* (PISA) administered by the OECD (2016), relies heavily on a composite SES measure, Economic and Social and Cultural Status (ESCS) comprising parents' occupation and education, and many indicators of material, cultural and educational resources. In the paradigm of PISA, ESCS is seen as a powerful independent predictor of student achievement. Students who outdid their ESCS forecast - i.e. who overcame disadvantaged socio-economic origins by scoring well in PISA tests - are defined as 'resilient' students.

In the UK, politicians and senior civil servants maintain that "the primary determinant of how well (or badly) you do in life is class, not your talent or effort" (Saunders, 2019, pp. 3–19,14). *The Children's Society (UK)* links childhood poverty to academic underachievement, poor mental health, the experience of bullying, and adult unemployment. Wilkinson and Pickett's (2009) book linking greater household income inequality to a series of negative outcomes with data from several countries with children's educational levels, physical and mental health, social and family relations was a clear statement of exogenous influences bearing down on children's lives.

In Ireland, the prevailing view among politicians, academics and journalists is that SES inequalities pervade educational outcomes. In a newspaper interview in 2016, a leading educational sociologist in Ireland, and associate of the *Economic and Social Research Institute* (ESRI) linked poor academic ability and challenging classroom behaviours among children to their parents' lower income, and the parental inability to purchase educationally stimulating materials for the home. Harsher parenting, by economically stressed parents, was also linked to economic insecurity (quoted in June 13th, 2016 in The Irish Examiner, 'Poverty impacting children's ability to learn'). An ongoing Irish government initiative since 2005, DEIS, *Delivering Equality of Opportunity in Schools*, linked lower scores in reading and mathematics primarily to economic deprivation, and sought to address the problem by directing additional resources to schools in deprived areas. A 2019 parliamentary report on educational inequality and disadvantage in Ireland, twice made the claim that the association between social inequality/social class and educational outcome was causal: "Social class further impacts on children's educational attainment. At the end of primary school, children from higher professional backgrounds had a mean literacy score of 43 (out of a possible 50), those from semi- or un-skilled manual backgrounds had a score of 28, and those in households where neither parent was employed had a mean score of 25." (Houses of the Oireachtas, 2019; 5 and Appendix 3, section 3; 2).

1.4. The rationale for this study

This study examines the effects of SES measured by social class, household income and parental education vis-à-vis cognitive ability for a range of important educational and social outcomes measured several years later.

There are several advantages of this study compared to previous studies. First, the measure of cognitive ability is a standard cognitive ability test, the Drumcondra Reasoning Test (DRT). The widely relied-upon AFQT has been criticized as being a measure, not of intelligence, but of school achievement (Fischer et al., 1996, p. 56). Currie and Thomas (1999) suggest that AFQT scores are a better measure of family background than intelligence. Second, unlike the AFQT measure, DRT is measured at a single point in the educational career. A common criticism of Herrnstein and Murray's (1994) analyses is that AFQT score correlates highly ($r = 0.54$) with years of education at the time of testing (Fischer et al., 1996, p. 60), since it was collected from adolescents aged 16 to 22. Finally, in contrast to most studies of adolescents, the Irish dataset includes an accurate and household-size adjusted measure of family income. The overall aim of this study is to assess the veracity of the widespread belief that the educational and social outcomes of Irish adolescents can be attributed largely to SES, indicated here by social class, family income, and parental education.

2. Materials and method

2.1. Data

The Department of Health and Children in Ireland commissioned a large longitudinal study, *Growing Up in Ireland* (GUI) (Murray, McCrory, Thornton, Williams, & McQuail, 2011). The dataset analysed in this paper was produced from the cohort study that followed children from age 9 (wave 1), revisiting them at age 13 (wave 2), and most recently at age 16–18 (wave 3). The analysis reported here is mainly based on the data from waves 2 and 3.

The first wave surveyed a representative sample of 8568 children in late 2007 and early 2008, using schools as the primary sampling unit. The original sample was large comprising about 14% of all 9-year-olds in Ireland in 2007. Wave 2 data was collected in late 2011 and early 2012 comprised 7525 children, that is 88% of the original sample. Wave 3 administered in late 2015 and early 2016, comprised 6216 participants, 73% of the original cohort. The GUI collects data from the participating children, their primary and secondary caregivers, from the teachers in the child's school and from the school principal in relation to the school characteristics. The data collected includes standardised educational tests and school achievements, measures of cognitive ability, personality traits, household income and parental characteristics.

2.2. Analysis plan

The research goal was to estimate the effects of social class, household income, gender, cognitive ability, and parental education, assessed at age 13, on several important outcomes assessed mainly four years later, at age 17.

Three models were analysed. SPSS version 26 was used for data-analysis.

1. Model 1 entered social class differences, household income, gender and parental education as independent variables.
2. Model 2 entered cognitive ability based on the Drumcondra Reasoning Test (DRT) and gender.
3. Model 3 entered social class differences, household income, gender, parental education and cognitive ability.

Summary data for all non-categorical variables are presented in Appendix 1.

2.3. Independent variables

2.3.1. Cognitive ability

This was assessed in wave 2 when the child was aged approximately 13. The test used was the Drumcondra Reasoning Test (DRT), which assesses numerical, verbal and overall reasoning ability (Educational Research Centre or ERC, 1997). The DRT has been used in Irish schools for over 30 years, and examines a variety of abilities, such as the ability to understand, think and reason with words, and to reason with numbers and manipulate numerical relationships. The verbal subtest is based on synonyms, classifications, analogies and antonyms. Numerical ability is assessed by examining operation with numbers, relationships with numbers, sequential ordering and numerical abstractions. The DRT was standardised using data from approximately 6000 students in the Irish educational system, either at the end of the primary system, or commencement of the secondary school system. Its recommended administration time is 50 min. The answers are in a multiple-choice format. There are 40 items assessing verbal reasoning, and 40 items assessing numerical ability. A sample question assessing verbal reasoning is, "Which word is the odd one out? Terrify; Scare; Frighten; Argue". A sample numerical ability question is "Which number comes next after 1, 2, 4, 8, 16 …? 10; 20; 24; 32." In its usage for the GUI longitudinal survey, the administrators transformed the Drumcondra Numerical Reasoning and the Drumcondra Verbal Reasoning Ability scores into a single overall logit score. Scoring on individual items in the DRT are not provided in the survey dataset, so it was not possible to calculate measures of reliability.

2.3.2. Household income

The GUI survey coordinators provided a derived measure entitled, 'Equivalised household income'. This derived variable in euro per year was produced by the GUI study coordinators by calculating [disposable household income] = [total gross household income] - [statutory deductions of income tax + social insurance contributions]. Disposable household income was then divided by equivalised household size assigning a weight of 1 to the first adult in the household, a weight of 0.6 to each subsequent adult, and a weight of 0.33 to each child (see Quail, Williams, Thornton, & Murray, 2014: 26). The measure is a highly sensitive and discriminating one, with a mean of 17,986 euros, a median of 16,000 euros, and a standard deviation of 9613.7. 'Equivalised' means adjusting for household size and can be understood as the amount of disposable income per household member. It should be noted that the *Growing Up in Ireland* survey is carried out by the ESRI, Ireland's foremost research institute regarding measures of household income, and income equality. The measure of equivalized household income created, and commonly used, by the institute is the most accurate and robust measure of income for households in the country. In order to avoid distortions in any one year of household income, the data for household income in waves 1 and 2 were averaged then divided by 1000. As is common practice, average equivalized household income was logged to reduce the influence of very high incomes on the estimates. Logged Household income had a mean of 4.21, a median of 4.22, and a standard deviation of 0.20. and ranged from 3.44 to 5.14. The measure was available for 6039 respondents.

2.3.3. Social class

The GUI produces an assessment of the social class of each household based on the occupation of the adults. The original seven occupational groups for highest occupational status of either parent were reduced to four groups:

Professionals (9.4%), Managerial and technical (30.5%), White-collar (19.7%), Manual and other (40.3%). Simple dummy coding was used to create three dummy variables, contrasting professionals, managers and technicians, and routine white-collar employees with manual workers.

2.3.4. Parental education

The number of full-time years of education of both parents were summed and averaged. The exact number was available for the mother. However, fathers' level of educational attainment consisted of only four categories., These were recoded to 10 years of formal education

(12.9%), 14 years (62.7%), 18 years (21.3%) and 22 years (4.0%).

2.4. Dependent (outcome) measures assessed at age 17

2.4.1. Educational/cognitive measures

2.4.1.1. National exam. The overall outcome of a national standard academic examination, the Junior Certificate, typically taken at age 15/16, was used to measure academic achievement.

The Junior Certificate is an Irish national examination taken by virtually all Irish children after three years of secondary school, usually at age 15–16. It includes both mandatory and optional academic subjects, and typically a student takes 9 to 13 subjects. The examination is the culmination of three years of study of the various subjects, and the examination process consists of approximately two to three weeks of individual subject examinations at the end of the school year in June. Subjects may be taken at higher, ordinary or foundation level. At wave 3, almost all of the cohort had taken the examination and provided the study with their results. For reasons of anonymity, the grades achieved were collapsed into broad categories – A, B, or C, at Higher level, D at Higher level; A, B, or C, at Ordinary level, D at Ordinary level, A, B, or C, at Foundation level, D at Foundation. As in other analyses of the examination, (see Sofroniou, Shiel, & Cosgrove, 2000) the grades were placed on a 12 point scale per subject (with for example, A in Higher equal to 12 and D in Foundation equal to 1) and each participant had all their grades summed into a single standardised exam score. The loss of discrimination on individual grades, through clustering, means that the correlation between cognitive ability and examination result is almost certainly understated.

2.4.1.2. Verbal attainment aged 17. Wave 3 of the GUI included a test of verbal fluency attainment. This was based on two measures: a FAS score (the number of words that could be generated in one minute starting with either F, A or S) and an Animal Naming score (the numbers of animal species that could be named in one minute). This measure was used in another Irish longitudinal study, TILDA (see O'Regan, Cronin and Kenny, 2011), and its properties were discussed by Tombaugh, Kozak, and Rees (1999).

2.4.1.3. Vocabulary attainment. Wave 3 of the GUI included a test of vocabulary attainment. This test assessed vocabulary by providing a 20-item test where each item is followed by a list of five other words, and the task is to identify the word in the list of five that corresponds most closely in meaning to the original word. This measure was used in its longer format in the British Cohort Study (BCS, at age 16) and in its shorter 20-item version in the BCS, aged 42, see Sullivan and Brown (2013).

2.4.1.4. Numerical attainment. Wave 3 of the GUI included a test of numerical attainment. This test was based on combined performance in "three mathematical calculations" in basic arithmetic (see Murphy et al., 2018). Similar items were used in the BCS to assess numeracy aged 16, see Dodgeon, 2008.

2.4.2. Life difficulties measures

This sub-group of measures were all based on the very widely used Strengths and Difficulties Questionnaire (Goodman, 1997), completed by the Primary Caregiver (PCG) - almost always the mother – in relation to their child. The Strengths and Difficulties Questionnaire (SDQ) assesses young people's socio-emotional behavior. It has four subscales assessing negative outcomes, each a composite of four items.

1. SDQ-emotional – the SDQ subscale for assessed emotional difficulties.

Table 1
Correlation matrix of all non-categorical variables used in the regression analyses. R values, $P < 0.001$** Non-imputed data.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. DRT Cognitive Ability															
2. Log Household Income	0.28**														
3. Parental Education	0.29**	0.37**													
4. Examination result	0.53**	0.29**	0.29**												
5. Verbal aged 17	0.35**	0.16**	0.17**	0.24**											
6. Vocabulary aged 17	0.61**	0.22**	0.24**	0.37**	0.32										
7. Numerical aged 17	0.58**	0.21**	0.22**	0.41**	0.29**	0.41**									
8. SDQ – emotional difficulties	−0.18**	−0.11**	−0.12**	−0.15**	−0.11**	−0.10**	−0.22**								
9. SDQ – conduct difficulties	−0.17**	−0.10**	−0.08**	−0.19**	−0.09**	−0.15**	−0.16**	0.30**							
10. SDQ – hyperactivity	−0.27**	−0.09**	−0.11**	−0.33**	−0.10**	−0.22**	−0.23**	0.31**	0.49**						
11. SDQ – peer difficulties	−0.06**	−0.10**	−0.07**	−0.13**	−0.03	0.03	−0.09**	0.38**	0.23**	0.22**					
12. SDQ – total score	−0.26**	−0.14**	−0.14**	−0.30**	−0.12**	−0.17**	−0.26**	0.74**	0.67**	0.76**	0.61**				
13. Mother Admiration	0.11**	0.06**	0.02	0.11**	0.03	0.08**	−0.05	−0.04	−0.21**	−0.17**	−0.08**	−0.17**			
14. Primary Caregiver Stress	−0.09**	−0.05**	−0.01	−0.11**	−0.04	−0.08**	−0.11**	0.31**	0.38**	0.33**	0.22**	0.44**	−0.18**		
15. Trust in People	0.10**	0.08**	0.08**	0.10**	0.01	0.05	0.08**	−0.06**	−0.09**	−0.05**	−0.04	−0.08**	0.07**	−0.06**	
16. Satisfaction with life	0.11**	0.07**	0.05**	0.11**	0.03	0.04	0.12**	−0.24**	−0.16**	−0.14**	−0.18**	−0.25**	0.22**	−0.15**	0.11**

Note: DRT Cognitive Ability refers to the Drumcondra Reasoning Test, taken aged 13. Higher scores indicate greater cognitive ability. Log Household income is based on estimated household income averaged over two survey sweeps and logged. Verbal-17, Vocabulary-17 and Numerical-17 are assessments of the respondent aged 17 on three dimensions- higher measures indicate greater abilities. SDQ measures are derived from the Strengths and Difficulties Questionnaire. Mother Admiration is a composite measure assessing the level of admiration the respondent holds for their mother with higher scores indicating more admiration. Primary Caregiver Stress is a self-assessment of the respondent's primary care giver's feeling of stress. Trust in People is the respondent's assessment of their general level of trust in other people with higher scores indicating more trust. Satisfaction with Life is the respondent's assessment of their general life satisfaction with higher measures indicating more satisfaction.

Table 2
Social Class, Logged Household Income, Cognitive Ability, Gender, and Parental Education on measures of school attainment and abilities, and adjusted R squared as measure of the models' power. Imputed data, $N = 5,252$. Estimates for strength of individual variables based on the t value of their coefficient, pooled from ten imputed iterations.

	National Examinations			Verbal Fluency Measure, aged 17			Vocabulary Measure, aged 17			Numeracy Measure, aged 17		
	M1	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**	**M1**	**M2**	**M3**
Social Class1 Professional vs. Manual	3.43**	-	.30	3.99***	-	2.09*	5.19***	-	1.83	3.52***	-	.05
Social Class2 Manager vs. Manual	3.08**	-	1.59	1.66	-	.66	3.72***	-	2.14*	4.52***	-	3.11**
Social Class3 White-Col. vs. Manual	2.58*	-	.3.32**	-.92	-	-.74	-1.71	-	-1.58	-.12	-	.30
Logged Household Income	10.84***	-	7.89***	.4.97***	-	2.29*	6.60***	-	1.90	6.26***	-	1.70
Parent Education	12.06***	-	7.15***	5.59***	-	2.07*	9.49***	-	3.01**	7.57***	-	1.65
Gender	5.89***	10.16***	10.92***	-2.00*	1.21	1.43	-3.70***	2.62**	2.93**	-18.17***	-14.52***	-14.25***
Cognitive Ability Aged 13	-	39.86***	35.40***	-	26.14***	22.09***	-	50.47***	46.00***	-	48.61***	43.19***
Adjusted R Squared	*.163*	*.327*	*.368*	*.045*	*.128*	*.134*	*.098*	*.367*	*.383*	*.146*	*.385*	*.389*

Note: Dependent variables in the Table 2 are: National Examinations – a measure to reflect grades received in a national examination with the grades combined to create a single standardised score; Verbal Fluency Measure - a measure of verbal fluency taken at age 17; Vocabulary Measure – a measure of vocabulary richness taken at aged 17; and a numeracy measure - a measure of numerical ability taken aged 17.
The independent measures are Social Class1 (a dummy variable comparing children of professionals to a baseline of children of manual workers); Social Class2 - (a dummy variable comparing children of management workers to a baseline of children of manual workers); Social Class 3 (a dummy variable comparing children of white-collar workers to a baseline of children of manual workers); Logged Household Income – a measure of household income, averaged over two survey sweeps, and logged; Parental Education – a composite measure reflecting mother and father years in formal education; gender - with females coded higher than males -, and the cognitive ability measure based on the Drumcondra Reasoning Test taken aged 13.
* $P < 0.05$
** $P < 0.01$
*** $P < 0.001$

2. SDQ-conduct – the SDQ subscale assesses problems in the child's conduct.
3. SDQ-hyperactivity – the SDQ subscale for difficulties with hyperactivity.
4. SDQ-peer – the SDQ subscale for difficulties in peer relationships.
5. SDQ-total – the mean combination of the four negative sub-scales of the SDQ.

2.4.3. *Relationship measures*

1. Mother Admiration – the degree to which the young person indicated admiration for their mother was assessed on two five-point items.
2. Primary Caregiver Stress – the level of parental stress was assessed using the Parental Stress Scale (Berry and Jones, 1995). Higher scores indicate higher levels of stress in the primary caregiver.
3. Trust in people – The young person's general trust in others was assessed with a single item, ten-point scale – "generally speaking do you think people can be trusted", with scores ranging from very low trust (0) to very high trust (10).
4. Life satisfaction – general life satisfaction was assessed on a single item, ten-point scale, from not at all satisfied (0) to extremely satisfied (10).

3. Results

Although missing data numbers were generally low – averaging 260 cases per variable, or about 4.3% - imputation for missing data was employed. The 'Multiple Imputation' method (MI) tool in SPSS was employed, (Fully-conditional specification, Predictive Mean Matching) with 10 iterations or imputations generated for each of the measures. This led to the same 5252 cases being analysed for all the regression results, with the pooled outcomes reported, based on the ten iterations.

The correlation matrix for the continuous measures (non-imputed) is presented in Table 1 above. Cognitive ability is seen to be strongly associated with intellectual attainment, and the Pearson's r score for association to the national state exam score was 0.53. The correlations of vocabulary and numeracy scores with cognitive ability were higher still, (0.61, 0.58) but lower with verbal fluency lower (0.35). The correlations of the cognitive ability score to household income (logged) was 0.28, and to parental education was 0.29. Cognitive ability was moderately correlated with the overall SDQ score, (−0.26), and SDQ-hyperactivity difficulties subscale (−0.27), i.e. students with higher cognitive ability were reported to have less difficulties, particularly in relation to hyperactivity. Cognitive ability was only modestly linked to higher levels of 'admiration for mother' sub-scale, trust in people, and satisfaction with life, and very modestly negatively associated with stress levels among the primary caregiver. Household income (logged) was positively related to exam and intellectual attainment, but at levels lower than cognitive ability (exams = 0.29, verbal = 0.16, vocabulary = 0.22, numerical = 0.21). Income was also negatively related to adolescent difficulties, with the five measures all close to the very modest −0.1 association.

Weaker still were the correlates of income with relationship measures, though income was still significantly associated with more positive outcomes – more admiration for mother, less caregiver stress, more trust in people, more satisfaction in life. The correlates for parental education largely shadowed those of household income, with modest positive associations to attainments (exams = 0.29, verbal = 0.17, vocabulary = 0.24, and numerical = 0.22), very modest relationships to negative adolescent difficulties, i.e. less difficulties where parents had higher levels of education, but not significant for two of the relationship measures (mother admiration, and caregiver stress).

The multivariate results are presented in three regression tables. Table 2 presents the regression coefficients for the analyses of

Table 3
Social Class, Logged Household Income, Cognitive Ability, Gender, and Parental Education on Life Difficulties (SDQ measures), and adjusted R squared as measure of the models' power. Imputed data, $N = 5{,}252$. Estimates for strength of individual variables based on the t value of their coefficient, pooled from ten imputed iterations.

	SDQ – Emotional Difficulties			SDQ – Conduct Difficulties			SDQ - Hyperactivity			SDQ – Peer Problems			SDQ – Total		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3
Social Class Professional vs. Manual	-2.18*	-	-1.45	-1.33	-	-.38	-1.22	-	.54	.25	-	.46	-1.71	-	-.33
Social Class Manager vs. Manual	-2.35*	-	-1.97*	-1.41	-	-.92	-2.36*	-	-1.5	-2.96**	-	-2.84**	-3.25**	-	-2.57*
Social Class White-col. vs. Manual	1.33	-	1.26	0.00	-	-.11	1.13	-	.98	-.14	-	-.16	1.01	-	.88
Logged Household Income	-3.09**	-	-2.15*	-3.98***	-	-2.70**	-2.72**	-	-.44	-4.68***	-	-4.34***	-5.06***	-	-3.20**
Parent Education	-4.22***	-	-2.88**	-2.66***	-	-.87	-4.91***	-	-1.66	-1.42	-	-1.01	-5.11***	-	-2.50*
Gender	16.19***	15.03***	14.79***	-.69	-2.13*	-2.30*	-9.63***	-12.76***	-12.87***	-.04	-.09	-.40	2.20*	.12	-.19
Cognitive Ability Aged 13	-	-11.21***	-7.94***	-	-12.90***	-10.39***	-	-21.78***	-19.35***	-	-4.95***	-2.31*	-	-18.96***	-15.17***
Adjusted R Squared	*.076*	*.079*	*.087*	*.014*	*.032*	*.035*	*.031*	*.100*	*.100*	*.013*	*.005*	*.014*	*.035*	*.071*	*.079*

Note: Dependent variables in the Table 3 are based on the Strengths and Difficulties Questionnaire (SDQ). This provides assessments of the adolescent child by the primary caregiver, specifically on difficulties they are experiencing in the area of emotion, conduct, hyperactivity, peer relations, and a total combined score. Higher scores in each SDQ domain and overall indicate more difficulties.
The independent measures are Social Class1 (a dummy variable comparing children of professionals to a baseline of children of manual workers); Social Class2 - (a dummy variable comparing children of management workers to a baseline of children of manual workers); Social Class 3 (a dummy variable comparing children of white-collar workers to a baseline of children of manual workers); Logged Household Income – a measure of household income, averaged over two survey sweeps, and logged; Parental Education – a composite measure reflecting mother and father years in formal education; gender - with females coded higher than males -, and the cognitive ability measure based on the Drumcondra Reasoning Test taken aged 13.

* $P < 0.05$
** $P < 0.01$
*** $P < 0.001$

examinations performance, and verbal, vocabulary and numeracy attainment. These models used the following combinations as independent variables in a linear multiple regression.

Model 1 (M1): social class (three dummy-coded variables), logged mean household income, gender, and parental education.

Model 2 (M2): cognitive ability, captured by the DRT, and gender.

Model 3 (M3): social class, logged household income, gender, parental education, and cognitive ability.

In Table 2, the first dependent measure was performance on a national examination taken two to three years subsequent to the DRT measure. Estimates for strength of individual variable associations were based on the t value of their coefficient, pooled from ten imputed iterations. Positive t values indicate better exam performance is associated with higher levels of the independent measure. The data in model 1 show that exam performance was higher among children from professional, managerial and white collar workers compared to children of manual workers. Exam performance increased with household income and parental education, and was higher among girls compared to boys. Combined, these measures explained 16.3% 6 of variance. However, cognitive ability and gender explained almost 32.7% of the variance (model 2). Including all the independent variable measures in model 3, the variance explained increases to 36.8%. The addition of social class, family income and parental education only increased variance explained by 4%. Cognitive ability at age 13 had a very strong effect with a t value for its co-efficient of 39.86. The effects of SES were much smaller. The beta for parental education was 7.15 in model 3 compared to 12.06 in model 1. The pattern was similar for the three other dependent measures in Table 1. In each case, cognitive ability and gender together accounted for more variance than the SES variables and gender together. The beta coefficients of family income and parental education were far smaller than for cognitive ability. There were sizable gender differences. For the national examination, girls exhibited higher scores and for numeracy, boys had higher scores.

In Table 3, the dependent measures were the SDQ measures; with higher scores meaning greater difficulties. According to model three for the first dependent measure - SDQ-emotional difficulties – children from professional and managerial backgrounds had less emotional difficulties than children from manual backgrounds. Children from manual backgrounds had somewhat less difficulties, on average, than children from white-collar backgrounds. Greater emotional difficulties were reported among girls; and associated with lower parental education and lower cognitive ability. Overall, across the five SDQ measures, cognitive ability tended to explain more variance than the SES variables. Gender was important for hyperactivity, boys being more problematic. For the analyses in Table 3, the common pattern is that cognitive ability and gender accounted for more variation in the dependent variable than the SES variables plus gender, and the effects of cognitive decline only marginally with the addition of the SES variables. In contrast, the addition of cognitive ability (model 3) reduces the effects of the SES measures more substantially. The exception was 'peer problems' where the effects of household income and the difference between children from manager and manual households only marginally declined with the addition of cognitive ability.

Table 4 included four dependent measures. Higher scores indicated greater admiration of the child's mother, more stress of the primary caregiver, greater trust in people, and more satisfaction in life. Although overall, the adjusted R squared values were low, the consistently most powerful variable was cognitive ability which was significantly associated with more positive outcomes. Of the SES variables, only family income had significant, albeit small effects. For two of the four variables (mother admiration, satisfaction with life), model 2 - gender and cognitive ability – explained as much or almost as much variance, as model 3, in which all the social class measures are added. In other words, the addition of the SES measures did not increase the variance explained by cognitive ability and gender. Gender was important to mother admiration (girls more admiring of their mothers, than boys),

Table 4
Social Class, Logged Household Income, Cognitive Ability, Gender, and Parental Education on Relationships in Life, and adjusted R squared as measure of the models' power. Imputed data, $N = 5{,}252$. Estimates for strength of individual variables based on the t value of their coefficient, pooled from ten imputed iterations.

	Mother Admiration			Primary Caregiver (PCG) Stress			Trust in People			Satisfaction with Life		
	M1	M2	M3	M1	M2	M3	M1	M2	M3	M1	M2	M3
Social Class Professional vs. Manual	.74	-	.00	.07	-	.68	2.05*	-	1.62	.93	-	.39
Social Class Manager vs. Manual	.76	-	.38	.04	-	.35	-.91	-	-1.13	.57	-	.29
Social Class White Col. vs. Manual	1.33	-	1.42	-2.23*	-	-2.30*	-.93	-	-.89	.03	-	.09
Logged Household Income	2.77**	-	1.82	-2.99**	-	-2.19*	3.21**	-	2.61**	3.42**	-	2.67**
Parent Education	.14	-	-1.14	1.06	-	2.16*	2.97**	-	2.16*	1.05	-	.02
Gender	6.86***	7.94***	8.03***	.90	-.10	-.11	-1.98*	-1.35	-1.24	-3.18**	-2.36*	-2.25*
Cognitive Ability Aged 13	-	9.05***	7.72***	-	-6.55***	-6.12***	-	6.66***	4.63***	-	7.45***	5.94***
Adjusted R Squared	*.015*	*.026*	*.027*	*.004*	*.011*	*.013*	*.009*	*.010*	*.013*	*.009*	*.014*	*.016*

Note: Dependent variables in the Table 4 are: the Mother Admiration measure with higher scores indicating more admiration by the respondent for their mother; the Primary Caregiver Stress measure, a self-reported level of stress by the respondent's caregiver with higher levels indicating more stress; Trust in People is the respondent's assessment of their general level of trust in other people with higher scores indicating more trust, and Satisfaction with Life is the respondent's assessment of their general life satisfaction with higher measures indicating more satisfaction.
The independent measures are Social Class1 (a dummy variable comparing children of professionals to a baseline of children of manual workers); Social Class2 - (a dummy variable comparing children of management workers to a baseline of children of manual workers); Social Class 3 (a dummy variable comparing children of white-collar workers to a baseline of children of manual workers); Logged Household Income – a measure of household income, averaged over two survey sweeps, and logged; Parental Education – a composite measure reflecting mother and father years in formal education; gender - with females coded higher than males -, and the cognitive ability measure based on the Drumcondra Reasoning Test taken aged 13.
* $P < 0.05$
** $P < 0.01$
*** $P < 0.001$

and life satisfaction (boys more satisfied). For 'Primary Caregiver Stress' and 'Trust in People', there were effects for social class background with weaker effects for gender.

4. Discussion

4.1. Summary

The analysis focused on the effects of SES measured by social class, household income and parental education vis-à-vis cognitive ability on a range of adolescent outcomes in Ireland. Cognitive ability measured at age 13 had strong associations with educational, cognitive, life difficulties, and relationship outcomes. On the other hand, SES factors–family social class, household income, and parents' educational attainment–had much weaker effects with outcomes often considered strongly linked to SES.

4.2. Limitations

Some of the outcomes, such as the examination data, lacked discrimination. Others were measured only with a single survey item. There was an attrition of respondents in the longitudinal study which is a concern because they may be qualitatively different from respondents who remained in the study. However, the extent of attrition was small. The main goal was to compare the relative explanatory strengths of cognitive ability and SES for some important outcomes. SES is a complex concept, and there is no consensus for its specific measurement. While we attempted to account for the three most commonly used attributes – parental occupation, household income, and parental education – these were inevitably quite distinct in their measurement units. The household income measure was precise, highly discriminating and measured over two points in time. Parental education was a composite ordinal variable. Occupational class was incorporated in the analysis with three dummy-coded variables. It is impossible to claim with complete confidence that subtle variations in a construal like SES were fully captured by this approach. But there is no compelling evidence to indicate that a different set of SES measures would produce important variations from the findings reported here.

The data in the survey were gathered using clustered sampling, as non-clustered designs are impractical and prohibitively expensive. Clustered designs, however, have larger standard errors, and may underestimate true population variance, and introduce bias into analyses. This potential bias is a limitation for the Growing Up in Ireland survey. However, in this survey, the survey administrators provide weightings than can be applied to reduce this bias. In a technical document, the survey administrators (Thornton, Williams, McCrory, Murray, & Quail, 2011, pp. 22–24) provide the sample values, the true population values and the weighted values for fifteen key characteristics such as child sex, family structure, mother's age, school type etc. to demonstrate that the weighted sample recommended for analysis, and used in this paper, is well-balanced and representative in relation to the general population.

4.3. Correspondence with the literature

In the introduction, two approaches to different areas of life were outlined. The first emphasized cognitive ability and the second SES. The regression analyses presented here support the former approach over the latter – at least on the outcome measures analysed here.

It is commonly asserted that SES is the ultimate driver of both cognitive ability and student performance. Ritchie (2015) wrote "This is an argument that is regularly levelled at scientists studying intelligence … maybe it's not that IQ causes better [outcomes], but instead higher social class causes both better [outcomes] and higher IQ." (Ritchie, 2015; 45). However, the pattern of correlations does not support this explanation. For SES to account for the effects of cognitive ability, it would have to have stronger correlations with the outcomes than cognitive ability; a weaker relationship cannot explain stronger relationships. Furthermore, the SES measures correlate less strongly with most of outcomes than cognitive ability. Clearly the main effects of cognitive ability are powerful, and its effects mostly independent of SES variables.

Overall, these findings concur with careful reading of the empirical literature. While the assumption of strong SES effects for many outcomes is widespread, its associations with life outcomes tend to be rather

modest, often very small. When childhood SES and childhood IQ were compared as predictors of adult SES and educational or occupational attainment in three widely-cited large longitudinal studies (Staff, Hogan, & Whalley, 2017, Table 3; Cheng & Furnham, 2012, Fig. 2,; and Damian, Su, Shanahan, et al., 2014, Tables 3, 5, 6), the relative sizes of the coefficients for childhood IQ were in all cases far stronger than childhood SES. Even the modest SES 'effects' that are found may not be due to economic and cultural resources, but may, at least partly, reflect parental genes not encompassed by children's cognitive abilities, such as in non-cognitive traits like persistence and focus. Furthermore, the strong link between measured intelligence in childhood, seen in these findings, and later educational attainments corresponds with the estimates reported in Strenze's influential meta-analysis. The growing evidence that higher measured intelligence has positive outcomes beyond educational outcomes and into health outcomes (such as Deary's, 2009 analyses in cognitive epidemiology) and job performance (Ones, Dilchert, & Vivwesvaran, 2014) was complemented in this study by the finding of modest, but significant links between cognitive ability and, emotional and relationship variables, even where SES had been accounted for.

4.4. Conclusion

External factors such as household income and social class continue to dominate discussion of children's progress in life. Despite the counter evidence from many empirical studies, there is a widespread insistence among academics, researchers, and policymakers that the driving factor influencing the lives of young people is home financial resources. That many outcomes in children's lives emerge endogenously, from the child's own personality and ability, particularly cognitive ability, is not widely accepted. Imagine, as a thought experiment, that a typical group of contemporary social scientists was asked to estimate the likely influence of both cognitive ability and socio-economic background factors, assessed among early teen adolescents on key outcomes in the late teenage years. How many of them would put cognitive ability ahead of the social background factors? Probably few. More likely, most would propose a reversal of the patterns of the tables in this paper, and assign the preponderant impact to household income and social class. Hopefully, the findings from this study, and previous and ongoing research will prompt a reappraisal of these assumptions.

4.5. Data access note

The SPSS code used for the analysis is available from the first-listed author. The dataset, the Growing Up in Ireland Anonymised Microdata File (GUI-AMF), is freely available to all researchers, from the Irish Social Science Data Archive (ISSDA), https://www.ucd.ie/issda/.

Appendix A. Summary data for all non-categorical measures

Variable	N	Mean	Median	SD	Range	Min	Max
DRT Cognitive Ability	5713	−0.13	−0.19	0.91	5.32	−2.75	2.57
Log Household Income	6039	4.21	4.22	0.20	1.70	3.44	5.14
Parental Education	6025	14.27	14.00	3.12	15.00	8.00	23.00
Examination result	5592	−0.22	0.14	1.12	5.70	−3.42	2.29
Verbal aged 17	5968	21.48	21.00	5.76	29	10	39
Vocabulary aged 17	5929	8.68	8.00	3.29	15	2	17
Numerical aged 17	5968	2.34	2.00	1.26	4	0	4
SDQ – emotional	5961	2.01	1.00	2.12	10	0	10
SDQ – conduct	5961	1.04	1.00	1.33	10	0	10
SDQ – hyperactivity	5961	2.42	2.00	2.25	10	0	10
SDQ – peer	5961	1.43	1.00	1.48	10	0	10
SDQ – total	5961	6.89	6.00	5.08	33	0	33
Mother Admiration	5745	7.92	8.00	1.72	8	2	10
PCG Stress	5848	10.46	10.00	3.95	24	6	30
Trust	6029	5.02	5.00	2.43	9	1	10
Satisfaction	5940	7.20	8.00	2.12	10	0	10

Note: DRT Cognitive Ability refers to Drumcondra Reasoning Test, taken at age 13; Log Household Income is a measure of household income taken at two points in time, averaged, and logged; Parental Education – a composite measure reflecting mother and father years in formal education; National Examinations – a measure to reflect grades received in a national examination with the grades combined to create a single standardised score; Verbal Fluency Measure - a measure of verbal fluency taken at age 17; Vocabulary Measure – a measure of vocabulary richness taken at aged 17; and a numeracy measure - a measure of numerical ability taken aged 17; Strengths and Difficulties Questionnaire (SDQ). This provides assessments of the adolescent child by the primary caregiver, specifically on difficulties they are experiencing in the area of emotion, conduct, hyperactivity, peer relations, and a total combined score. Higher scores in each SDQ domain and overall indicate more difficulties; Mother Admiration measure with higher scores indicating more admiration by the respondent for their mother; the Primary Caregiver Stress measure, a self-reported level of stress by the respondent's caregiver with higher levels indicating more stress; Trust in People is the respondent's assessment of their general level of trust in other people with higher scores indicating more trust; and Satisfaction with Life is the respondent's assessment of their general life satisfaction.

References

Allegrini, A. G., Selzam, S., Rimfeld, K., von Stumm, S., Pingault, J. B., & Plomin, R. (2019). Genomic prediction of cognitive traits in childhood and adolescence. *Molecular Psychiatry, 24*(6), 819–827.

Anger, S. (2012). The intergenerational transmission of cognitive and non-cognitive skills during adolescence and young adulthood. In J. Ermisch, M. Jäntti, & T. M. Smeeding (Eds.), *From parents to children: The intergenerational transmission of advantage*. New York: Russell Sage Foundation.

Anger, S., & Heineck, G. (2010). Do smart parents raise smart children? The intergenerational transmission of cognitive abilities. *Journal of Population Economics, 23*, 1255–1282. https://doi.org/10.1007/s00148-009-0298-8.

Berry, J. O., & Jones, W. H. (1995). The parental stress scale: Initial psychometric evidence. *Journal of Social and Personal Relationships, 12*, 463–472. https://doi.org/10.1177/0265407595123009.

Black, S. E., Devereux, P. J., & Salvanes, K. G. (2009). Like father, like son? A note on the intergenerational transmission of IQ scores. *Economics Letters, 105*(1), 138–140. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-69549130591&partnerID=40.

Bouchard, T. J., Jr. (2013). The Wilson effect: The increase in heritability of IQ with age. *Twin Research and Human Genetics, 16*(5), 923–930. Retrieved from https://ezp.lib.unimelb.edu.au/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=edswsc&AN=000325833400001&site=eds-live&scope=site.

Boutwell, B. B., Meldrum, R. C., & Petkovsek, M. A. (2017). *Intelligence, 64*, 30–35. https://doi.org/10.1016/j.intell.2017.07.002.

Carlson, M. J., & Corcoran, M. E. (2001). Family structure and children's behavioral and cognitive outcomes. *Journal of Marriage and Family, 63*(3), 779–792. https://doi.org/10.1111/j.1741-3737.2001.00779.x.

Cheng, H., & Furnham, A. (2012). Childhood cognitive ability, education, and personality traits predict attainment in adult occupational prestige over 17 years. *Journal of Vocational Behavior, 81*, 218–226.
Chmielewski, A. K. (2019). The global increase in the socioeconomic achievement gap, 1964 to 2015. *American Sociological Review, 84*(3), 517–544. https://doi.org/10.1177/0003122419847165.
Chmielewski, A. K., & Reardon, S. F. (2016). Patterns of cross-national variation in the association between income and academic achievement. *AERA Open, 2*(3), 1–27.
Corgnet, B., Espín, A. M., Hernán-González, R., Kujal, P., & Rassenti, S. (2016). *Journal of Behavioral and Experimental Economics, 64*, 20–27. https://doi.org/10.1016/j.socec.2015.09.008.
Currie, J., & Thomas, D. (1999). The intergenerational transmission of "intelligence": Down the slippery slopes of The Bell Curve. *Industrial Relations, 38*(3), 297–330. Retrieved from <Go to ISI>://000081300200003.
Damian, R., Su, R., Shanahan, M., et al. (2014). Can personality traits and intelligence compensate for background disadvantage? Predicting status attainment in adulthood. *Journal of Personality and Social Psychology, 109*, 473–489.
Deary, I. J. (2009). Introduction to the special issue on cognitive epidemiology. *Intelligence, 37*, 517–519. https://doi.org/10.1016/j.intell.2009.05.001.
Deary, I. J. (2012). Intelligence. *Annual Review of Psychology, 63*, 453–482. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-82955169673&partnerID=40&md5=e7efef68e62f56512054216c91148a0b.
Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence, 35*, 13–21. https://doi.org/10.1016/j.intell.2006.02.001.
Dodgeon, B. (2008). *Guide to the dataset: BCS70 16 year follow up: APU arithmetic test*. London: Centre for Longitudinal Studies, Institute of Education.
Duckworth, A. L., Quinn, P. D., & Tsukayama, E. (2012). What no child left behind leaves behind: The roles of IQ and self-control in predicting standardized achievement test scores and report card grades. *Journal of Educational Psychology, 104*(2), 439–451. https://doi.org/10.1037/a0026280.
Duncan, G. J., Brooks-Gunn, J., & Klebanov, P. K. (1994). Economic deprivation and early childhood development. *Child Development, 65*(2), 296–318. https://doi.org/10.1111/j.1467- 8624.1994.tb00752.x.
Duncan, G. J., Yeung, W. J., Brooks-Gunn, J., & Smith, J. J. (1998). How much does childhood poverty affect the life chances of children? *American Sociological Review, 63*, 406–423.
Educational Research Centre. (1997). *Drumcondra reasoning test*. Dublin: Educational Research Centre, St Patrick's College.
Fergusson, D. M., Horwood, L. J., & Boden, J. M. (2008). The transmission of social inequality: Examination of the linkages between family socioeconomic status in childhood and educational achievement in young adulthood. *Research in Social Stratification and Mobility, 26*(3), 277–295. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-48749088986&partnerID=40.
Fergusson, D. M., Horwood, L. J., & Ridder, E. M. (2005). Show me the child at seven II: Childhood intelligence and later outcomes in adolescence and young adulthood. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 46*(8), 850–858. Retrieved from http://www.scopus.com/scopus/inward/record.url?eid=2-s2.0-27744460553&partner=40&rel=R5.0.4.
Fischer, C. S., Hout, M., Jankowski, M. S., Lucas, S. R., Swidler, A., & Voss, K. (1996). *Inequality by design: Cracking the bell curve myth*. Princeton: Princeton University Press.
Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry, 38*, 581–586. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x.
Grönqvist, E., Öckert, B., & Vlachos, J. (2017). The intergenerational transmission of cognitive and noncognitive abilities. *Journal of Human Resources, 52*(4), 887–918. https://doi.org/10.3368/jhr.52.4.0115- 6882R1.
Guo, Q., Sun, P., Cai, M., Zhang, X., & Song, K. (2019). Why are smarter individuals more prosocial? A study on the mediating roles of empathy and moral identity. *Intelligence, 75*, 1–8. https://doi.org/10.1016/j.intell.2019.02.00.
Harwell, M., Maeda, Y., Bishop, K., & Xie, A. (2017). The surprisingly modest relationship between SES and educational achievement. *Journal of Experimental Education, 85*(2), 197–214. https://doi.org/10.1080/00220973.2015.1123668.
Hauser, R. M., & Carter, W. Y. (1995). The bell curve: a perspective from sociology. *Focus, 17*(2).
Heckman, J. (1996). Lessons from the Bell Curve. *Journal of Political Economy, 103*(5), 1091–1120.
Herrnstein, R. J., & Murray, C. (1994). *The bell curve: Intelligence and class structure in American life*. New York: The Free Press.
Hill, W. D., et al. (2019). Genome-wide analysis identifies molecular systems and 149 genetic loci associated with income. *Nature Communications, 10*(5741), 1–16. https://doi.org/10.1038/s41467-019-13585-5.
Holzer, H., Schanzenbach, D. W., Duncan, G. J., & Ludwig, J. (2008). The economic costs of childhood poverty in the United States. *Journal of Children and Poverty, 14*, 41–61.
Houses of the Oireachtas. (2019). Joint Committee on Education and Skills Report on educational inequality and disadvantage, and barriers to education. https://data.oireachtas.ie/ie/oireachtas/committee/dail/32/joint_committee_on_education_and_skills/reports/2019/2019-06-05_report-on-education-inequality-disadvantage-and-barriers-to-education_en.pdf.
Kaukiainen, A., Björkqvist, K., Lagerspetz, K., Österman, K., Salmivalli, C., Rothberg, S., & Ahlbom, A. (1999). The relationships between social intelligence, empathy, and three types of aggression. *Aggressive Behavior, 25*, 81–89. https://doi.org/10.1002/(SICI)1098-2337(1999)25:23.0.CO;2-M.
Kaufman, S. B., Reynolds, M. R., Liu, X., Kaufman, A. S., & McGrew, K. S. (2012). Are cognitive g and academic achievement g one and the same g? An exploration on the Woodcock–Johnson and Kaufman tests. *Intelligence, 40*(2), 123–138. Retrieved from http://www.sciencedirect.com/science/article/pii/S0160289612000104.
Korenman, S., & Winship, C. (2000). A reanalysis of the bell curve: Intelligence, family, background and schools. In K. Arrow, S. Bowles, & S. Durlauf (Eds.), *Meritocracy and economic inequality* (pp. 137–178). Princeton: Princeton University Press.
Lee, J. J., et al. (2018). Gene discovery and polygenic prediction from a genome-wide association study of educational attainment in 1.1 million individuals. *Nature Genetics, 50*, 1112–1121. https://doi.org/10.1038/s41588-018-0147-3.
Lemos, G. C., Almeida, L. S., & Colom, R. (2011). Intelligence of adolescents is related to their parents' educational level but not to family income. *Personality and Individual Differences, 50*(7), 1062–1067. https://doi.org/10.1016/j.paid.2011.01.025.
Mears, D. P., & Cochran, J. C. (2013). What is the effect of IQ on offending? *Criminal Justice and Behavior, 40*, 1280–1300. https://doi.org/10.1177/0093854813485736.
Meldrum, R. C., Petkovesk, M. A., Boutwell, B. B., & Young, J. T. N. (2017). Reassessing the relationship between general intelligence and self-control in childhood. *Intelligence, 60*, 1–9. https://doi.org/10.1016/j.intell.2016.10.005.
Murray, A., McCrory, C., Thornton, M., Williams, J., & Quail, A. (2011). Growing Up in Ireland: Design, instrumentation and procedures for the child cohort. *Department of Health and Children. Dublin, Ireland*.
Murphy, D., Quail, A., Williams, J., Gallagher, S., Murray, A., McNamara, E., & O'Mahony, D. (2018). *A summary guide to wave 3 of growing up in Ireland's child cohort (at 17/18 years)*. Dublin, Ireland: Department of Health and Children.
OECD. (2016). *PISA 2015 results: Excellence and equity in education. 1*. Paris: Organisation for Economic Co-operation and Development.
OECD. (2019). *PISA 2018 results. 2*.
Ones, M., Dilchert, S., & Vivwesvaran, C. (2014). Cognitive abilities. In N. Schmitt (Ed.), *The Oxford handbook of personnel assessment and selection* (pp. 179–224). Oxford: Oxford University Press.
O'Regan, C., Cronin, H., & Kenny, R. A. (2011). Mental health and cognitive function. In *Fifty plus in Ireland 2011: First results from The Irish longitudinal study on ageing (TILDA)*. RCSI: e-publications@RCSI.
Plomin, R., & Deary, I. J. (2014). Genetics and intelligence differences: Five special findings. *Molecular Psychiatry, 20*, 98–108. https://doi.org/10.1038/mp.2014.105.
Plomin, R., DeFries, J. D., Knopik, V. S., & Neiderhiser, J. M. (2013). *Behavioral genetics* (6th ed.). New York: Worth Publishers.
Quail, A., Williams, J., Thornton, M., & Murray, A. (2014). *A summary guide to wave 2 of the child cohort (aged 13) of growing up in Ireland*. Dublin: The Stationery Office.
Reardon, S. F. (2011). The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. In G. J. Duncan, & R. Murnane (Eds.), *Whither opportunity? Rising inequality, schools, and children's life chances* (pp. 91–116). New York: Russell Sage Foundation.
Richards, L., Garratt, E., & Heath, A. (2016). *The childhood origins of social mobility: Socio-economic inequalities and changing opportunities*. London: Social Mobility Commission (UK).
Ritchie, S. (2015). *Intelligence. All that matters*. London: John Murray Learning.
Saunders, P. (2019). *Social mobility truths*. London: Civitas.
Silver, I. A., & Nedelec, J. L. (2018). Cognitive abilities and antisocial behavior in prison: A longitudinal assessment using a large state-wide sample of prisoners. *Intelligence, 71*, 17–31. https://doi.org/10.1016/j.intell.2018.09.004.
Silver, I. A. (2019). Linear and non-linear: An exploration of the variation in the functional form of verbal IQ and antisocial behavior as adolescents age into adulthood. *Intelligence, 76*, 1–14. https://doi.org/10.1016/j.intell.2019.101375.
Sofroniou, N., Shiel, G., & Cosgrove, J. (2000). Explaining performance on the junior certificate examination: A multilevel approach. *The Irish Journal of Education, 30*, 25–49.
Staff, R. T., Hogan, M. J., & Whalley, L. J. (2017). Childhood intelligence and personality traits neuroticism and openness contributes to social mobility. *Personality and Individual Differences, 114*, 206–212.
Strenze, T. (2007). Intelligence and socioeconomic success: A meta-analytic review of longitudinal research. *Intelligence, 35*(5), 401–426. Retrieved from http://www.scopus.com/scopus/inward/record.url?eid=2-s2.0-34547592375&partnerID=40.
Sullivan, A., & Brown, M. (2013). Social inequalities in cognitive scores at age 16: The role of reading. In *CLS Working Paper 2013/10*. London: Centre for Longitudinal Studies, Institute of Education.
Thornton, M., Williams, J., McCrory, C., Murray, A., & Quail, A. (2011). Sample design and response in wave one of the nine-year cohort of Growing Up in Ireland. Retrieved from https://www.ucd.ie/t4cms/GUI-SampleDesign9YearCohort.pdf.
Tombaugh, T. N., Kozak, J., & Rees, L. (1999). Normative data stratified by age and education for two measures of verbal fluency: FAS and animal naming. *Archives of Clinical Neuropsychology, 14*, 167–177. https://doi.org/10.1093/arclin/14.2.167.
Ttofi, M., Farrington, D. P., Piquero, A. R., Lösel, F., DeLisi, M., & Murray, J. (2016). Intelligence as a protective factor against offending: A meta-analytic review of prospective longitudinal studies. *Journal of Criminal Justice, 45*, 4–18. https://doi.org/10.1016/j.jcrimjus.2016.02.003.

Walberg, H. J. (1984). Improving the productivity of America's schools. *Educational Leadership, 41*(8), 19–27.

Watson, D., Maître, B., & Whelan, C. T. (2012a). Understanding childhood deprivation in Ireland. *Lenus. The Irish Health Repository*. https://www.lenus.ie/handle/10147/220796.

Watson, D., Maître, B., & Whelan, C. T. (2012b). *Social inclusion report no. 2: Understanding childhood deprivation in Ireland*. Ireland: Department of Social Protection/ESRI. Dublin.

White, K. R. (1982). The relationship between socio-economic status and academic achievement. *Psychological Bulletin, 91*(3), 461–481. https://doi.org/10.1037/0033-2909.91.3.461.

Wilkinson, R., & Pickett, K. (2009). *The Spirit level: Why more equal societies almost always do better*. London: Allen Lane.

Wraw, C., Der, G., Gale, C. R., & Deary, I. (2018). Intelligence in youth and health behaviours in middle age. *Intelligence, 69*, 71–86. https://doi.org/10.1016/j.intell.2018.04.005.