

# Impact of socio-economic background on early perceptions of engineering

Findings from the Engineering Brand Monitor 2021

December 2022

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## Key findings

1. 58% of young people from low education and income backgrounds indicated that one or both parents think science is very interesting, compared with 80% of young people from high education and income backgrounds.
2. 39% of young people from low education and income background stated that their teacher has specifically encouraged them to continue with science education, compared with 61% of young people from high education and income backgrounds.
3. 43% of young people from low education and income backgrounds indicated they thought engineering would be a suitable career for them, compared with 66% of young people from high education and income backgrounds.
4. 48% of young people from low education and income backgrounds indicated they know what engineers do in their jobs, compared with 69% of young people from high education and income backgrounds.
5. 27% of young people from low education and income backgrounds indicated they know which subjects or qualification they would need to take to become an engineer, compared with 62% of young people from high education and income backgrounds.
6. 28% of parents from low education and income households indicated they were confident giving their child advice about careers in engineering, compared with 57% of parents from high education and income households.

Previous EngineeringUK research shows that just 24% of those working in engineering come from low socio-economic backgrounds<sup>1</sup>. Furthermore, the most recent figures from Higher Education (HE) show that a higher proportion of engineering and technology undergraduate students had highly educated parents, grew up in more affluent areas, and attended a privately funded school compared to the average UK HE student<sup>2</sup>. This briefing details how responses to questions in our Engineering Brand Monitor (EBM)<sup>3</sup> survey differed across young people from different social backgrounds. Is young people's social background associated with their knowledge about engineering, and educational and career pathways to engineering, their engagement with STEM careers activities and their aspirations relating to engineering? And to what extent do responses to questions about engagement with career activities and engineering differ between their parents?

Social background is a complex concept to measure quantitatively. Young people's parents were asked about their own or their partner's highest educational qualification, and their household income. For this report young people were categorised into four groups:

**Table 1: Description of socio-economic groups**

Name	Description <sup>4</sup>	% young people in the sample
High education and income	Young people who had at least one parent with a degree or higher qualification, and had a household income above £40,000 per year	41%
High education and low income	Young people who had at least one parent with a degree or higher qualification, and had a household income below £40,000 per year	11%
Low education and high income	Young people for whom neither parent had a degree or higher qualification, and had a household income above £40,000 per year	22%
Low education and income	Young people for whom neither parent had a degree or higher qualification and had a household income below £40,000 per year.	26%

The aim of combining measures of parental education and household income in this way was to tease apart the influences of parental academic knowledge and associated capital, and material resources as measured through household income. This briefing focuses on the comparison between young people in the high education and income group, with young people in the low education and income group.

When referring to young people in 'high socio-economic group', or 'more advantaged backgrounds' in this briefing it refers to young people in the high education and income background only. Where the report refers to young people in 'low socio-economic group', or 'less advantaged' in this briefing it focuses on those in the low education and income background only as defined in table 1.

<sup>1</sup> EngineeringUK. 'Social mobility in engineering,' 2018. <https://www.engineeringuk.com/research-policy/diversity-in-engineering/social-mobility-in-engineering/>

<sup>2</sup> Advance HE. 'Equality in higher education: students statistical report 2021' <https://www.advance-he.ac.uk/knowledge-hub/equality-higher-education-statistical-report-2021>

<sup>3</sup> Engineering Brand Monitor 2021, parents and students report <https://www.engineeringuk.com/research-policy/attitudes-knowledge/attitudes-and-knowledge-young-people/>

<sup>4</sup> For young people growing up in a lone parent family, 'at least one / neither parent' is substituted with 'a/their parent.'

## 2. Methodology

The majority of the data in this briefing is taken from the EBM, a survey of young people, their parents, and teachers to explore their knowledge, perceptions and understanding of engineering. In 2021, more than 4,000 young people aged 7 to 19 and their parents were surveyed and responses from parents and young people were linked together, allowing the direct influence of parents upon their children to be examined. The EBM data is nationally representative.

### 2.1 Descriptive analysis

Descriptive statistics are presented and simple tests of association (Pearson's chi-squared or T-tests, where appropriate) were used to test whether associations were statistically significant. All relationships shown in this paper were statistically significant unless it is explicitly stated otherwise.

### 2.2 Logistic regression

Logistic regression analysis is used in this report to test the size of associations between multiple demographic characteristics, young people's knowledge about and aspirations towards engineering careers. Logistic regression is a statistical analysis method used to predict the probability of an event occurring. This method is used when the outcome of interest is binary; in the case of this paper, that young people know what engineers can do in their jobs, or whether they are likely to choose a career in engineering.

## 3. Capability: Enjoyment and perception of ability in science and maths subjects at school

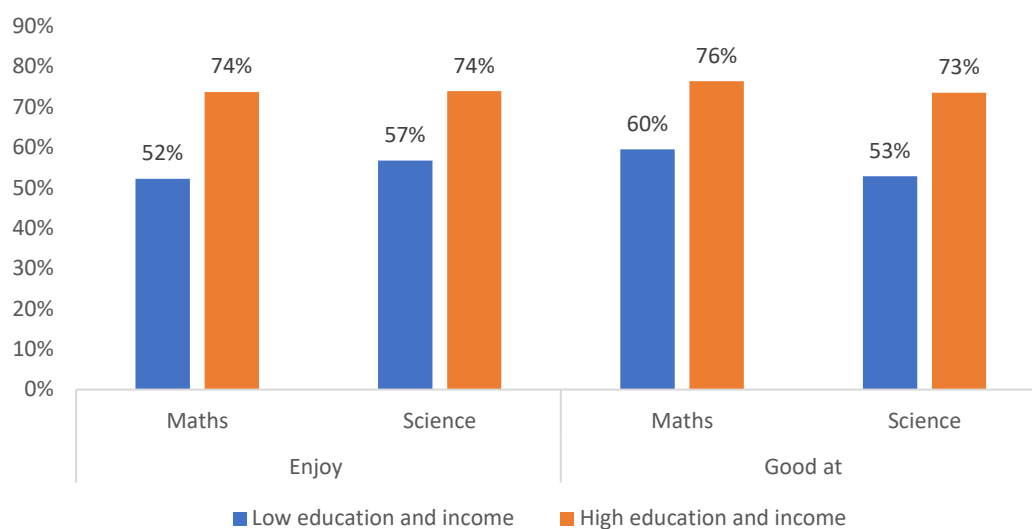
For young people to start to consider engineering as a career option for themselves, they need to be confident that they have the capability to do so. In our survey, the primary way we measured capability was the extent to which young people enjoyed science and maths at school, and whether they thought they were good at the subjects. There is a considerable body of literature linking young people's enjoyment and perception of ability in science and maths subjects at school to their STEM careers aspirations.<sup>5</sup>

Young people from the high socio-economic group were most likely to say they enjoyed, and thought they were good at, maths and sciences subjects at school, while young people from the low socio-economic group were less likely to say the same. For example, 60% of young people whose parents did not have a degree and had a household income below £40k said they thought they were good at maths, compared to 76% of young people who had at least one parent with a degree and a household income over £40k.

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<sup>5</sup> Wondimu Ahmed & Renee R. Mudrey (2019) The role of motivational factors in predicting STEM career aspirations, *International Journal of School & Educational Psychology*, 7:3, 201-214, DOI: 10.1080/21683603.2017.1401499

**Figure 1: Proportion of young people who said they enjoyed or thought they were good at science and maths by social background**



EngineeringUK Engineering Brand Monitor 2021

Q1 - How much do you enjoy doing the following subjects? Responses were on a 5-point Likert scale from 'don't enjoy it at all' to 'enjoy it very much'. Percentages presented represent the proportions reporting 'enjoy it a little' or 'enjoy it very much.'

Q2 - How far do you agree or disagree with the following statements? I am good at the following subjects... Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

Young people could also choose 'don't study this subject.'

Young people's enjoyment of, and particularly their perception of ability in, a subject depends largely, but not only, on their academic attainment in that subject.<sup>6</sup> We were not able to collect accurate data on young people's attainment. However, we know that socio-economic advantage is strongly positively related to young people's academic test performance, and that these inequalities have been increasing as a result of the pandemic and related policies.<sup>7 8</sup>

Nonetheless, there remains a high proportion of young people who have strong capability in science and maths subjects. Across all social background groups, over half of young people said they enjoyed or thought they were good at science and maths. This suggests that, even if capability gaps were not addressed, there would still be a large number of young people from all backgrounds who have these baseline attributes to pursue a career in engineering.

#### 4. Engineering knowledge and science capital

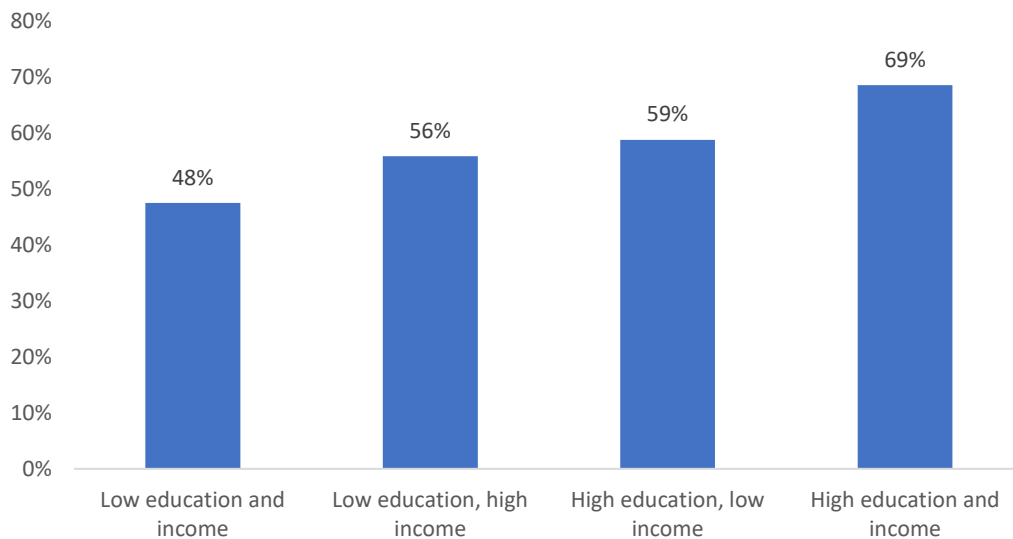
We asked young people directly whether they know about the types of things engineers can do in their jobs. Around half (48%) of young people whose parents had lower income and education levels said they did, compared to over two-thirds (69%) of young people whose parents were in the highest income and education group.

<sup>6</sup> Gender also plays a big part, girls who do well academically in these subjects are less likely to think they are good, this is further explored in Engineering UK's EBM - Gender briefing

<sup>7</sup> OECD (2016), PISA 2015 Results (Volume I): Excellence and Equity in Education, PISA, OECD Publishing, Paris, <https://doi.org/10.1787/9789264266490-en>.

<sup>8</sup> <https://epi.org.uk/publications-and-research/education-recovery-and-resilience-in-england-phase-two-report-october-2021/>

**Figure 2: Proportion of young people who agreed that they know about the different types of things engineers can do in their jobs, by social background**



Source - EngineeringUK Engineering Brand Monitor 2021

Q - In general, I know about the different types of things the following people can do in their jobs: Engineers. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

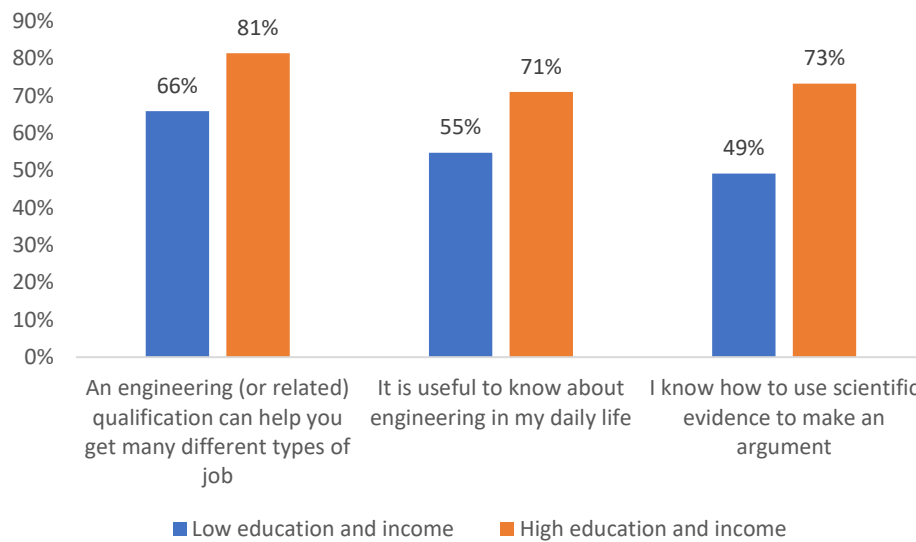
Science capital is a concept that encompasses young people's science-related knowledge, attitudes, experiences and resources.<sup>9</sup> By adapting questions relating to science knowledge and attitudes to measure perceptions of engineering more specifically, we have built on this concept to measure 'engineering capital'.

Young people from more advantaged backgrounds were also more likely to have better access to knowledge about, and to engage with, science and engineering. They had a higher engineering capital score on average, and across all measures of engineering capital their responses indicated more awareness of engineering than their less advantaged peers.

In terms of knowledge and attitudes, young people from higher-income families, and with at least one parent with a degree or equivalent qualification, were more likely to acknowledge the transferability of an engineering qualification (81% compared to 66%), to say it is useful to know about engineering in their daily life (71% compared to 55%), and to say they know how to use scientific evidence to make an argument (73% compared to 49%), than young people who came from lower income and education households.

<sup>9</sup> Archer, L. et al. "Science capital": A conceptual, methodological, and empirical argument for extending bourdieusian notions of capital beyond the arts', J. Res. Sci. Teach., 2015.

**Figure 3: Engineering knowledge and attitudes by social background**



Source - EngineeringUK Engineering Brand Monitor 2021

Q1 - How much do you agree or disagree with the following statements? Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

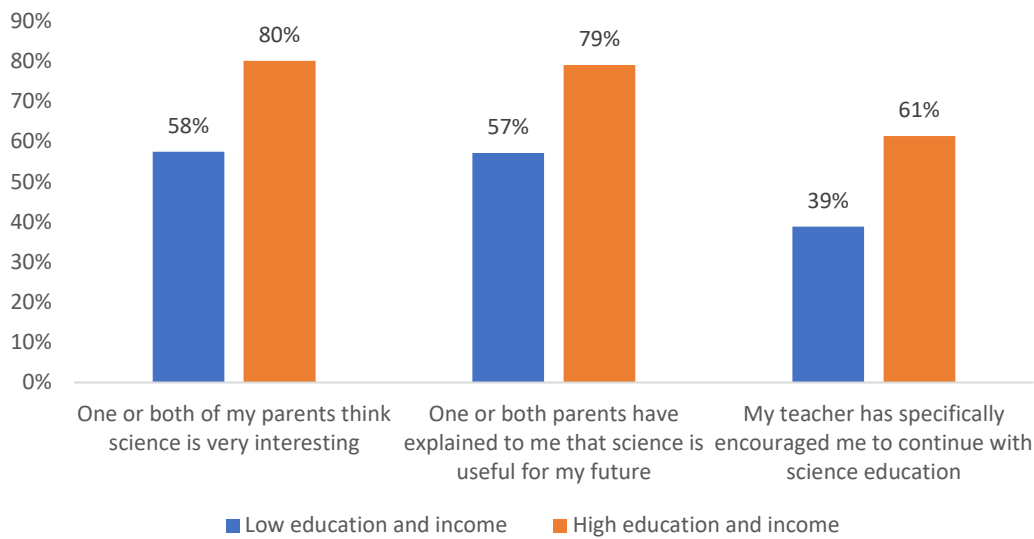
It is important to note the scale of these differences. There were also significant differences in science capital by a young person's gender, however the extent of the differences was much larger between the most advantaged and least advantaged young people in our sample compared to the differences between girls and boys. For example, 54% of girls and 62% of boys said they know how to use scientific evidence to make an argument, a difference of 7 percentage points<sup>10</sup>. In comparison, the reported knowledge gap between the most and least advantaged young people in our sample was 24 percentage points (73% compared to 49%).

Science capital also refers to science-related resources a young person has, for example, their parents' engagement with science and how this is passed on to their children. Science capital can also be fostered by teachers, particularly in the absence of information at home. Compared to their less advantaged peers, the most advantaged young people were more likely to say their parent's thought science was very interesting (80% compared to 58%), their parents had explained that science is useful for their future (79% compared to 57%) and that their teachers have encouraged them to continue with science education (61% compared to 39%).

<sup>10</sup> Numbers do not align exactly due to rounding.



**Figure 4: Influences and networks in promoting science education by social background**



Source - EngineeringUK Engineering Brand Monitor 2021

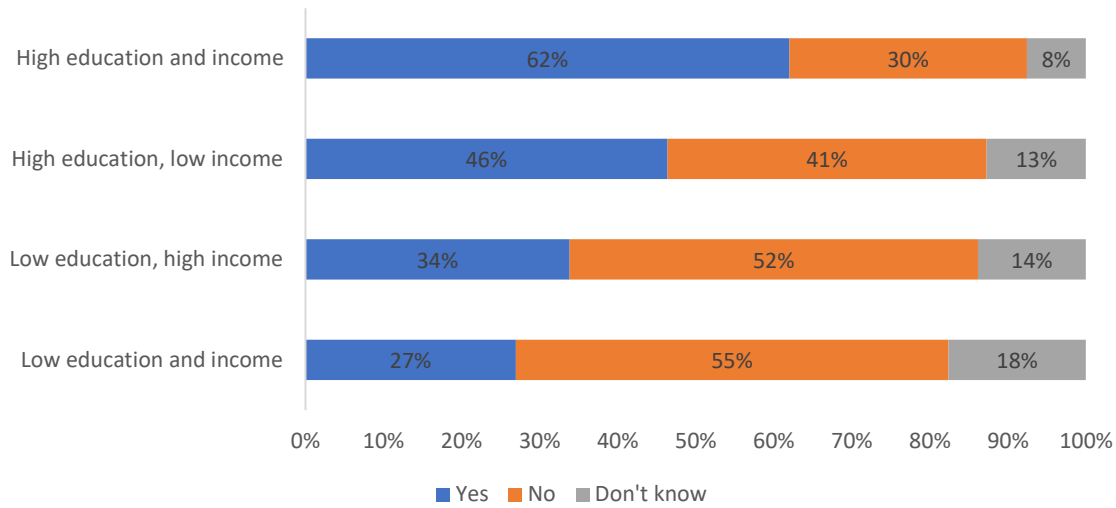
Q1 - How much do you agree or disagree with the following statements? Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

Figure 4 indicates that young people from less advantaged backgrounds were less likely to receive encouragement with regard to science from their influential support networks. If we want more young people to pursue science beyond GCSE, the last point when it is compulsory, then young people need to feel they are capable of doing so and encouragement from their support networks will likely contribute to that.

## 5. Knowledge of different educational pathways to a career in engineering

One area where there were very large differences in young people's responses by social background was their reported knowledge about the different educational pathways to engineering. Over twice as many young people from more advantaged backgrounds said they knew what subjects or qualifications they would need to study to become an engineer compared to those from less advantaged backgrounds.

**Figure 5: Young people’s knowledge about the subjects or qualifications they would need to take to become an engineer, by social background**



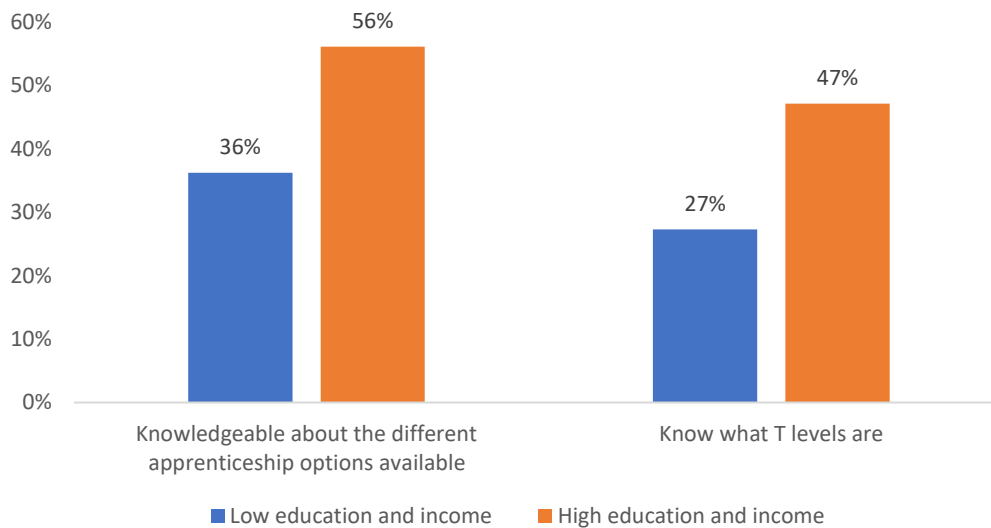
Source - EngineeringUK Engineering Brand Monitor 2021  
 Q1 - Do you know what subjects or qualifications you would need to take next to become an engineer in the future? Percentages presented represent the proportions reporting ‘Yes’

This indicates that young people from less advantaged backgrounds are not receiving an adequate amount of information and encouragement about science and the pathways necessary to pursue a career in engineering.

Just over one third (36%) of young people from less advantaged backgrounds said they are knowledgeable or very knowledgeable about the different apprenticeship options available to them, compared to 56% of young people from more advantaged backgrounds. And while just over a quarter (27%) young people from less advantaged backgrounds knew what T levels<sup>11</sup> were, almost half (47%) of more advantaged young people said they did.

<sup>11</sup>T Levels were initially launched in 2020, with new subjects starting in 2021 and 2022, including 3 engineering-specific subjects in 2022. This question was asked in April and May 2021, so knowledge may have improved since then. See: <https://www.gov.uk/government/publications/introduction-of-t-levels/introduction-of-t-levels>

**Figure 6: Young people’s reported knowledge about apprenticeship options and T Levels by social background**



Source - EngineeringUK Engineering Brand Monitor 2021

Q1 - How knowledgeable are you about the different apprenticeship options available to you? Options were on a 4-point scale from 'Not knowledgeable' to 'Very knowledgeable', Q2 - Do you know what T levels are? Options were 'Yes' or 'No'.

These significant differences are likely a consequence of less access to quality careers advice at school for less advantaged young people<sup>12</sup> (as we expand on below), as well as less parental and family knowledge to draw on to fill these gaps through engineering capital. Closing the gaps in young people’s knowledge about pathways to engineering by their background is key and should be a focus of outreach activity to improve diversity in engineering.

### 5.1 Engagement with careers activities

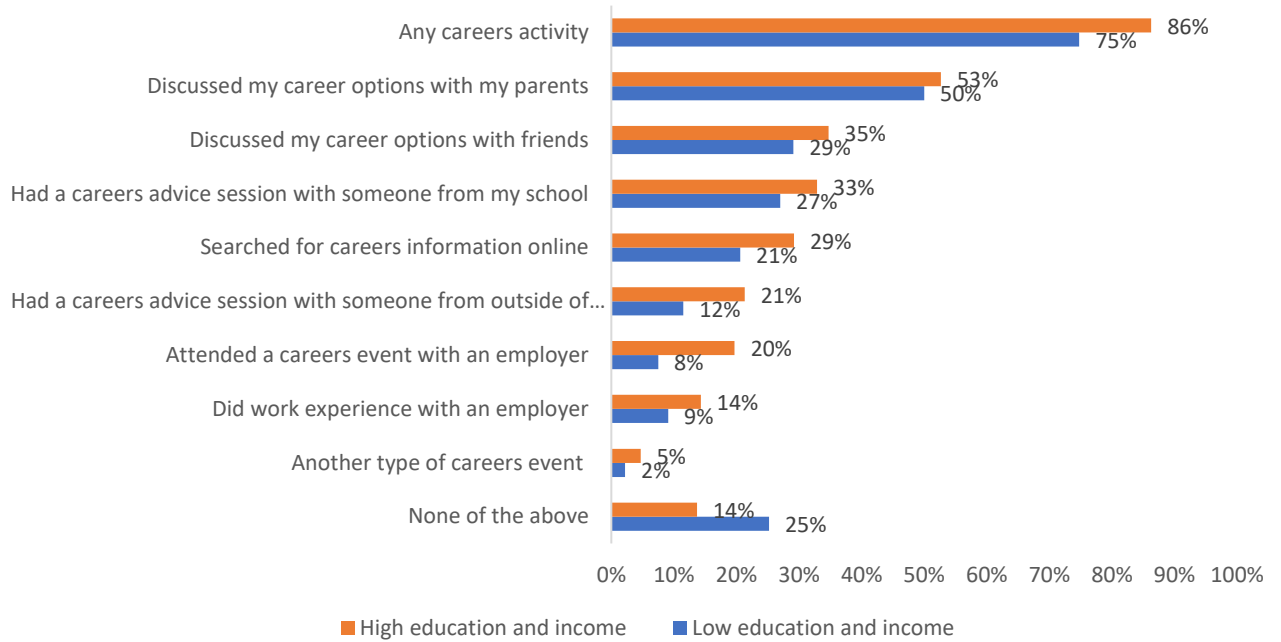
Encouragingly, a relatively large proportion of young people had engaged with careers activities in the past 12 months despite the disruption caused by the pandemic. When we asked young people about their engagement with careers activities, we stated that activities could have taken place online or in-person (unless this was not relevant to the specific activity, for example searching for careers information online).

However, young people from more advantaged backgrounds were more likely to have taken part in any type of activity (86%) compared to three quarters (75%) of less advantaged young people, indicating a quarter of the less advantaged group had not taken part in any careers activity.

Despite a high proportion of young people from both more and less advantaged backgrounds indicating they had taken part in careers activities in the past 12 months, there was a gap between the two groups when it came to access to external sources of careers activity. As indicated in figures 4, 5 and 6 young people from less advantaged backgrounds are less likely to receive encouragement to pursue science, or the information around pathways into engineering from parents or teachers. Therefore, not having access to external sources could contribute to the underrepresentation of young people from less advantaged backgrounds in engineering.

<sup>12</sup> Aspire 2 Project Spotlight, Year 11 Students’ Views of Careers Education and Work Experience, L. Archer and J. Moote, 2016.

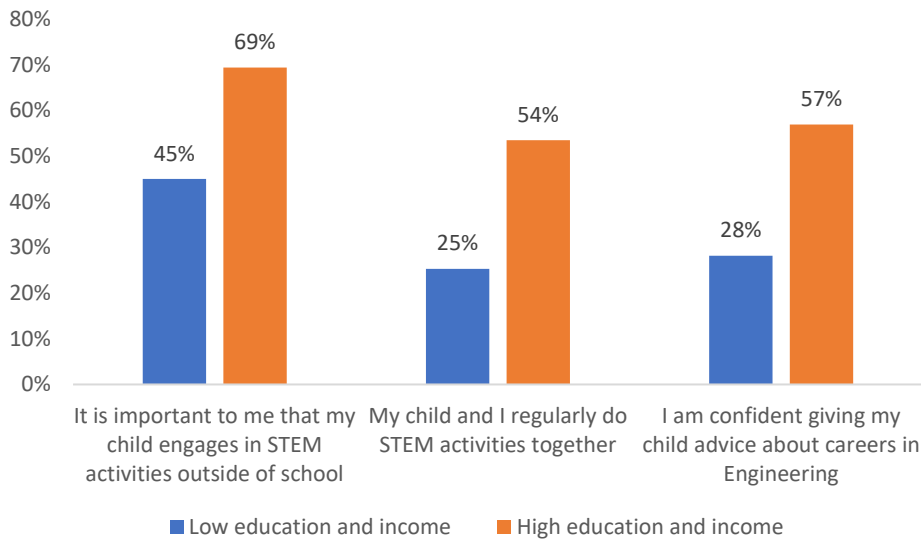
**Figure 7: Careers activities young people had taken part in, in the past 12 months, by social background**



Source - EngineeringUK Engineering Brand Monitor 2021  
 Q - Have you heard about engineering careers from any of the following sources?

Parents were the largest source of careers advice or activity for all groups of young people. Parents’ responses relating to their engagement with careers advice and activities also differed according to their social background. Parents from a household with income over £40k and high level of education were more likely to report that they value STEM activities with their child, that they do STEM related activities together with their child, and that they are confident giving their child advice about STEM careers. Importantly, they also had higher aspirations towards engineering careers for their child.

**Figure 8: Parents’ engagement with careers activities and advice, by social background**



Source - EngineeringUK Engineering Brand Monitor 2021

Q1 - How much do you agree or disagree with the following statements?: It is important to me that my child engages in STEM activities outside of school; My child and I regularly do STEM activities together. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree'. Q2 - Generally, how confident do you feel in giving your child advice about careers in the following areas?: Engineering. Responses were on a 5-point Likert scale from 'not at all confident' to 'very confident'. Percentages presented represent the proportions reporting 'fairly confident' or 'very confident'.

Very few parents said they found the idea of their child pursuing a career in engineering unappealing or very unappealing, with 8% from low education and income households, compared with 5% high education and income households. However, just 67% of parents from households with incomes less than £40k and no university attendance said they found the idea appealing or very appealing, compared to 82% of parents from more advantaged households. Parents from less advantaged households were much more likely to be ambivalent about the idea, with 26% responding 'neither' compared to 13% of parents from the high socio-economic group.

**Table 2: Levels of parental appeal of their child pursuing a career in engineering, by their social background<sup>13</sup>**

	Low education and income	High education and income
Very unappealing	2.3%	1.8%
Unappealing	5.5%	2.8%
Neither	25.6%	13.2%
Appealing	45.1%	38.3%
Very appealing	21.6%	43.9%

Source - EngineeringUK Engineering Brand Monitor 2021

Q - How appealing do you find the idea of your child pursuing a career in engineering? Responses were on a 5-point Likert scale from 'very unappealing' to 'very appealing'.

The higher proportion of parents in the low education and income household indicating they find engineering neither appealing nor unappealing indicates a potential lack of knowledge of engineering, especially when coupled with their lower confidence in giving engineering careers advice (figure 8). Since neither group particularly finds the idea of

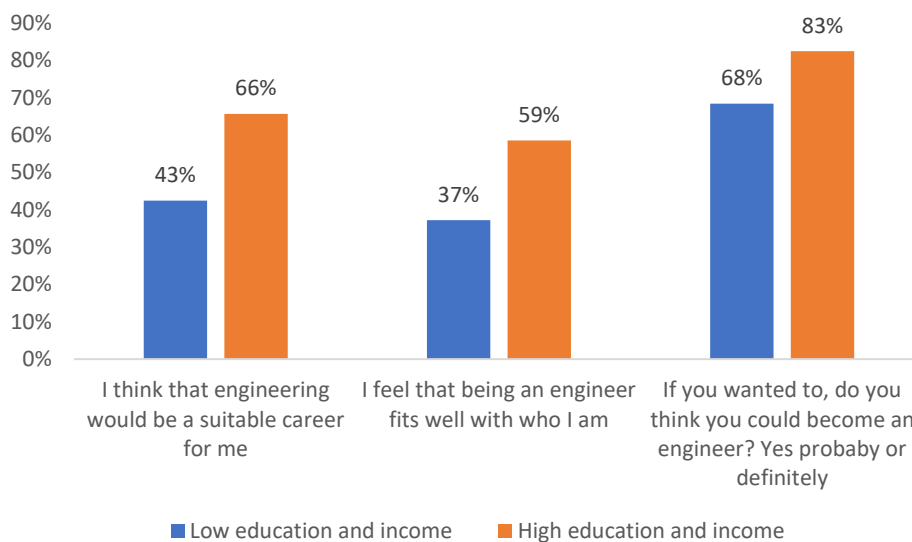
<sup>13</sup> Percentages do not align exactly due to rounding.

their child pursuing a career in engineering unappealing, perhaps parents in the less advantaged group are less able to support their children pursuing careers in engineering, due to their lack of science and engineering knowledge.

## 5.2 Inclusivity

In developing career aspirations, it's important that young people can see themselves as engineers in the future. Along with young people's knowledge about engineering careers and educational pathways, their engineering capital, and their parents' engagement with careers activities, young people from less advantaged backgrounds were also less likely to see themselves as engineers. Fewer than half (43%) of young people from less advantaged backgrounds said they think engineering would be a suitable career for them and just 37% said that being an engineer fits well with who they are, compared with 66% and 59% of young people from more advantaged backgrounds respectively. Responses to the question 'if you wanted to, do you think you could become an engineer' were more positive, with 68% of young people from less advantaged backgrounds agreeing. This suggests that overall, young people are confident in their ability to pursue engineering if they do choose that career. However, there remained a large difference between young people from different social backgrounds. For young people from more advantaged backgrounds, 83% agreed with the statement.

**Figure 9: Young people's responses to questions about inclusivity and engineering, by social background**



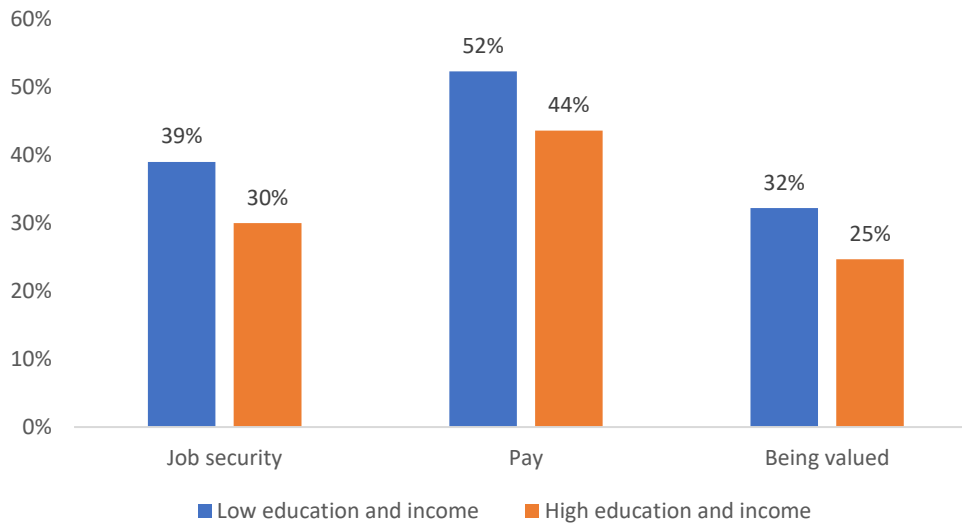
Source - EngineeringUK Engineering Brand Monitor 2021

Q How much do you agree or disagree with the following statements? - I think that engineering would be a suitable career for me; I feel that being an engineer fits well with who I am; If I wanted to, I could become an engineer. Responses were on a 5-point Likert scale from 'strongly disagree' strongly agree.' Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

## 5.3 Motivations for pursuing a career

When asked about factors important in choosing a career, many options were selected at similar rates regardless of socio-economic background, including careers with 'opportunities to being creative' and 'something I'm interested in'. However, some responses were selected more significantly by young people from households earning less than £40k and where neither parent attended university, than young people whose household situation is the opposite.

Figure 10: Factors young people indicate are important when deciding on careers



Source - EngineeringUK Engineering Brand Monitor 2021

Q - Which of the following factors do you think would be important to you when deciding upon a career? Please select all that apply. Options included: pay, working conditions & environment, working hours (9-5), opportunities to work abroad, enjoyment, something I'm interested in, something that challenges me, making a difference / having an impact, career prospects and progression, being valued, job security, recommendation from friends or family, opportunities to undertake practical work, opportunities to work in a team, opportunities to be creative, ability to combine work and having a family, improving environmental sustainability, other (write-in), don't know

Young people from less advantaged backgrounds are more likely to indicate pay, job security, and being valued as important than young people from more advantaged backgrounds. Many of these factors are applicable to engineering, as engineering skills tend to be in demand, and roles are often higher paid than the national average.

#### 5.4 Interest in a career in engineering

Young people were asked directly if they were interested in a career that involves engineering, and why they were or were not interested. Overall, reported interest in a career in engineering was high, with 44% of young people from less advantaged backgrounds and 64% of young people from more advantaged backgrounds expressing some interest.

#### 5.5 Regression analysis: can capability, opportunity and parent engagement explain differences in aspirations to pursue engineering by social background?

Regression models were run to test whether the association between young people's social background and their interest in a career in engineering was explained by differences in their capability, opportunity and their parents' engagement with careers advice and activities.

Regression models were built up sequentially in stages, with four models that included the following factors:

- + Model 1: Demographic characteristics - Young people's age, gender, ethnicity and socio- economic group as defined in table 1 for the High education and income group and the Low education and income group.
- + Model 2: Capability - Model 1 + Composite scores for enjoyment of, and perception of ability in, STEM subjects (maths, science, physics, biology and chemistry).

- + Model 3: Opportunity - Model 2 + and indicator for whether young people said they know what types of things engineers can do in their jobs, or not, and composite scores for science capital.
- + Model 4: Parent responses - Model 3 + whether parents said it was important to them that their child engages in STEM activities outside of school, and that they and their child regularly do STEM activities together.

Figure 11 shows the *predicted probability* that a young person will express interest in a career in engineering in each of the four models listed above. In the first model, young people's other demographic characteristics are controlled for, and it's predicted that 43% of young people from less advantaged backgrounds and 61% of young people from more advantaged backgrounds will say they are interested in a career in engineering.

When young people's capability in maths and science are introduced to the models, the gap in aspirations between young people from low and high economic and education backgrounds reduces substantially and is no longer significant. That is to say that when comparing young people who similarly enjoyed and thought they were good at maths and science, there were no significant differences in aspirations towards engineering careers by social background.

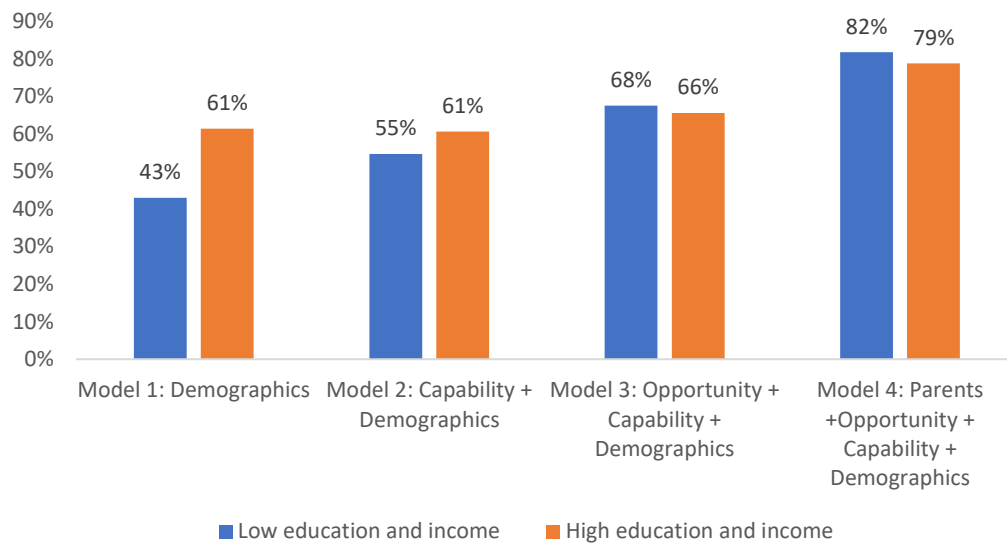
Or, put into context, these results suggest that if less advantaged young people's enjoyment and perception of ability in maths and science were raised to match young people from more advantaged backgrounds, the gaps in aspirations to engineering careers could be greatly reduced.

Equally, when young people's science capital and knowledge about what engineers could do was equal (model 3), there were no significant differences in aspirations towards engineering by social background. If young people's enjoyment, perception of ability, knowledge about engineering and science capital was to be the same, we predict that 68% of young people from less advantaged backgrounds, and 66% of young people from more advantaged backgrounds, would say they were interested in a career that involves engineering.

When parental support is introduced, there were no significant differences between young people from more or less advantaged backgrounds. The prediction is that 82% of young people from less advantaged backgrounds, and 79% of young people from more advantaged backgrounds, would say they were interested in a career that involved engineering. This also results in the largest increase for both groups, indicating the significance that parental influence plays in young people's enjoyment of STEM, and to their career aspirations.



**Figure 11: Predicted probability that children are interesting in a career that involves engineering, by social background.**



## 6. Discussion

In EngineeringUK’s Engineering Brand Monitor main report, one recommendation was:

The STEM community and those engaging with young people in careers advice must support all young people to feel confident in their capability to become an engineer, especially girls, students from underrepresented minority ethnic groups, disabled young people and those from socioeconomically disadvantaged backgrounds. We would like to see the community better understand what works for different groups, develop more programmes and activities aimed at the groups currently underrepresented in the engineering profession, and promote the engineering workforce as an inclusive and diverse environment.

This report reinforces the idea that, in order to reduce any barriers for young people from lower socio-economic backgrounds might experience in pursuing a career in engineering, more targeted interventions need to take place for young people from less advantaged backgrounds.

Young people from households with lower income and lower education levels are less likely to know about engineering, believe they can become engineers, or know the educational pathways to become an engineer. A significant barrier appears to be knowledge, accrued from many sources, but parental knowledge plays a significant role. Parents from lower socio-economic groups are less likely to know about engineering and less confident in being able to recommend a career in engineering to their children.<sup>14</sup> Therefore, this group of young people would benefit from receiving greater levels of information from additional sources, particularly school, or targeted careers advice. If the modelling is proved accurate, then this increased knowledge combined with greater STEM capital could diminish some, if not all, the differences between young people in the high and low social-economic groups.

<sup>14</sup> Educational pathways: Harnessing the talent pool, report - Engineering UK - September 2022