What role do students’ enjoyment and perception of ability play in social disparities in subject choices at university?

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ABSTRACT
Prior research has shown that students from less educated families are less likely to study both science, technology, engineering and mathematics (STEM) subjects and arts and humanities subjects. This article used a large representative sample of university students in England to explore the relationship between students’ enjoyment, perception of ability and socio-economic disparities in subject choices. Although these attitudes differed by students’ parents’ education level, and were associated with subject choices, disparities in choices persisted when accounting for these differences. Students with less educated parents were less likely to choose arts and humanities and more likely to study social sciences, law and business, over STEM, even when their enjoyment and perception of ability in subjects were similar. Students whose parents had higher levels of education were more likely to choose STEM over arts and humanities as their enjoyment of STEM increased, suggesting different underlying processes informing student choices by social background.

Introduction
Considerable research has outlined educational inequalities in the United Kingdom, and the mechanisms through which more advantaged families help their children to achieve higher levels of education (for example, Blanden and Gregg 2004; Blanden, Gregg, and Machin 2005; Bukodi et al. 2015; Goldthorpe and Mills 2008). This research has typically focused on vertical stratifications in education, of quantity of education and attainment differentials by students' background. With increasing access to university, relative quality of education, or the horizontal stratification within levels of education, is an increasingly important driver of the intergenerational transmission of advantage (Gerber and Cheung 2008). This article focuses on students’ choices of field of study within university, shown to be associated with family background (Codiroli Mcmaster 2017; Van de Werfhorst, Sullivan, and Cheung 2003).

Subject choices have strong implications for personal outcomes, including access to professional or higher paying occupations (Altonji, Kahn, and Speer 2016; Walker and Zhu 2011). They are also important for promoting an equitable society, which is compromised...
if students are stratified within education according to levels of advantage. Despite this, there remains limited research into the reasons for social background disparities in subject choices. In contrast, the mechanisms explaining gender segregation into subjects is a highly researched area, focusing primarily on the uneven distribution of personal traits that predict choices, including how much students enjoy subjects and their perceived ability in their chosen field (for example, Sheldrake, Mujtaba, and Reiss 2014; Eccles 1983). This study extends the current literature by analysing relationships between students’ attitudes, including their perception of ability and enjoyment of subjects, and subject choices at degree level.

Firstly, I consider whether differences in students’ attitudes towards subjects can explain socio-economic gaps in subject choices at university. Whilst students’ social background was associated with both subject studied at university and their attitudes at age 13–14 years, differences in choices remained even for young people with similar attitudes. These differences also persisted when controlling for prior educational attainment and qualifications. The study goes further by examining whether students’ attitudes are differentially associated with choices by students’ family background. This could signal different drivers of choice for students from different social backgrounds; for example, whether students are less likely to choose subjects they enjoy or think they are good at, depending on family circumstances. I find that students whose parents had higher levels of education were more likely to choose science, technology, engineering and mathematics (STEM) over arts and humanities as their enjoyment of STEM increased. Results are discussed with reference to the theoretical literature, and findings are contrasted with research into gender stratification into subjects.

**Literature review**

**Field of study and social background**

The literature on field of study in higher education has primarily considered a rather limited definition of subject choices, focusing on STEM subjects over all other subjects. This reflects the large gender disparities in uptake of these subjects, and a strong policy agenda in increasing participation in STEM (HM Government, 2017). The Higher Education Statistics Authority outlines key demographic characteristics associated with subject studied at university on a yearly basis, showing that socio-economic status (SES) disparities appear particularly large in science, engineering and technology (CaSE 2012).

These statistics do not, however, take into account attainment differences by students’ background (for example, The Royal Society 2008). In response to arguments that these disparities occur because higher attaining students are both more likely to study STEM and more likely to come from more advantaged families, a number of studies have explored the extent to which these disparities remain when accounting for differences in test scores. Van de Werfhorst, Sullivan, and Cheung (2003) analysed data from the 1958 National Childhood Development Study, showing that social class predicts participation in ‘prestigious’ subjects at university (i.e. medicine and law), even when attainment was taken into account. Focusing on science participation, Gorard, See, and Smith (2009) analysed data from the Pupil-level Annual Schools Census and the National Pupil Database, exposing a strong association between SES and participation in all levels of post-compulsory science. They point out that no suitable explanation has been put forward to fully account for this disparity. Recent research suggests that students whose parents are more highly educated are most likely to
study arts and humanities, and least likely to study social sciences, law and business (SLB) (Codiroli Mcmaster 2017).

There has been limited research into why these disparities in choices by social background occur. Whilst Gorard, See, and Davies (2012) point to a need for more robust evidence in the question of how student attitudes and beliefs drive post-compulsory participation, there is a rich evidence base suggesting that students’ perception of ability and enjoyment could be key in explaining students’ subject choices generally. In this article, I test whether differences in attitudes explain these disparities in subject choices. This hypothesised mechanism is illustrated in Figure 1.

**Perception of ability, enjoyment and subject choices**

The relationship between perception of ability and STEM study has been explored in some depth; defined as the extent to which students rate their own ability positively either overall or in specific tasks. STEM subjects are perceived to be particularly difficult, and students perceive science and mathematics study to only be suitable for naturally ‘brainy’ students (DeWitt, Archer, and Osborne 2013a). There is indeed evidence that science and mathematics are more difficult at A-level when comparing relative difficulty of achieving high grades (Coe et al. 2008), and this additional barrier to study may put off many students who could otherwise enjoy STEM but are not confident in their academic ability. Whilst perception of ability is strongly related to actual attainment, it also independently predicts subject choices and aspirations. Results from the Programme for International Student Assessment show that, across Organisation for Economic Co-operation and Development (OECD) countries, students’ self-efficacy beliefs in mathematical problem solving at age 15 years is strongly associated with science career aspirations (Schulz 2005). More recently, Sheldrake, Mujtaba, and Reiss (2014) show in a large longitudinal study that students’ ratings of their ability in mathematics predicted both General Certificate of Secondary Education (GCSE) (age 16 years) attainment and aspirations for future study. Students’ self-beliefs can also go some way to explaining gender disparities in subject choices (for example, Lyons and Quinn 2010). It is unclear whether perception of ability can explain disparities in choices along other student characteristics, which this article aims to address by looking directly at disparities by social background.

Along with perception of ability, Sheldrake, Mujtaba, and Reiss (2014) found intrinsic motivation to be key in aspirations for future mathematics study. Intrinsic motivation, or

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**Figure 1.** Representation of the hypothesis that students’ intrinsic motivations will explain differences in subject choices.
students’ inclination to study subjects based on personal reward and enjoyment, is an important factor in academic decisions. Whilst it seems that overall students do enjoy studying mathematics at the start of secondary school, there is considerable variation in preferences, and enjoyment appeared to be declining in line with future study aspirations from 2003 to 2007 (National Audit Office 2010). Where this relates to students’ family background is less clear.

The study of intrinsic motivations has strong roots in psychological literature. Eccles (1983) aimed to explain gender differences in uptake of science and mathematics by modelling psychological characteristics of students, and their subsequent choices. There has been extensive research into associations between subjective task-value and subject choice, finding consistently that task-value can go some way to explaining gender gaps (for example, Eccles, 2011; Eccles and Wigfield 2002). In contrast, as part of another longitudinal study into student aspirations with a focus on STEM (ASPIRES), DeWitt et al. (2013b) show that enjoyment of science and mathematics do not necessarily predict participation. However, little work focuses on SES, and research in this area was generally undertaken with students from more advantaged backgrounds.

**Different drivers of choice?**

Attitudes may also be differentially related to choices depending on students’ family circumstances. This possible moderation effect is illustrated in Figure 2. Cultural reproduction theory (Bourdieu 1984) and the theory of relative risk aversion (Breen and Goldthorpe 1997) offer some insight into differing processes underlying choice depending on students’ background. Cultural reproduction theories focus on cultural capital held by more advantaged families, including education, cultural knowledge and participation, and manner of speech and presentation. It appears that parents’ education specifically drives disparities in subject choices, as opposed to financial resources or social class (Codiroli Mcmaster 2017), and parents who have been to university may have more knowledge of the range of options available for students within university, and the career opportunities those options may lead to. They may also be more likely to encourage students in their interests through involvement in their education (Sacker, Schoon, and Bartley 2002; Sui-Chu and Willms 1996) and through promoting after-school activities that match their preferences (Lareau 2000).

![Figure 2](image.png)

*Figure 2.* Representation of the hypothesis that students’ intrinsic motivations have different relationships with subject choices depending on their backgrounds (moderation effect).
Researchers working on the ASPIRES project suggest that another form of capital, students’ science capital (the extent to which their families have knowledge of STEM, work in STEM careers themselves and encourage STEM participation), may account for participation disparities. Science capital is strongly associated with other forms of capital and students’ relative level of advantage (Archer et al. 2012). Students with more science capital are more likely to be knowledgeable about the range of career options after studying STEM, and to realise that skills learned from STEM degrees can be transferable to many different sectors and roles. This echoes Akerlof (1997), who argued that parents pass on knowledge of university systems. In respect to subject choices, parents appear to pass on knowledge of the value of studying particular subjects, and the relative advantages they may confer.

According to the model of relative risk aversion, people aspire to achieve social standing that is at least as good as their parents (Breen and Goldthorpe 1997), leading to lower educational aspirations if parents are not well educated themselves. Assuming students want to avoid downward social mobility, this may lead students from more advantaged backgrounds to aspire to more prestigious subjects, and to be more concerned with economic return to study over subjects they enjoy. Recent UK research suggests that students from higher income families are indeed more concerned with economic returns of university choices (Davies et al. 2013). For this to translate into more advantaged students choosing higher return subjects rests on the assumption that students have accurate understandings of returns to education (Botelho and Pinto 2004).

In contrast, considering the additional barriers students from less advantaged background face in the labour market (Crawford and Greaves 2015), more advantaged students may see university as a chance to study something they are interested in ‘for learning’s sake’, and to be more concerned with intrinsic rewards university study will bring over extrinsic rewards. In his 1974 book Education, Opportunity, and Social Inequality, Boudon outlined the differences between primary and secondary effects in education. Primary effects refer to attainment in school, which may influence subjects students can study, whilst secondary effects refer to choices made by students based on values and preferences passed down by parents (Boudon 1974; Girard and Bastide 1963). Boudon (1974) argues that secondary effects of social background on education arise from the fact that there are different benefits, and costs, to remaining in education depending on family resources. Whilst it is likely that the majority of students are somewhat concerned about job security and salaries upon graduation, this may be a more salient concern for students from less educated families, who have less of a ‘safety net’ provided by parents and family. They may not have access to professional networks, knowledge and/or financial capital to help enter more stable professions (particularly arts and humanities-focused jobs). In other words, there is a higher cost and lower benefit to obtaining a degree for less advantaged students, who may therefore be less concerned about choosing subjects they enjoy, and more concerned about selecting a subject with the highest possible return. This echoes some previous studies suggesting that students from higher SES backgrounds are more concerned with intrinsic, rather than extrinsic, rewards of higher education (Kohn and Schooler 1983; Mortimer, Lorence, and Kumka 1986).

In summary, previous literature tells us that students’ background is associated with subject choices, with students from more privileged backgrounds appearing to choose subjects that confer higher economic rewards and potentially entrenching their privilege. Another strand of research suggests that students’ attitudes and preferences strongly predict
choices, and can go a large way to explaining choice disparities by gender. This article brings together these distinct literatures to further understand the reasons for disparities in subject choices by family background. I test the hypothesis that differences in students’ choices are driven by differences in students’ personal attributes, specifically ratings of their own abilities and enjoyment in these subjects. I do this by looking at students’ choices of three groups of subjects: STEM; SLB; and arts and humanities. SLB subjects are distinguished from arts and humanities subjects because they offer very different occupational returns upon graduation and different students choose these subjects (Walker and Zhu 2013; Codiroli Mcmaster 2017).

Method

Participants

This article uses data from Next Steps, formerly the Longitudinal Study of Young People in England. This is a longitudinal panel study following over 15,000 students, which started in 2004 when students were 13–14 years old. The final wave of data used in this article was collected in 2010 when students were 18–19 years old. The data have been linked with the National Pupil Database, giving detailed information on students’ academic attainment across school years. Of the 8682 participants in wave seven, 3894 were studying for a degree at university; and of these, 3884 gave valid responses for the subject studied, and 3878 also gave valid responses for ethnicity and gender. Thus, the final analytical sample was 3878.

The longitudinal nature of the data allowed me to compare students’ characteristics and attitudes measured at age 13–14 years (in the first wave of data collection) with choices at age 18–19 years, eliminating the possibility that subject studied would influence reporting of characteristics or attitudes. For example, students who were studying STEM, or were in the process of applying to study STEM at university, may report enjoying science and mathematics because they were more actively engaged with the subjects.

As far as possible, Next Steps aimed to be representative of the population at the time, despite problems of attrition and non-response associated with longitudinal studies. This was achieved through initially sampling under-represented groups and those less likely to participate, including ‘boost samples’ of student groups with higher levels of attrition, and including sampling weights to better reflect the population. A full specification of sampling design, methods used and student characteristics included in the analytical weights can be found in the Longitudinal Study of Young People in England user guide (Department for Education 2011). Combined longitudinal and cross-sectional weights were used throughout the analysis (unless indicated otherwise).

Along with complete non-response, missing data were present on individual variables. Fewer than 10% of values were missing on each variable. However, because this was not confined to 10% of individuals, using complete case analysis would have reduced the sample whilst disposing of other useful information. More importantly, to only conduct analysis on participants with full responses would introduce bias into the analysis, as this requires the strong assumption that data are missing completely at random (Allison 2001). In other words that there are no characteristics associated with non-response on any particular items. Employing multiple imputation methods was recommended by Mostafa and Wiggins (2015) as an appropriate way to reduce bias caused by attrition and non-response in longitudinal...
surveys, whilst relaxing this assumption, and therefore missing data were imputed through chained equations with 20 datasets created. This method makes the more conservative assumption that data are missing at random; that the missingness can be accounted for by other observable variables in the model (data can still not be assumed to be missing not at random, because it is not possible to test whether missingness is associated with some unobserved or unmeasured differences between individuals). The method also gives advantages above other imputation methods (e.g. mean imputation) by not underestimating expected variation in responses, and giving more realistic standard error estimates (Little and Rubin 1987).

**Analytical strategy**

This article aims to address the following two research questions:

1. Do students’ enjoyment and perception of ability explain observed disparities in subject choice by student’s background?
2. Do these associations differ by students’ parents’ education level?

I first present descriptive statistics outlining the extent of differences in subject choices and attitudes towards STEM and English by students’ parents’ education level and students’ relative attitudes by subject choices. Examining the raw relationships between attitues, family background and subject choices is an important first step in informing my first research question. I go on to present a series of tables outlining the proportions of students studying each subject group at different levels of perception of ability and enjoyment in STEM and English, split by parents’ education level. This will go some way to answering my second research question: do associations between student’s attitudes and subject choices differ depending on their social background?

Raw comparisons of proportions of students studying each subject can give some indication of disparities in participation; however, they do not give the full picture since student characteristics are highly correlated with one another, and also with prior achievement in school. For example, students’ ethnicity and social background are both highly correlated, and associated with choices in different ways. In consideration of this, and to more fully address my research questions, I use multinomial logistic regression methods. The regression models are built up in four stages with increasing levels of complexity, described in detail in the Results section.

**Measures and descriptive statistics**

**Subject choice**

In the English education system, students begin choosing subjects at around age 14 years (when studying for GCSE examinations). At this stage they will be required to study a set of compulsory subjects, including mathematics, science and English, but can choose from a range of other subjects. At age 16 years, when students aspiring to attend university choose subjects for Advanced-level qualifications (A-levels) or equivalent, choices are further refined and there are no compulsory subjects. On application to university, students typically choose one subject to focus on in depth. Disparities in subject choices by social background...
have been observed at all of these educational stages (Anders et al., 2018; Codiroli Mcmaster 2017).

Subject choices were split into three groups, reflecting differences in future outcomes, including job prospects and average salaries upon graduation (see Walker and Zhu 2013). The subject groups included were arts and humanities, STEM and SLB subjects. Recent data collected from the Destination of Leavers from Higher Education show that 83% of STEM graduates were in professional occupations six months after graduation, compared with 70% of SLB graduates and 64% of arts and humanities graduates, in 2015/16. Table 1 presents subjects included in each group, and the proportions of students choosing each group of subjects in the current sample.

There is some disagreement about whether medicine and allied subjects should be included in the STEM grouping in the current literature. This article follows recent research (for example, Botcherby and Buckner 2012; Equality Challenge Unit 2016) in including these subjects under STEM for three reasons. Firstly, social class disparities in uptake of medicine are large (Equality Challenge Unit 2016; van de Werfhorst, Sullivan, and Cheung 2003) and the focus of this article is family background disparities. Second, the subjects clearly have a strong science component and require some specialisation in science before entry. Finally, the article aims to speak to policy concerns regarding lower uptake of key subjects, and it is of clear policy relevance to also focus on uptake of medical sciences. SLB subjects are also considered separately, as compared to arts and humanities, because they offer higher returns upon graduation (Walker and Zhu 2013).

**Explanatory variables**

**Student characteristics.** The focal measure of family background in this study is parents’ highest qualification. This follows prior research showing that parents’ education has the strongest association with subject choices when compared with social class and financial resources (Codiroli Mcmaster 2017). The qualification of the parent with the highest

| Table 1. Subjects included in groupings, and proportions of students studying each group of subjects. |
|-------------------------------|-------------------------------------------------|---------------|-----------------|
| Subject choice              | Subjects                                           | Proportion of students (%) | Unweighted N<sup>a</sup> |
|-----------------------------|---------------------------------------------------|-----------------------------|---------------------------|
| Arts and humanities         | Architecture, Building and planning, Linguistics, European language, Eastern literature, History and philosophy, Creative arts, Education | 37                          | 1252                     |
| STEM                        | Medicine and dentistry, Subjects allied to medicine, Biological sciences, Veterinary sciences, Agriculture and related, Physical sciences, Mathematical and computer sciences, Engineering and technologies | 38                          | 1482                     |
| SLB                         | Social sciences, Law, Business and administration studies | 25                          | 1144                     |

<sup>a</sup>Because proportions are weighted and numbers are not, they do not match.
education level (or only parent) was used in the analysis. Students were split into three groups: those whose parents had a degree or higher qualification (35%); those whose parents had A-levels, some higher education or equivalent (36%); and those whose parents were educated to GCSE level or below (29%). This was taken from wave one interviews with parents, at the same time as students’ reports of enjoyment and perception of ability in subjects. Students’ ethnicity (white, mixed ethnicity, Indian, Pakistani, Bangladeshi, black African, black Caribbean or other ethnicity) and gender were also included in all analysis.

Figure 3 shows the raw relationship between students’ parents’ education level and subject choices. Students whose parents were better educated were most likely to choose either STEM or arts and humanities subjects, and least likely to choose SLB subjects.

**Enjoyment and perception of ability.** Enjoyment of STEM was defined by combining two variables: ‘How much do you like or dislike this subject: maths?’ and ‘How much do you like or dislike this subject: science?’. For enjoyment of English, students were asked ‘How much do you like or dislike this subject: English?’. Ratings were on a Likert scale from one to four, with one indicating ‘like a lot’ and four indicating ‘don’t like at all’. Scores were reversed, so a high score indicates high enjoyment of each subject. Attitudes towards mathematics and science were combined to reflect the fact that the choice of studying mathematics and science was combined in the outcome measure. Perception of ability in STEM was defined by combining scores for the questions ‘How good or bad [are you] at this subject: maths?’ and ‘How good or bad [are you] at this subject: science?’ For English, students were asked ‘How good or bad [are you] at this subject: English?’ Ratings were also on a Likert scale from one to four, with one indicating ‘very good’ and four indicating ‘very bad’. For the final variable, high scores indicated high perception of ability. These traits were measured in the first waves of data collection, when students were 13–14 years old.

Figures 4 and 5 show how students’ enjoyment of and perception of ability in STEM and English differ by parents’ education level and by the subjects they study at university.
Students whose parents are highly educated are most likely to say they are good at STEM and English, and (to a lesser extent) to say they enjoy science, mathematics and English. Students studying STEM subjects at university were most likely to say they were good at, and enjoyed, science and mathematics at age 13–14 years, whilst those who choose arts and humanities were most likely to have said they were good at and enjoyed English at school.

Prior attainment and qualification type. Students’ prior attainment measured at Key Stage (KS) 2 and KS4 (GCSEs) are included as controls in the analysis. KS2 point scores in mathematics, science and English are included separately to acknowledge expected differing associations between achievement and choice across the three subjects. Due to data restric-
tions, GCSE scores could not be included as separate subjects, so capped overall scores are included. Attainment at A-level (or equivalent) was not included in consideration of the fact that the difficulty of subjects differs, and students would have taken very different profiles of subjects (with different levels of difficulty) depending on the subject group they aspired to study at university. Type of qualification, however, was included, coded as A-level or ‘other qualification’. Eighty-four per cent of young people attending university had studied A-levels. The remaining qualification types were combined to retain sample sizes, but primarily include more vocationally oriented qualifications (e.g. Business Technology Education Council qualifications).

All continuous measures were standardised with a mean of zero and standard deviation of one.

**Interactions between students’ enjoyment, perception of ability and social background**

Figures 6–9 illustrate how associations between attitudes and subject choices differ by parental education, with each line representing students whose parents have a different level of education. Students are split into three equal-sized groups (low, medium or high) according to their perception of ability or enjoyment in STEM and English in relation to their peers. The vertical axis represents the proportions of students studying the select subject groups. Where lines diverge, differences in subject choices by social background are observed. Where lines are not parallel, interactions between social background and attitudes are observed. Overall, the results suggest that students whose parents have a degree are more likely to be driven by how good they think they are and how much they enjoy STEM or English when making subject choices, compared to students whose parents have lower levels of education.

Figures 6 and 7 compare the proportions of students studying each subject group by their perception of ability and enjoyment of STEM. For choice of arts and humanities subjects, students of different social backgrounds who think they are good at or enjoy STEM are more alike in their choices (in this case with lower proportions choosing arts and humanities). Differences in choices appear larger for students who do not think they are good at or like STEM. For choice of STEM subjects, a similar interaction is observed in the opposite direction. As students’ perception of ability and enjoyment of STEM increases, the social gradient in choices increases. There does not appear to be a consistent interaction concerning SLB subjects and perception of ability. However, as enjoyment of STEM subjects increases, students whose parents have a degree or higher are increasingly less likely to study SLB compared to students whose parents have lower levels of education.

Figures 8 and 9 show that similar interactions are also observed for perception of ability and enjoyment of English. Overall, the associations between attitudes and choice of arts and humanities or STEM subjects are stronger for students whose parents have higher levels of education. These patterns are again not observed for choice of SLB subjects.

In the Introduction I discussed possible directions of interactions suggested by the theory of relative risk aversion. According to the theory, students from more advantaged backgrounds would be more likely to choose subjects that had higher occupational returns in
Figure 6. Proportion of students studying each group of subjects by perception of ability in STEM, split by parents’ education. Note: HE, higher education.

Figure 7. Proportion of students studying each group of subjects by enjoyment of STEM, split by parents’ education. Note: HE, higher education.

Figure 8. Proportion of students studying each group of subjects by perception of ability in English, split by parents’ education. Note: HE, higher education.

Figure 9. Proportion of students studying each group of subjects by enjoyment of English, split by parents’ education. Note: HE, higher education.
aiming to avoid downward mobility, and less likely to choose subjects based on intrinsic motivations. In contrast, students from less advantaged backgrounds are already achieving upward mobility simply by attending university. The results suggest that students whose parents are more educated are most likely to choose subjects for intrinsic reasons, contrary to what would be expected if the theory of relative risk aversion was applicable to subject choices.

Given that the main driver of disparities is parents' education level specifically, rather than social class or family income, an alternative interpretation is that parents' education more directly impacts the strength of associations. The literature suggests more educated parents are better able to foster students' interests and perceived strengths, and push them in the direction of subjects that suit their individual preferences (Sacker, Schoon, and Bartley 2002; Sui-Chu and Willms 1996; Lareau 2000). This explanation would account for the fact that the results run counter to what would be expected given the theory of relative risk aversion.

The results are, however, in line with Boudon's (1974) arguments about the different costs and benefits to higher education, which may then lead to different drivers behind these decisions. Whilst there is greater chance of occupational success upon graduation for students who study STEM or SLB, more advantaged students may also expect a level of success from studying arts and humanities, with their less advantaged peers facing more barriers upon graduation in these particular subjects. For example, they will have more access to well-educated networks that can offer advice and guidance in applications and work experience. Their parents will also be more able to support them financially through periods of worklessness or unpaid internships. Further, their increased cultural capital may help them indirectly, and be particularly useful when applying for and attending interviews for jobs in arts and humanities. This could thus explain why students from more advantaged backgrounds are more inclined to study subjects for 'enjoyments sake' and worry less about employability upon graduation.

These figures show a consistent picture of differences in associations between students' attitudes and choices by their background. In the next stage of the analysis I go on to test whether relationships remain when controlling for other factors, including prior attainment.

**Regression results**

**Raw model**
The first multinomial logistic regression model aimed to test the 'raw' association between parents' education level and subject choices; with ethnicity, gender and other family background characteristics controlled. Consistent with prior research, the relative risk ratios presented in Table 2 illustrate that students whose parents have higher levels of education are more likely to choose STEM over SLB subjects at university. Students with less educated parents were just under 50% more likely to choose SLB subjects than STEM subjects, compared with students whose parents had a degree or higher qualification.

**Attitudes, prior attainment and qualifications**
The second and third models additionally control for academic attainment and attitudes. The introduction of these variables aims to answer my first research question: do students' enjoyment and perception of ability explain observed disparities in subject choices by
Table 2. Multinomial logistic regressions showing students' odds of studying arts and humanities, or SLB, over STEM subjects at university.

| Subject choice (reference: STEM) | Artsc and humanities | All prior attainment and qualifications | Interactions | SLB | Attitudes and Ks2 attainment | All prior attainment and qualifications | Interactions |
|----------------------------------|----------------------|----------------------------------------|--------------|-----|-------------------------------|----------------------------------------|--------------|
|                                  | Raw                  | Attitudes and KS2 attainment            | Interactions |     | Raw                          | Attitudes and KS2 attainment            | Interactions |
| Parents' education (reference: degree) |                      |                                        |              |     |                              |                                        |              |
| HE or A-levels                   | 1.034                | 0.958                                  | 0.872        | 0.881 | 1.511***                     | 1.439***                                | 1.294**      | 1.254 |
|                                  | (0.109)              | (0.107)                                | (0.101)      | (0.113) | (0.188)                      | (0.182)                                | (0.168)      | (0.176) |
| GCSE or lower                    | 0.965                | 0.822                                  | 0.726**      | 0.721** | 1.461***                     | 1.310*                                  | 1.141        | 1.074 |
|                                  | (0.114)              | (0.103)                                | (0.0947)     | (0.103) | (0.193)                      | (0.182)                                | (0.162)      | (0.166) |
| Attitudes towards subjects       |                      |                                        |              |     |                              |                                        |              |
| How good at STEM                 | 0.716***             | 0.737***                               | 0.705***     | 0.843** | 0.869**                      | 0.911                                  |              |       |
|                                  | (0.0455)             | (0.0474)                               | (0.0795)     | (0.0577) | (0.0601)                     | (0.115)                                |              |       |
| Enjoy STEM                       | 0.740***             | 0.751***                               | 0.642***     | 0.695*** | 0.706***                     | 0.617***                                |              |       |
|                                  | (0.0432)             | (0.0445)                               | (0.0676)     | (0.0444) | (0.0456)                     | (0.0755)                                |              |       |
| How good at English              | 1.398***             | 1.435***                               | 1.553***     | 1.131* | 1.611**                      | 1.200                                  |              |       |
|                                  | (0.0867)             | (0.0896)                               | (0.172)      | (0.0722) | (0.0742)                     | (0.146)                                |              |       |
| Enjoy English                    | 1.117*               | 1.127**                                | 1.172        | 1.014 | 1.020                        | 1.068                                  |              |       |
|                                  | (0.0659)             | (0.0676)                               | (0.135)      | (0.0589) | (0.0599)                     | (0.122)                                |              |       |
| Parents' education × STEM attitudes |                      |                                        |              |     |                              |                                        |              |
| Degree × enjoy STEM              |                      |                                        |              |     |                              |                                        |              |
| HE or A-levels × enjoy STEM      | 1.199                |                                        |              |     |                              |                                        |              |
|                                  | (0.182)              |                                        |              |     |                              |                                        |              |
| GCSE or lower × enjoy STEM       | 0.922                |                                        |              |     |                              |                                        |              |
|                                  | (0.156)              |                                        |              |     |                              |                                        |              |
| Degree × enjoy English           |                      |                                        |              |     |                              |                                        |              |
| HE or A-levels × enjoy English   | 1.140                |                                        |              |     |                              |                                        |              |
|                                  | (0.163)              |                                        |              |     |                              |                                        |              |
| GCSE or lower × enjoy English    | 1.495***             |                                        |              |     |                              |                                        |              |
|                                  | (0.229)              |                                        |              |     |                              |                                        |              |
| Parents' education × English attitudes |                    |                                        |              |     |                              |                                        |              |
| Degree × good at English         |                      |                                        |              |     |                              |                                        |              |
| HE or A-levels × good at English | 0.874                |                                        |              |     |                              |                                        |              |
|                                  | (0.132)              |                                        |              |     |                              |                                        |              |
| GCSE or lower × good at English  | 0.894                |                                        |              |     |                              |                                        |              |
|                                  | (0.144)              |                                        |              |     |                              |                                        |              |
| Degree × enjoy English           |                      |                                        |              |     |                              |                                        |              |
| HE or A-levels × enjoy English   | 0.921                |                                        |              |     |                              |                                        |              |
|                                  | (0.138)              |                                        |              |     |                              |                                        |              |
| GCSE or lower × enjoy English    | 0.964                |                                        |              |     |                              |                                        |              |
|                                  | (0.153)              |                                        |              |     |                              |                                        |              |
|                          |          |          |          |          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Controls                 |          |          |          |          |          |          |          |          |
| Female                   | 1.585*** | 1.082    | 1.139    | 1.135    | 1.196*   | 0.927    | 0.988    | 0.996    |
|                          | (0.139)  | (0.103)  | (0.111)  | (0.111)  | (0.114)  | (0.0972) | (0.106)  | (0.107)  |
| Ethnicity (reference: white) |          |          |          |          |          |          |          |          |
| Mixed                    | 1.014    | 1.085    | 1.099    | 1.124    | 1.303    | 1.345    | 1.366    | 1.361    |
|                          | (0.247)  | (0.280)  | (0.300)  | (0.309)  | (0.356)  | (0.379)  | (0.389)  | (0.390)  |
| Indian                   | 0.438*** | 0.462*** | 0.463*** | 0.461*** | 1.535*** | 1.594*** | 1.596*** | 1.628*** |
|                          | (0.0759) | (0.0876) | (0.0883) | (0.0885) | (0.219)  | (0.244)  | (0.250)  | (0.253)  |
| Pakistani                | 0.245*** | 0.247*** | 0.244*** | 0.233*** | 1.457*   | 1.545**  | 1.519**  | 1.518**  |
|                          | (0.0617) | (0.0598) | (0.0601) | (0.0570) | (0.283)  | (0.297)  | (0.295)  | (0.294)  |
| Bangladeshi              | 0.492*** | 0.485*** | 0.486*** | 0.473*** | 1.693*** | 1.760*** | 1.747*** | 1.728*** |
|                          | (0.121)  | (0.120)  | (0.124)  | (0.118)  | (0.328)  | (0.374)  | (0.363)  | (0.350)  |
| Black Caribbean          | 0.847    | 0.642    | 0.604    | 0.609    | 1.339    | 1.200    | 1.125    | 1.178    |
|                          | (0.304)  | (0.280)  | (0.262)  | (0.263)  | (0.475)  | (0.455)  | (0.420)  | (0.432)  |
| Black African            | 0.774    | 0.664    | 0.672    | 0.651    | 2.151*** | 2.117*** | 2.164*** | 2.100*** |
|                          | (0.196)  | (0.176)  | (0.183)  | (0.176)  | (0.487)  | (0.511)  | (0.542)  | (0.524)  |
| Other                    | 0.383*** | 0.405*** | 0.423*** | 0.413*** | 0.844    | 0.938    | 1.001    | 1.000    |
|                          | (0.117)  | (0.131)  | (0.138)  | (0.139)  | (0.226)  | (0.256)  | (0.277)  | (0.278)  |
| Independent school       | 0.896    | 0.671**  | 0.752*   | 0.764    | 1.058    | 0.909    | 1.016    | 1.015    |
|                          | (0.139)  | (0.111)  | (0.130)  | (0.135)  | (0.192)  | (0.171)  | (0.197)  | (0.198)  |
| Academic attainment      |          |          |          |          |          |          |          |          |
| GCSE (overall capped score) | 0.739**  | 0.737**  | 0.739**  | 0.667*** | 0.668*** |
|                          | (0.110)  | (0.110)  | (0.110)  | (0.0996) | (0.0998) |
| KS2 mathematics score    | 0.735*** | 0.789**  | 0.784**  | 0.900    | 1.075    | 1.081    |
|                          | (0.0684) | (0.0754) | (0.0753) | (0.100)  | (0.114)  | (0.115)  |
| KS2 science score        | 0.946    | 0.973    | 0.973    | 0.797**  | 0.827*   | 0.820*   |
|                          | (0.100)  | (0.105)  | (0.106)  | (0.0887) | (0.0923) | (0.0918) |
| KS2 English score        | 1.027    | 1.123    | 1.146    | 1.031    | 1.143    | 1.145    |
|                          | (0.106)  | (0.121)  | (0.123)  | (0.109)  | (0.129)  | (0.129)  |
| Studied A-levels         | 1.235    | 1.235    | 1.235    | 1.400**  | 1.382**  |
|                          | (0.183)  | (0.184)  | (0.184)  | (0.209)  | (0.207)  |
| Attending a Russell Group university | 0.592*** | 0.593*** | 0.592*** | 0.552*** | 0.552*** |
|                          | (0.0694) | (0.0706) | (0.0713) | (0.0719) | (0.0719) |

Note: Relative risk ratios are shown with standard errors in parentheses. HE, higher education.

*Other family background characteristics were included in the initial analysis to ensure that parents' education was the main driver of choices, and that coefficients did not change substantially if they were added as controls. These included National Statistics Socio-economic Classification (NS-SEC) (highest of both parents), housing tenure and how well the family reported managing on finances. None were independently associated with subject choices, nor did they substantively impact results. Thus, the more parsimonious regression models are presented in this article.

*p < 0.10, **p < 0.05, ***p < 0.0.
student’s background? For students with similar academic attainment, enjoyment and perception of ability, only students whose parents have intermediate levels of education remain more likely to choose SLB over STEM, compared with students whose parents have high levels of education. The difference in choices between STEM and SLB subjects for students with the lowest and highest levels of education is no longer statistically significant. The relationship between social background and choice of arts and humanities over STEM subjects, however, becomes statistically significant when controlling for GCSE scores. This suggests that academic attainment, particularly attainment at age 16 years, is a stronger push factor for studying STEM subjects instead of arts and humanities for less advantaged students.

Students’ perception of ability and enjoyment of subjects did indeed predict university choices over and above their relationships with prior attainment. Attitudes are standardised so relative risk ratios represent change in propensity to study arts and humanities or SLB, over STEM, with one standard deviation increase in the corresponding indicator. Students studying arts and humanities subjects rated themselves as less able in mathematics and science, and more able in English, at age 13/14 years than their peers who chose STEM subjects. They also said that they enjoyed mathematics and science less, and although they enjoyed English more this relationship was only significant at the 10% level. Students who chose SLB subjects also thought they were less able in mathematics and science than students who chose to study STEM, but they enjoyed these subjects more and enjoyed studying English less.

The profile of students studying arts and humanities over STEM subjects indicated by the models is not surprising. It includes students who, relative to their peers, think they are good at English, and are both less able at STEM and do not enjoy the subjects as much. In contrast, the profile of students studying SLB subjects over STEM offers some interesting insights into student choices. Compared to their peers, they seem to enjoy mathematics and science, but do not see themselves as good at the subjects, and come from families with intermediate levels of education. It is perhaps the case that these students were put off by the perception that mathematics and sciences are particularly difficult subjects, and thus chose subjects that may have some STEM content but are seen as more accessible regardless of ability. That these relationships are observed for students with similar academic ability indicates that students’ perception of their ability, over and above that informed by their actual test scores, is driving their choices.

In model three I additionally include an indicator for whether students studied A-levels, or alternative examinations, pre university entry. Whilst the majority of university students in the sample studied A-levels, in the UK education system students who are aiming to study more vocationally focused courses at university may study Business Technology Education Council examinations. Entry into these alternative examinations is associated with prior attainment and social background. Thus, we may expect students who are channelled into these vocational routes to not only study different subjects than their more ‘academic’ peers, but to also be less likely to choose subjects based on intrinsic values. As Boudon (1974) argued, these alternative branching points available in the UK education system are likely to increase class disparities in educational choices, as more advantaged young people (and their parents) are better able to use these choices to their advantage. Students who studied A-levels were more likely to study SLB than those who achieved other qualifications pre entry; however, inclusion of this variable did not affect the coefficients
on the relationship between parental background and subject choice. I also considered another branching point, entry into Russell Group universities, which include primarily research-focused institutions. Similarly, the inclusion of this variable did not substantively impact other associations, but was associated with subject choices (people attending a Russell Group university were more likely to study STEM over both arts and humanities and SLB).

**Interactions between students’ enjoyment, perception of ability and social background**

Finally, my second research question was whether these associations differ by students’ parents’ education level. Whilst this has been addressed in the descriptive statistics shown in Figure 7, the fourth regression models were run to test whether interactions persisted, and were statistically significant, when controlling for other student characteristics and attainment. The interaction between students’ enjoyment of STEM subjects and their parent’s education in choice to study arts and humanities over STEM was statistically significant. As enjoyment of STEM increased by a standard deviation, students whose parents had GCSEs or lower were around 50% more likely to choose art and humanities over STEM than students whose parents had a degree or higher. This interaction was robust to associations with prior academic attainment, qualifications and university type. Other interactions, including between students’ enjoyment of English and perception of ability in STEM or English, were not statistically significant when accounting for other background characteristics, including attainment and university attended.

**Discussion**

This article has explored the relationship between students’ enjoyment, perception of ability and socio-economic disparities in subject choices, using a large representative sample of university students in England. The article contributes to the literature on educational inequalities, particularly by extending a growing literature considering differences in subject choice by student’s background (Anders et al, 2018; Codiroli Mcmaster 2017; van de Werfhorst, Sullivan, and Cheung 2003). The article also contributes to the psychological literature outlining the relationships between students’ attitudes and subject choices. These studies were typically based on relatively advantaged students, and the extent to which these attitudes and associations differ based on students’ characteristics, with the exception of gender, had not yet been comprehensively explored.

The main findings of this article can be summarised as follows. My first research question considered whether students’ enjoyment and perception of ability explained disparities in subject choice by students’ background. Although attitudes differed by students’ background, and were associated with subject choices, disparities in choices persisted when accounting for these differences. Students with less educated parents were less likely to choose arts and humanities and more likely to study SLB, over STEM, even when their enjoyment and perception of ability in subjects were similar. My second research question concerned the interaction between students’ social background and their attitudes towards subjects when choosing their specialism at university. Students whose parents had higher levels of education were more likely to choose STEM over arts and humanities as their
enjoyment of STEM increased. This suggests different underlying processes informing student choices by social background.

Firstly, I examined the relationship between students’ personal and background characteristics in determining subject choices at university, and whether students make subject choices for the same reasons regardless of background. The study replicated prior work by showing differences in the subjects students chose to study according to their parents’ education level. Students whose parents had higher levels of education were both more likely to choose arts and humanities, and less likely to choose SLB, compared to students whose parents had lower levels of education. The study also confirmed findings from the psychological literature, showing that students from a range of social backgrounds were most likely to choose subjects they thought they were good at and enjoyed.

The uneven distribution of students’ enjoyment of and confidence in subjects by background was considered a potential driver of disparities in subject choices. Descriptive statistics suggested that students whose parents had lower levels of education were less likely to enjoy science and mathematics and to rate themselves as ‘good’ at these subjects. However, disparities in uptake remained when controlling for attitudes. Even when students enjoyed STEM, and thought themselves equally capable, students whose parents were more educated remained more likely to study arts and humanities over STEM, and to study STEM over SLB subjects at university. In contrast, gender differences in subject studied at university were explained entirely by differences in attitudes. More research is required to understand fully why the processes driving gender and social background disparities in choices differ so widely.

Further analysis sought to understand whether all students, regardless of background, were equally likely to make choices based on their personal preferences and beliefs about their abilities. The article identifies differences in processes influencing choices by students’ background. As students’ perception of ability and enjoyment of STEM increases, the social gradient in choices increases. To further understand this, it is important to explore the specific ways in which students’ family background may influence their rationale and motivations in making choices. There is evidence that students’ socio-economic position could influence their choices directly, through the importance they place on intrinsic versus extrinsic benefits of study. For example, whether they want to choose a subject they personally enjoy and think they are good at, or whether they are more likely to consider labour market returns and outcomes upon graduation (Breen and Goldthorpe 1997).

The theory of relative risk aversion suggests that students whose parents are better educated would be more inclined to choose subjects based on extrinsic motivations to avoid downward mobility; however, this study offers evidence to the contrary. Students whose parents are more educated are more likely to choose subjects based on intrinsic motivations. In line with Boudon’s (1974) work, this could be due to the fact they are likely to have a ‘safety-net’ upon graduation, and compared to less advantaged students are more likely to succeed in whichever field they choose. In expanding the concept of primary and secondary effects of social background on education, Boudon argues that secondary effects, or educational choices, are driven by the different costs and benefits associated with these choices depending on background, which is demonstrated by the greater likelihood of securing a better paid job for more advantaged students, regardless of subject studied or university attended (Britton et al. 2016).
There are a number of limitations to this study, which highlight a number of possible future research avenues. I have discussed theoretical concepts to help interpret results, including cultural and science capital, relative risk aversion and cultural reproduction theory, but I did not attempt to quantify these concepts. Whilst it may be argued that, given the broad and relational nature of the concepts, it would not be possible to do this, a number of studies have constructed quantitative measures of related concepts, including cultural capital (for example, Zimdars, Sullivan, and Heath 2009). Future researchers may wish to formalise these concepts and test how far they explain differences in subject studied by students’ background. Furthermore, this study is interested in the impacts of students’ different levels of enjoyment and perception of ability in subjects, but it is not within the scope of this article to test the reasons why these differences occur. Another fruitful area of research could be to test the extent that early streaming of students into subjects (Anders et al, 2018; Iannelli & Duta, 2018), or allocation of teachers to different students, may influence students’ attitudes to subjects.

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Note

1. Data sourced from the Destination of Leavers from Higher Education: https://www.hesa.ac.uk/data-and-analysis/students/destinations

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