

Gender disparity in early perceptions of engineering

Findings from the Engineering Brand
Monitor 2021

December 2022

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Key findings

1. Girls report less knowledge about engineering, less engagement with science and engineering activities, and are less likely to see themselves as engineers.
2. Parents of girls report less engagement with STEM activities with their child compared with parents of boys.
3. Girls were more likely to agree that they face more barriers, making it harder for them to get ahead in engineering than boys.
4. Boys were much more likely to agree that boys would make better engineers than girls.
5. A significantly higher proportion of boys said they knew about the different types of things engineers can do than girls (61% compared to 48%).
6. Girls were less likely than boys to think engineers needing to be innovative is important (40% boys vs 35% girls).
7. Less than half of girls said that they think engineering would be a suitable career for them (42%), or that they feel being an engineer fits who they are (35%), compared to 61% and 53% of boys.
8. Girls were also less likely to say that if they wanted to, they could become an engineer.
9. Girls were less likely to say they thought they were good at sciences and maths subjects at school, despite the fact that girls' performance in these subjects at school is at least as good as boys'.
10. Young people who had engaged in STEM activities outside of school with their parents were more likely to have knowledge of what an engineer can do in their job, and to see engineering as a 'good fit' for them.
11. Higher proportions of parents of boys would suggest engineering as a career to their child (72%) than parents of girls (57%).
12. Parents of boys were more than twice as likely to agree with the statement 'A child like mine would be well-suited to a career in engineering'.

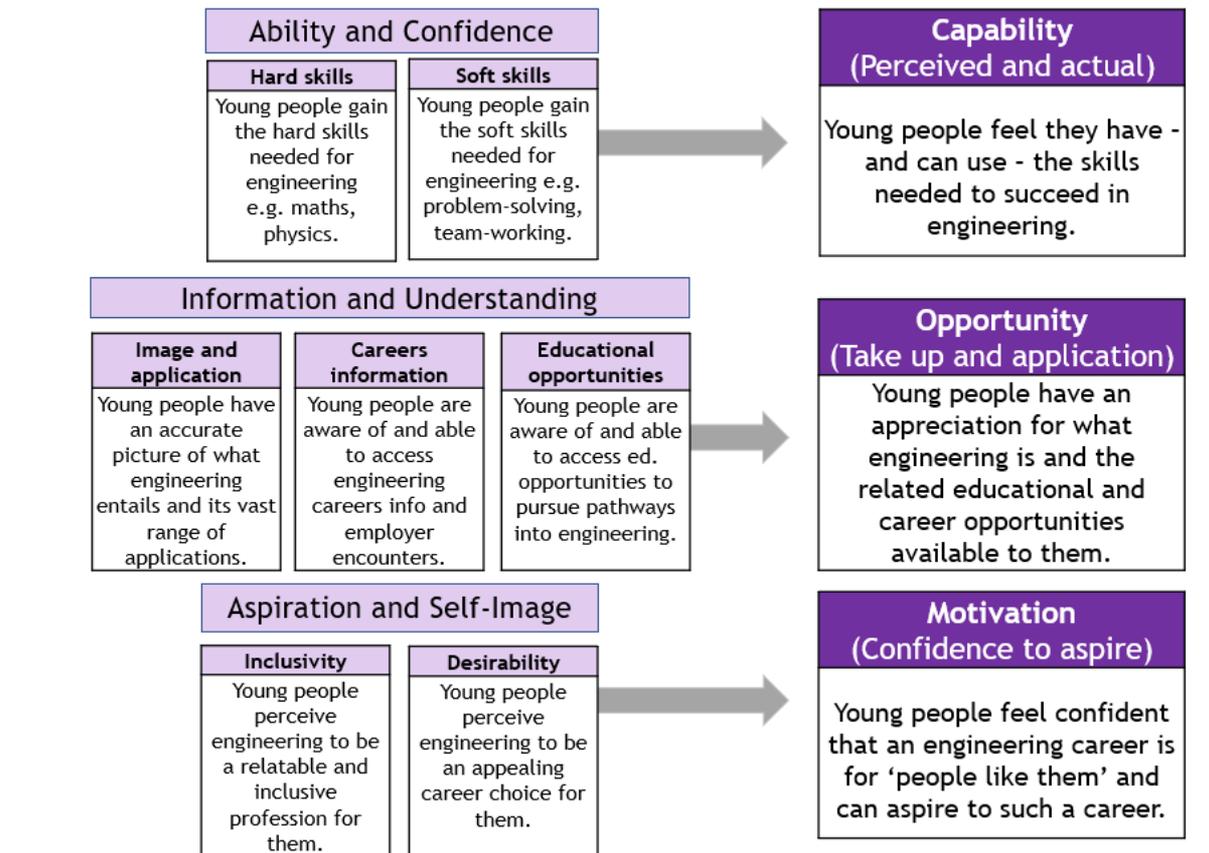
1. Introduction

Our recent briefing on women in engineering explored the gender disparity in the engineering workforce, noting that women made up just 16.5% of the workforce in 2021. Although this is indeed an increase from 10.5% in 2010, we saw that ‘core’ engineering (roles such as civil and mechanical engineers) had lower female representation at 15.2% compared with 19.0% in ‘related’ engineering (roles such as quantity surveyors and web designers). We also saw that higher proportions of women were working in engineering roles outside of the engineering sector (24.4%) than in the engineering sector (12.5%), suggesting that engineering is not perceived to be an attractive career for women.

However, the underrepresentation begins long before reaching the workforce, starting early in childhood and continuing throughout compulsory education. Despite higher attainment rates among girls, it seems that STEM subjects attract fewer girls than boys, starting at secondary school (GCSE’s/Scottish National 5S and A-Levels/Scottish Highers) and continuing into further and higher education (including apprenticeships and degrees)¹.

To contribute towards improving our understanding of this gender imbalance, in this briefing we explore the perceptions of engineering in young people, and how they differ between boys and girls aged 11 to 19. With the Engineering Brand Monitor (EBM), a national survey of young people, their parents, and teachers, we used the COM-B model (Figure 1.1) - that is whether they have the capability, opportunity and motivation to pursue a career in engineering - as a framework for asking questions to find out about young people’s views.

Figure 1.1: COM-B model of pursuit of engineering as a career



¹ Secondary pathways into engineering, EngineeringUK 2022

Our findings from the EBM survey show that girls report less knowledge about engineering, less engagement with science and engineering activities, and are less likely to see themselves as engineers. On top of this, their parents report less engagement with STEM activities with their child compared with parents of boys.

When asked about their opinions relating to gender (in)equality in engineering, female respondents were more likely to agree that girls face more barriers that make it harder for them to get ahead in engineering than boys. Further, male respondents were much more likely to agree that boys would make better engineers than girls.

These results could indicate that boys who aspire to a career in engineering think themselves to be better suited to engineering, and attribute this at least in part to their gender. However, it could also be the case that boys who have strong beliefs about differences between men and women are more drawn to careers that match their beliefs about gender norms.

2. Methodology

The majority of the data in this briefing is taken from the Engineering Brand Monitor (EBM), an annual 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, for the first time, responses from parents and young people were linked together and the direct influence of parents upon their young people was examined. The survey was weighted to ensure results were nationally representative based on gender and region.

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, 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 that they are likely to choose a career in engineering.

2.3 Predicted probabilities

Predicted probabilities are calculated from the output of the logistic regression models, such that predicted probabilities = $1/(1+\text{EXP}(-B))$.

3. Early perceptions of engineering

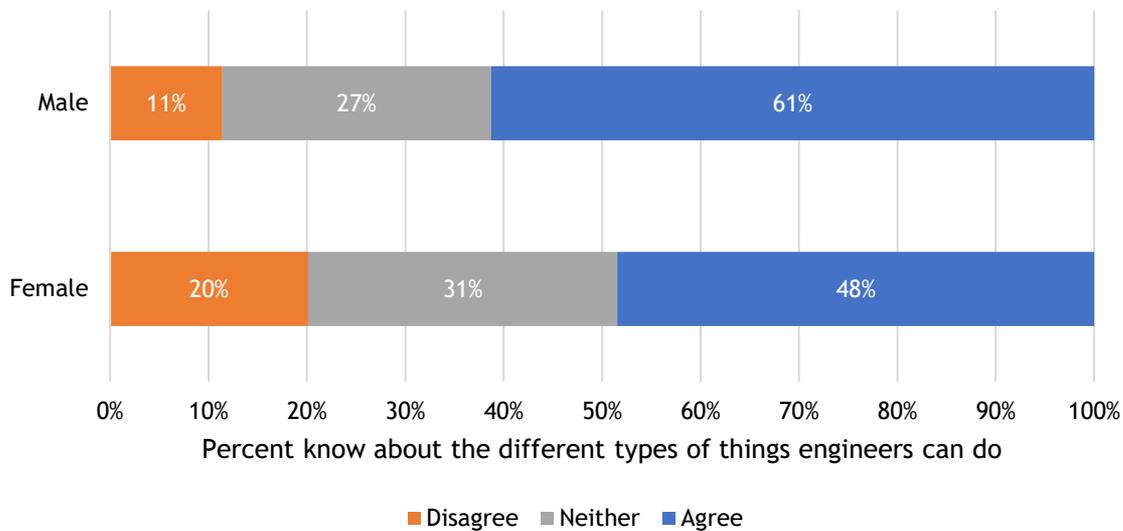
We know that young people start forming career aspirations at an early age, and that in order to create a more diverse engineering workforce in the future, it is imperative that STEM education is impactful and informative about different career options, including the variety of engineering roles available. By looking at the responses to the EBM survey, we were able to explore where differences lie between the responses by gender, to better understand what is making engineering less appealing to girls than boys.

3.1 Knowledge of engineering

For young people to be interested in a career in engineering, they first need to know about the opportunities available within engineering industries and occupations. By highlighting the range of roles and skills needed to be an engineer, and increasing knowledge and understanding of careers, more young people could potentially see themselves as an engineer of the future.

To measure current levels of understanding about engineering careers, we asked young people about their knowledge in the latest EBM. Figure 3.1 shows that, across all ages, a significantly higher proportion of boys said they knew about the different types of things engineers can do than girls (61% compared to 48%).

Figure 3.1: Percentage of young people that agreed that they know about the different types of things engineers can do in their jobs, by gender

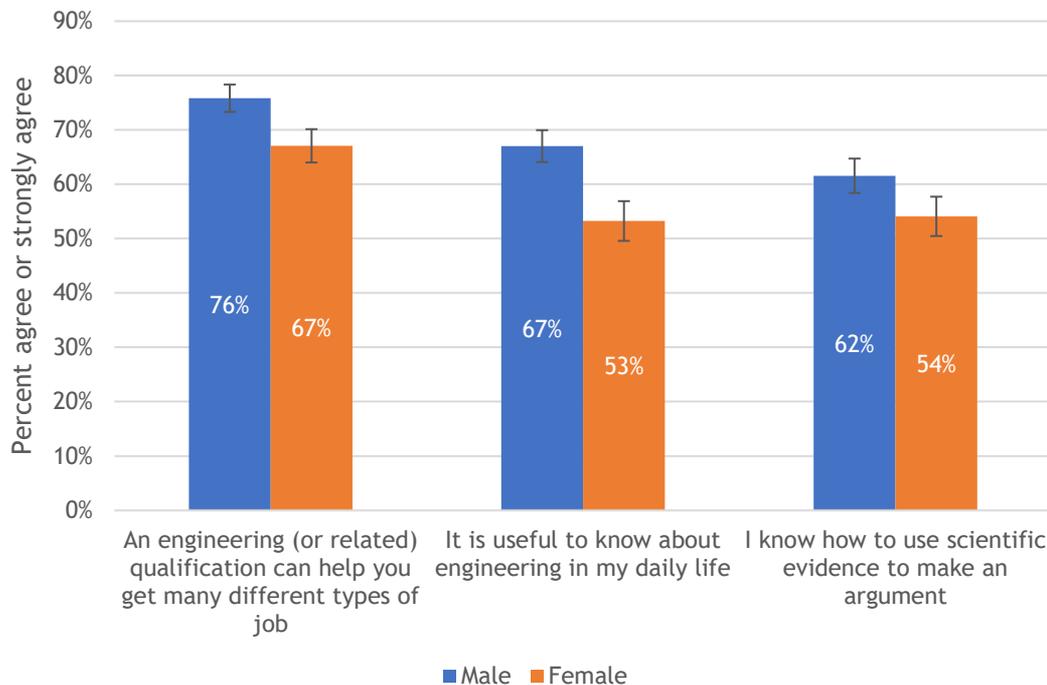


Source - EngineeringUK Engineering Brand Monitor 2021

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.

Additionally, boys were more likely to recognise the transferability of engineering qualifications (76% compared to 67% of girls) and the relevance of engineering knowledge to their lives (67% compared to 53%). They were also more likely to say they know how to use scientific evidence to make an argument (62% compared to 54%).

Figure 3.2: Engineering capital by gender



Source - EngineeringUK Engineering Brand Monitor 2021

Q- How much do you agree or disagree with the following statements? 1- An engineering (or related) qualification can help you get many different types of job, 2- It is useful to know about engineering in my daily life, 3- I know how to use scientific evidence to make an argument. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.'

3.2 Capability to pursue engineering

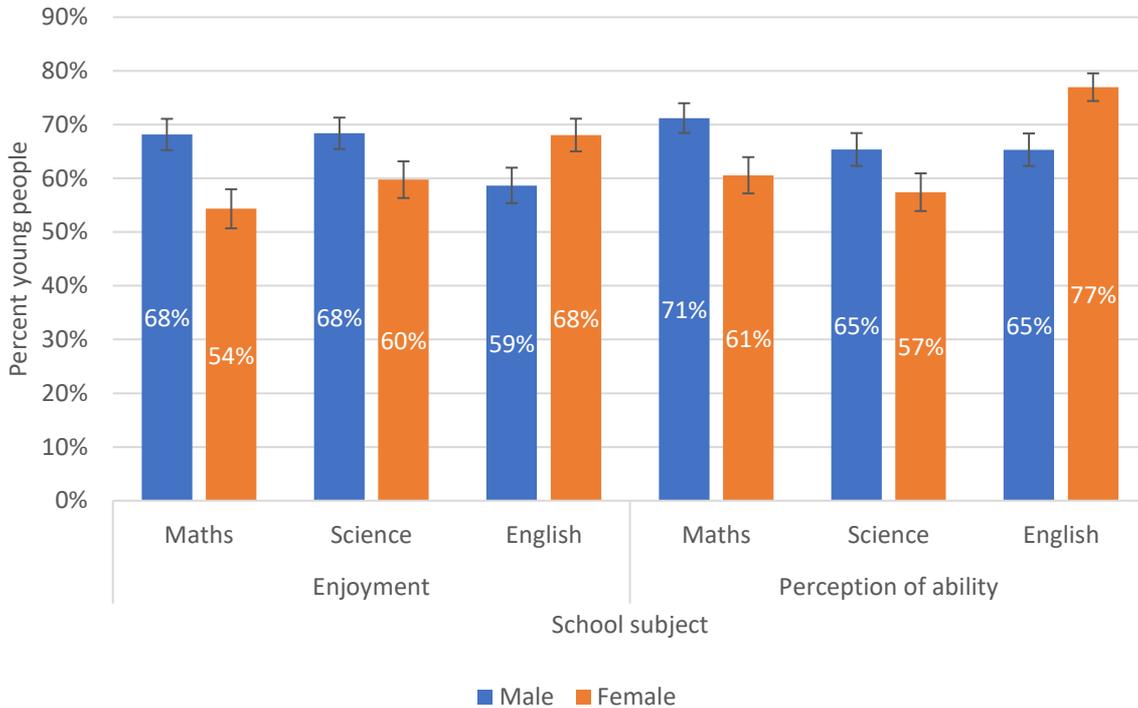
A key premise of engineering outreach is that for young people to consider engineering as a career option for themselves, they need to have, and to be confident that they have, the psychological capability to do so. In our survey, the primary way we measured capability was the extent young people enjoyed science and maths at school, and whether they thought they were good at the subjects. For example, there is a considerable body of literature² linking young people's enjoyment and perception of ability in science and maths subjects at school to their aspirations relating to STEM careers more generally.

Overall, the majority of young people enjoyed or thought they were good at the academic subjects included in the question. A similar proportion of boys said they enjoyed maths and science (68% respectively), and fewer said they enjoyed English (59%). In contrast, a higher proportion of girls said they enjoyed English (68%) compared to science (59%) and maths (54%).

Gender differences in perception of ability followed a similar pattern, with girls most likely to say they were good at English (77%), and least likely to say they were good at science (57%). Meanwhile, a higher proportion of boys said they were good at maths (71%) than science or English (65% respectively).

² What role do students' enjoyment and perception of ability play in social disparities in subject choices at university? Natasha Codioli McMaster (2019) British Journal of Sociology of Education, 40:3, 357-377, DOI: 10.1080/01425692.2018.1541311

Figure 3.3: Proportion of girls and boys who said they enjoyed, or thought they were good at, science, maths and English



Source - EngineeringUK Engineering Brand Monitor 2021

Q - 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.'

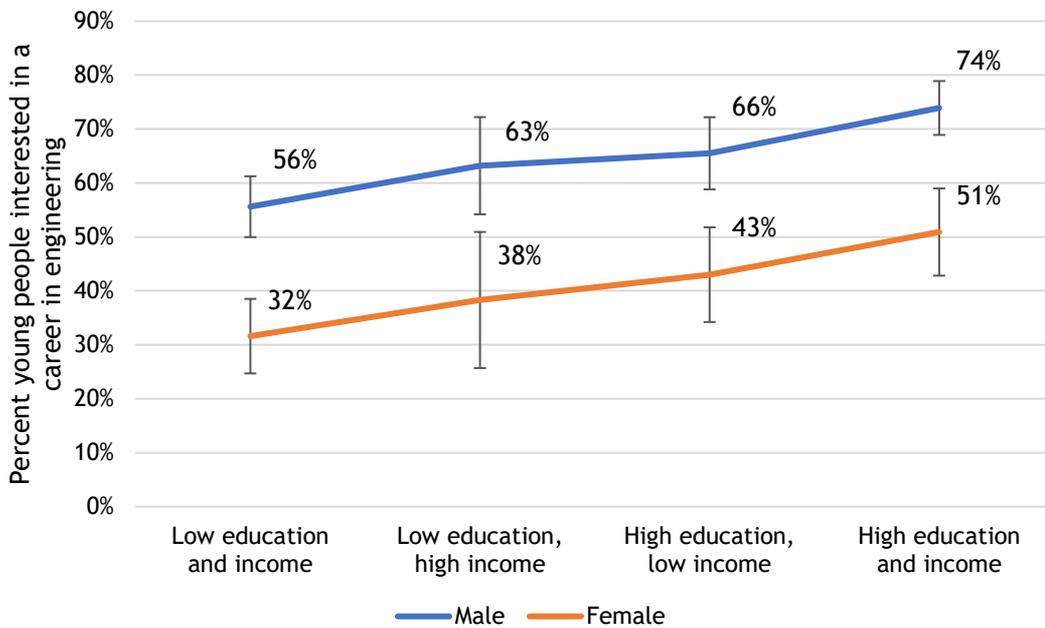
Q - How far do you agree or disagree with the following statements? I am good at... Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Percentages presented represent the proportions reporting 'agree' or 'strongly agree.' Young people could also choose 'don't study this subject.'

3.3 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. While nearly two-thirds of boys said they were interested in a career in engineering (63%), just two in five girls said the same (39%). In general girls and boys had the same reasons for being interested, or uninterested, in an engineering career. However, girls were more likely to choose 'it's challenging' as a positive reason for their interest in engineering (41% compared to 33% of interested boys), and girls were more likely to choose 'not interested in it' as a reason for their disinterest in an engineering career (58% compared to 46% of boys who were not interested).

A higher proportion of boys than girls said they were interested in a career in engineering across all socio-economic groups. Although overall young people whose parents did not have a degree and had a lower income were less likely to aspire to engineering, and those whose parents had a degree and higher income were more likely - the gender differences were similar across these groups. These gender differences were also similar across families where at least one parent worked in STEM or not.

Figure 3.4: Interest in a career in engineering, by gender and family background



Source - EngineeringUK Engineering Brand Monitor 2021

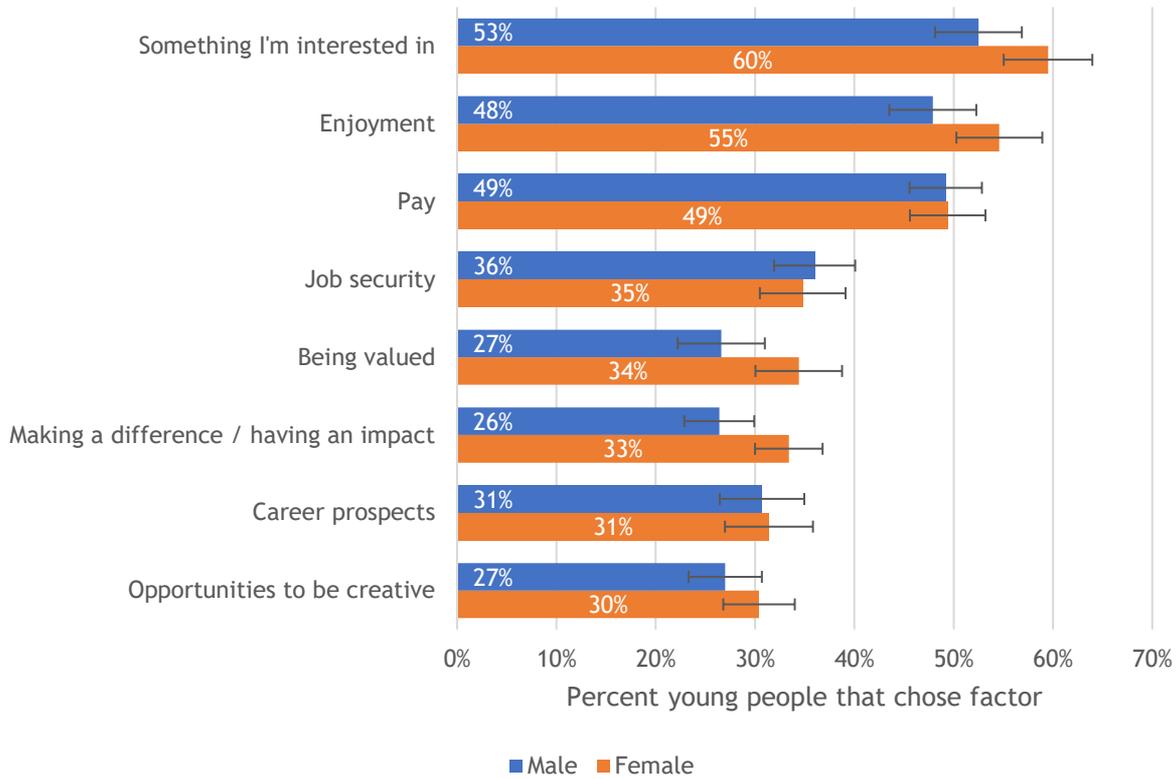
Q - How interested are you in a future career that involves any of the following?: Engineering. Responses were on a 5-point Likert scale from 'not at all interested' to 'very interested.'

3.4 What are girls and boys looking for in a career?

To make engineering more attractive for young people, and in particular girls, it is important to understand what they are looking for in a career and highlight what engineering can offer. When asked 'which of the following factors do you think would be important to you when deciding upon a career?' girls and boys again differed in their responses. Young people could choose as many factors as they wanted, and girls, in general, said more factors were important than boys.

Girls were more likely to choose options associated with finding fulfilment, meaning, and enjoyment in their job. They were more likely to say that pursuing something they are interested in (60% compared to 53% of boys) and that they enjoy (55% compared to 48%). Also, being valued (34% compared to 27%), making a difference or having an impact (33% compared to 26%), and opportunities to be creative (30% compared to 27%) were more important factors in choosing a career for girls compared to boys. On the other hand, they were just as likely to select factors such as pay, career prospects and job security as boys. It appears, therefore, it's not that girls do not value financial and practical benefits from work, but that they also value a broader range of aspects to work than boys.

Figure 3.5: Factors important to young people in a job, by gender



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

3.5 Image of engineering careers

Having a positive, and perhaps more importantly, accurate image of engineering is an important precursor to the development of engineering aspirations. If young people do not understand what engineers do in their jobs, or if they have a stereotypical view of engineers that does not do justice to the variety of career paths available in engineering, this may negatively influence their aspirations relating to engineering.

Young people were asked what engineers need to do their jobs well, and provided a list of characteristics including: innovative, practical, creative, numerate (good with numbers), a good communicator, well organised, team working skills, leadership skills, a quick learner, systematic (good at making a plan), analytical (able to think critically). Overall girls and boys had similar perceptions of engineers, but girls were less likely than boys to say they think engineers need to be innovative was important (chosen by 40% of boys, 35% of girls).

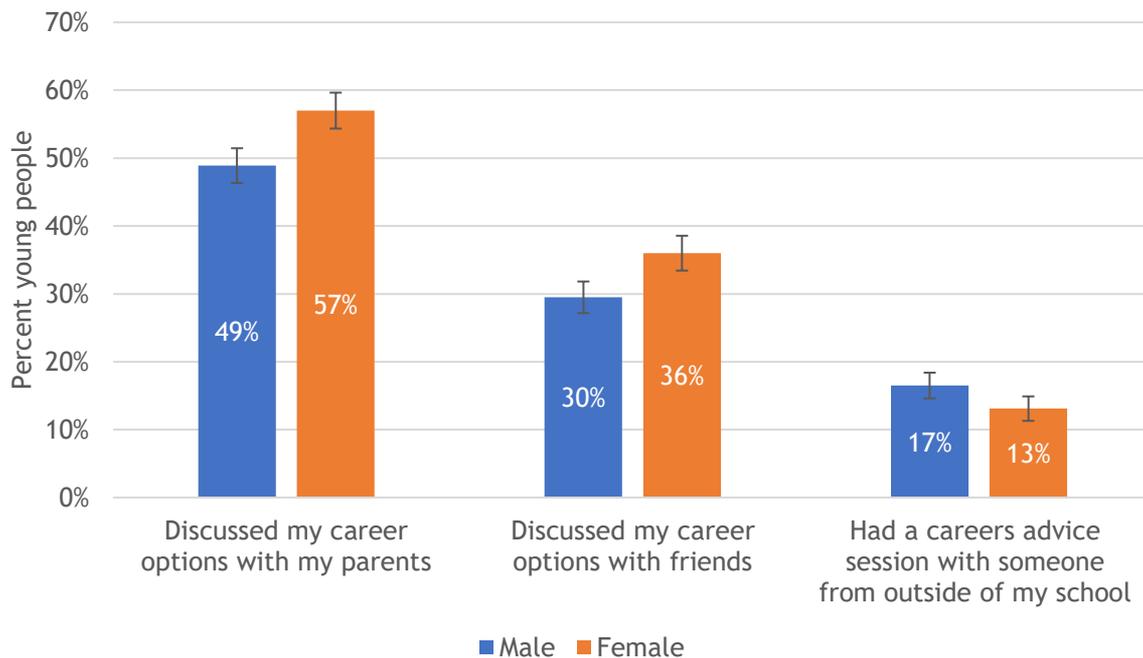
3.6 Engagement with careers activities

In many ways, boys' and girls' engagement with careers advice and activities were very similar. They were just as likely to have searched for careers information online, had a careers advice session with someone from their school or attended a careers event or participated in work experience with an employer³. They were also equally likely to have engaged with no careers activities or advice whatsoever.

³ All activities could have taken place online or in person, unless clearly specified otherwise.

The ways in which girls' and boys' engagement with careers differed tended to be through the more informal avenues. Girls were more likely to have discussed their careers options with their parents (57% compared to 49%) or with their friends (36% compared to 30%). In contrast, boys were slightly more likely to have had a careers session with someone from outside of their school (17% compared to 13%). For those young people who had discussed their careers options with their parents, searched for careers information online, or had a careers advice session with someone from their school, boys were more likely to say that this was related to careers in STEM areas.

Figure 3.6: Careers activities young people had taken part in, in the past 12 months, by gender



Source - EngineeringUK Engineering Brand Monitor 2021

Q - In the past 12 months, have you taken part in any of the following: Please select all that apply. Options included: discussed my career options with my parents; searched for careers information online; discussed my career options with friends; had a careers advice session (either online or in person) with someone from my school; had a careers advice session with someone from outside of my school (for example, an independent careers adviser) either online or in person; attended a careers event with an employer, either online or in person (for example, a tour of a workplace or a careers fair); did work experience with an employer (either in person or online); another type of careers event (either in person or online); none of the above

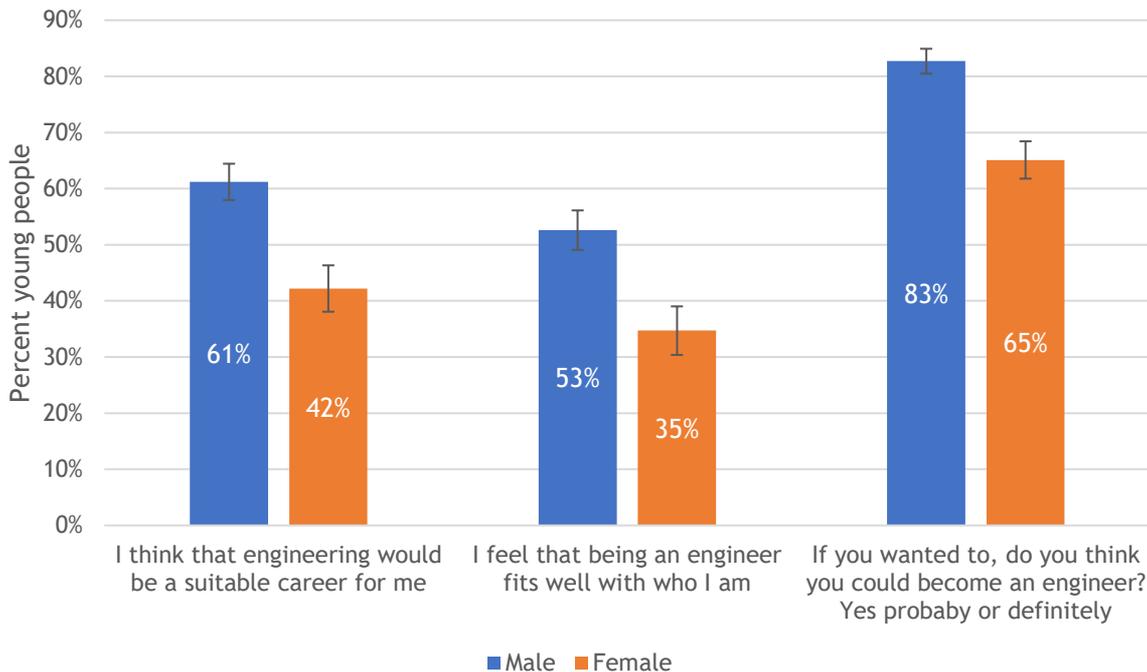
3.7 Inclusivity

In developing career aspirations, it's important that young people see themselves as engineers. We know that representations of engineers in the media tend to be of men. While this reflects the true state of affairs - over 80% of people working in engineering are men - this may lead to girls finding it harder to picture themselves as engineers or feeling that they won't 'fit in' in engineering.

Less than half of girls said that they think engineering would be a suitable career for them (42%), or that they feel being an engineer fits who they are (35%), compared to 61% and 53% of boys. Girls were also less likely to say that if they wanted to, they could become an engineer. Two-thirds of girls, 65%, responded 'yes, probably' (41%), or 'yes, definitely' (24%), compared to 83% of boys (49% yes probably and 33% yes definitely). This chimes with findings above around gender differences in young people's perceptions of their ability in science and maths.

Girls were less likely to say they thought they were good at sciences and maths subjects at school, despite the fact that girls’ performance in these subjects at school is at least as good as boys’ (and in many STEM subjects girls outperform boys)⁴.

Figure 3.7: Responses to questions about inclusivity and engineering, by gender



Source - EngineeringUK Engineering Brand Monitor 2021

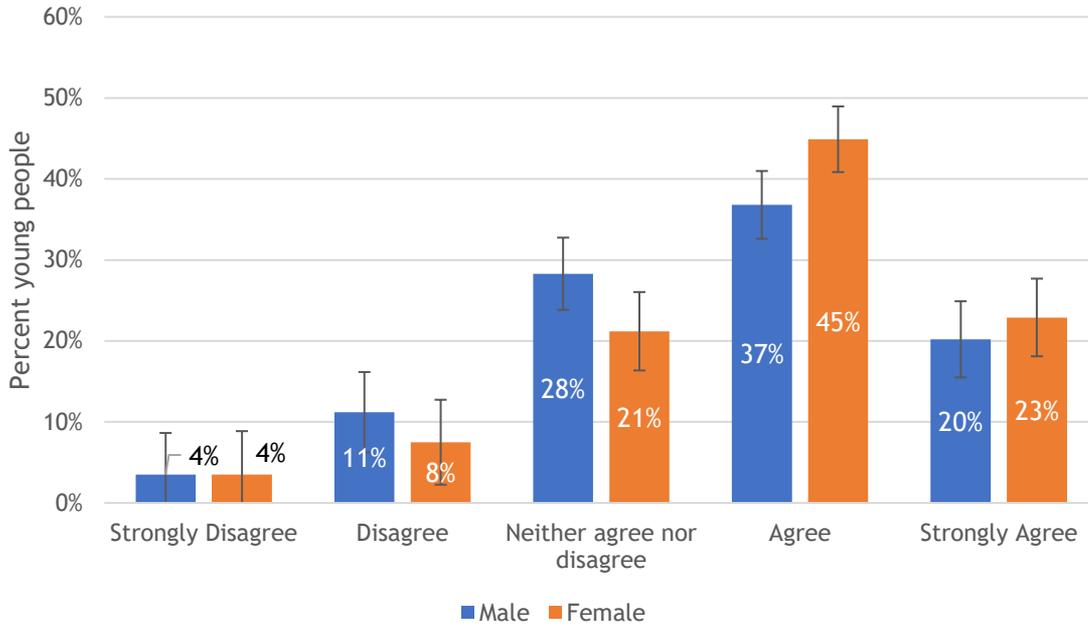
Q - How much do you agree or disagree with the following statements?: I think that engineering would be a suitable career for me; I feel that being an engineer fits well with who I am; Responses were on a 5-point Likert scale from ‘strongly disagree’ strongly agree.’ Percentages presented represent the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

Q - If I wanted to, I could become an engineer. Response options were ‘Yes, definitely’, ‘Yes, probably’, ‘No, definitely not’, ‘No, probably not’, ‘Don’t know’.

We also asked young people directly about their opinions on gender and engineering - whether they believed that girls face more barriers than boys that make it harder for them to get ahead in engineering, or whether boys would make better engineers than girls. Overall, 63% of young people either agreed (41%) or strongly agreed (22%) that girls face more barriers that make it harder for them to get ahead in engineering than boys. Girls were significantly more likely to agree with this statement, with 68% of girls agreeing compared to 57% of boys.

⁴ Cavaglia, C. et al., ‘Gender, achievement, and subject choice in English education’, Oxford Review of Economic Policy, 2020.

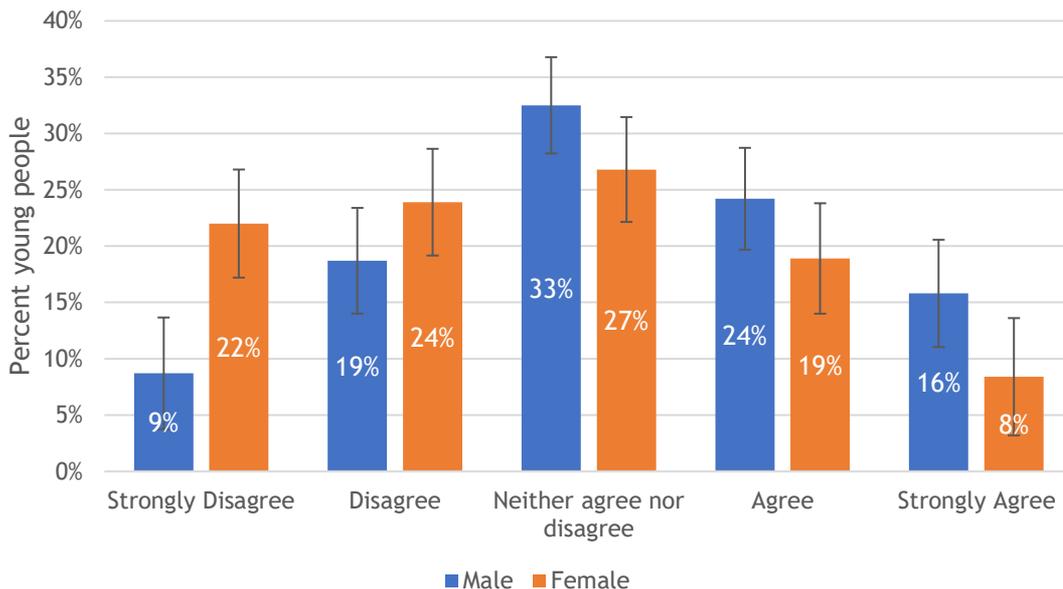
Figure 3.8: Young people’s beliefs about whether girls face more barriers that make it harder for them to get ahead in engineering than boys, by gender



Source - EngineeringUK Engineering Brand Monitor 2021
 Q - How much do you agree or disagree with the following statements?: Girls face more barriers that make it harder for them to get ahead in engineering than boys. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree,' or don't know.

Agreement with the next statement - that boys would make better engineers than girls - was much lower than for the question about barriers. Nonetheless, over a third (34%) of young people either agreed (22%) or strongly agreed (12%) that boys would make better engineers. Overall agreement was much higher among boys, with 40% of boys agreeing compared to 27% of girls.

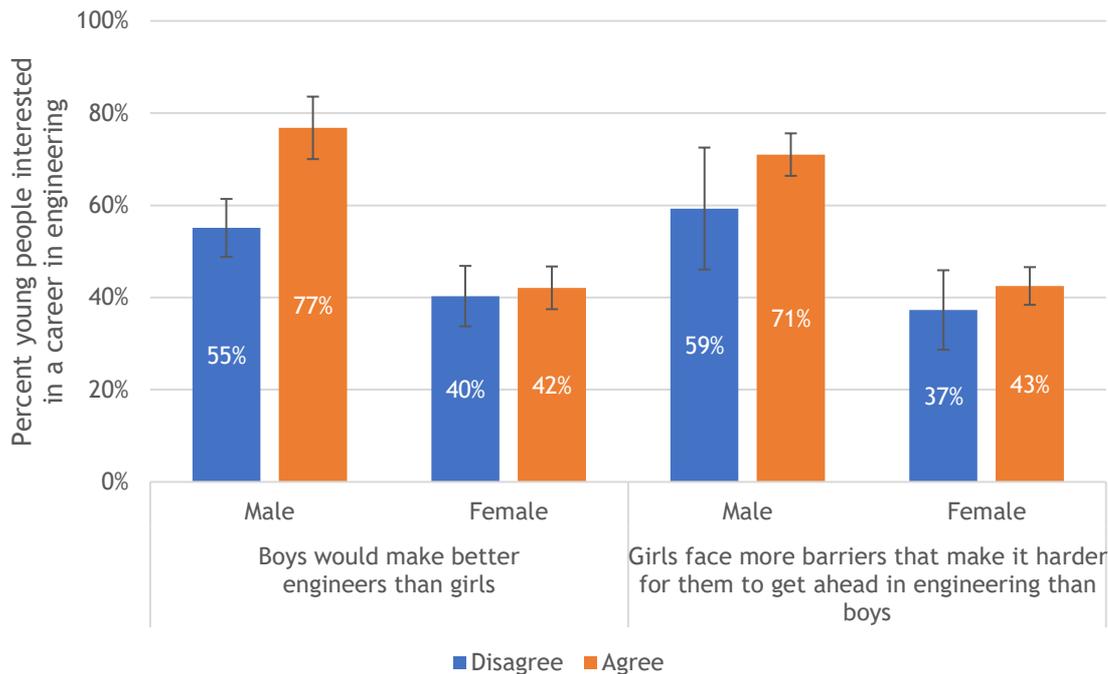
Figure 3.9: Young people’s beliefs about whether boys would make better engineers than girls, by gender



Source - EngineeringUK Engineering Brand Monitor 2021
 Q - How much do you agree or disagree with the following statements?: Boys would make better engineers than girls. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree,' or don't know.

Whether or not girls believed they ‘face more barriers than boys that make it harder for them to get ahead in engineering’, or that ‘boys make better engineers than girls’, did not affect their interest in a career in engineering. For boys, however, there were significant differences in interest in engineering careers by beliefs about gender. Higher proportions of boys who agreed that ‘boys would make better engineers than girls’ said they were interested in a career in engineering (77%), compared to boys who disagreed (55%). While differences were smaller, significantly higher proportions of boys who said girls face more barriers than boys were interested in a career in engineering (71%), compared to those who disagreed (59%).

Figure 3.10: Young people’s interest in a career in engineering, by their beliefs about gender and engineering



Source - EngineeringUK Engineering Brand Monitor 2021
 Q - How much do you agree or disagree with the following statements?: Boys would make better engineers than girls. Responses were on a 5-point Likert scale from ‘strongly disagree’ to ‘strongly agree’. Q - How much do you agree or disagree with the following statements?: Girls face more barriers that make it harder for them to get ahead in engineering than boys. Responses were on a 5-point Likert scale from ‘strongly disagree’ to ‘strongly agree,’ or don’t know. 8

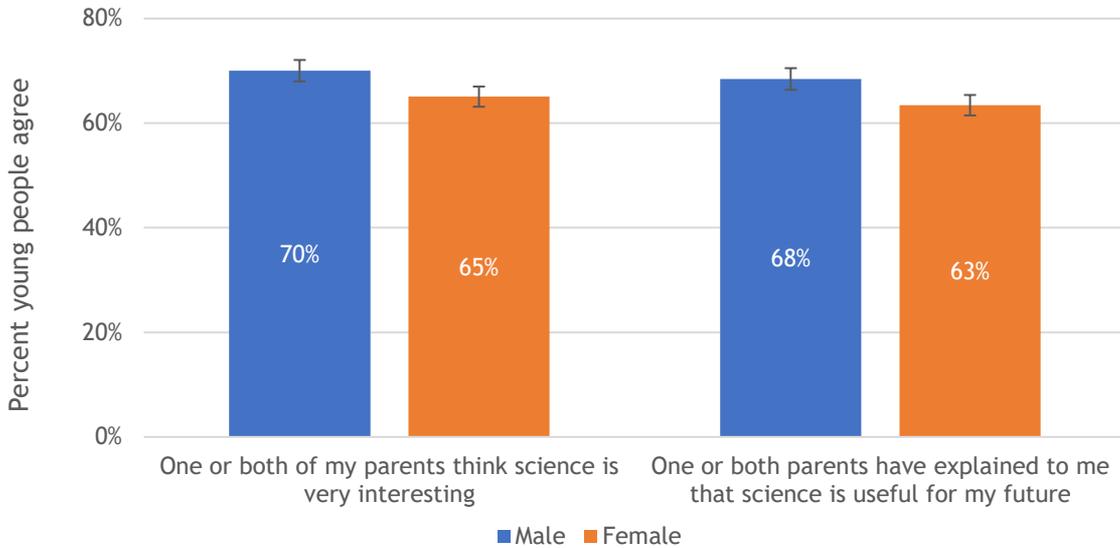
4. Parental gender biases

Previously we saw that just 39% of girls were interested in pursuing a career in engineering, far fewer than the 63% of boys who said the same. We also found that parents had a great influence on their children’s opinions in relation to careers and interest in engineering. Young people who had engaged in STEM activities outside of school with their parents were more likely to have knowledge of what an engineer can do in their job, and to see engineering as a ‘good fit’ for them.⁵ Comparing responses of parents of girls and boys, we notice that some biases remain which could be affecting girls’ opinions of engineering.

When young people were asked about their parents’ views on engineering, more boys than girls said that their parents think science is interesting and that they have explained to them that science is useful for their future (Figure 4.1).

⁵ ‘Engineering Brand Monitor 2021, parents and students report’, EngineeringUK, 2022

Figure 4.1: Parental view of engineering according to their child, by gender

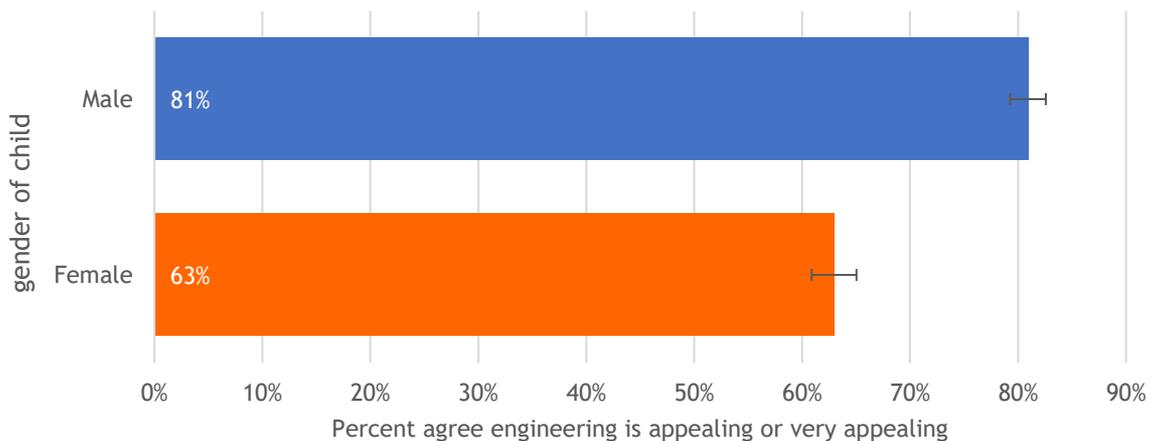


Source: Engineering Brand Monitor 2021

Q- One or both of my parents think science is very interesting. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'. Q- One or both parents have explained to me that science is useful for my future. Responses were on a 5-point Likert scale from 'strongly disagree' to 'strongly agree'.

We also found that 81% of parents of boys agreed the idea of their child pursuing a career in engineering was appealing, compared to 63% of parents of girls who said the same (Figure 4.2). Similarly, higher proportions of parents of boys would suggest engineering as a career to their child (72%) than parents of girls (57%) (Figure 4.3) and parents of boys were more than twice as likely to agree with the statement 'A child like mine would be well-suited to a career in engineering'.

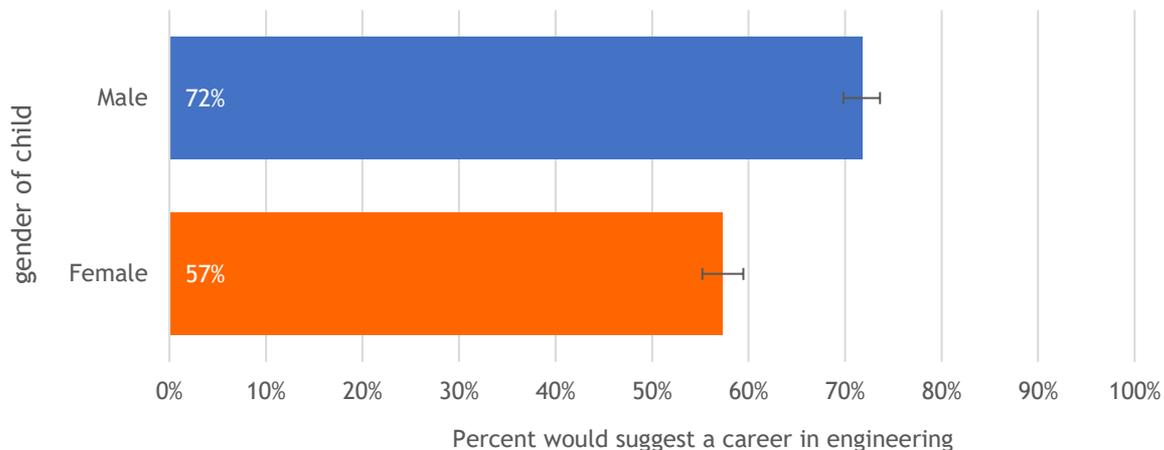
Figure 4.2: Percentage of parents that agree the idea of their child pursuing a career in engineering is appealing, by gender of their child



Source: 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'.

Figure 4.3: Percentage of parents that would suggest a career in engineering to their child, by gender of their child



Source: Engineering Brand Monitor 2021

Q- Would you ever suggest to your child that they consider a career in engineering? Response options were 'Yes', 'No' and 'Don't know'

This indicates that parental perceptions of engineering being a male-dominated profession and more suited to men is influencing young people's perception somewhat about whether engineering would be a good career for them. Other influences such as teachers and engineers themselves can be helpful in changing early perceptions and promoting engineering as a diverse workforce suitable for all.

5. Discussion

In EngineeringUK's Engineering Brand Monitor main report⁶, 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 need to tackle barriers into engineering for women from an early age. The findings here suggest that girls do not see engineering as a good fit for them and are not as interested in a career in engineering as boys. Girls also report less knowledge about the things that engineers can do for work, which may somewhat contribute to their lack of interest: they cannot see themselves as engineers of the future.

Much of the opinion suggests that engineering continues to be viewed as a male-dominated workforce. We see that young people, both boys and girls, agree that 'girls face more barriers that make it harder for them to get ahead in engineering than boys.' Also, that parents of boys are much more likely to suggest a career in engineering to their child and find it an appealing option, than parents of girls. Furthermore, the boys who agreed that 'boys would make better engineers than girls' were more likely to be

⁶ <https://www.engineeringuk.com/research-policy/attitudes-knowledge/attitudes-knowledge/>

interested in a career in engineering than those who did not agree. This could indicate that boys who aspire to a career in engineering think themselves to be better suited to engineering, and attribute this at least in part to their gender. However, it could also be the case that boys who have strong beliefs about differences between men and women are more drawn to careers that match their beliefs about gender norms.

Encouragingly, the factors that are important to girls when considering a career are the same as for boys. This shows the opportunity for encouraging more girls to consider a career in engineering, through positive case studies and highlighting careers and opportunities in the workforce.