EngineeringUK briefing

Social mobility in engineering

EngineeringUK

Social mobility in engineering: key facts

Engineering has the potential to offer real career opportunities for young people, whatever their background

A person's social background affects how well they do in the labour market

Just 24% of the engineering workforce are from disadvantaged backgrounds

There is a compelling business case to widen the engineering talent pool

Employment outcomes are slightly better for people from disadvantaged backgrounds who work in engineering than in other sectors

Widening participation in engineering can help to address the skills shortage and social justice

Unequal educational outcomes are a clear obstacle to social mobility in engineering

The interplay between class, gender and ethnicity may cause cumulative social disadvantage

Misconceptions about engineering can prevent young people from pursuing a career in the profession

Access to **vital careers guidance** is socially stratified

Pupils attending schools in deprived areas often **don't have the opportunity** to study triple science

There are many examples of **work to engage and inspire** more young people from disadvantaged backgrounds to pursue engineering

Executive summary

This briefing provides an overview of social mobility in engineering, both in terms of the educational pipeline and the workforce. It considers the potential implications of recent policy reforms, presents trends in STEM (science, technology, engineering and maths) educational attainment and participation among those from disadvantaged backgrounds, and reflects on how these impact on their employment outcomes. It also examines the barriers to participation in engineering and highlights various strategies being implemented to overcome them.

Our analysis shows that just 24% of those working in engineering come from low socio-economic backgrounds, an underrepresentation that is largely a consequence of low participation and attainment in the engineering educational pipeline.

- 44% of pupils eligible for free school meals (FSM) achieve an A*-C grade GCSE in maths compared with 71% of non-FSM pupils; the respective figures for physics are 8% compared with 23%.
- In A level Maths, 54% of those eligible for FSM in school achieve an A*-B grade, compared with 66% of those who were not eligible. The corresponding figures for physics are 39% and 52%.
- Just 1 in 10 engineering and technology first year undergraduates come from the most disadvantaged POLAR4 quintile.

To address the skills shortage and reap the considerable benefits a more diverse workforce can offer, we must do more as a community to support young people from disadvantaged backgrounds to study and excel in STEM and work to identify and tackle barriers that may inhibit them from pursuing engineering. These include:

- Lower levels of prior academic attainment, including in STEM subjects
- Lower levels of science capital
- Negative perceptions or misperceptions of engineering
- Patchy, socially-stratified access to careers education and work experience
- Schools in disadvantaged areas being less likely to offer triple science, potentially affecting students' ability to study engineering-facilitating subjects at A level, such as physics
- A lack of appropriate data to monitor and evaluate interventions

Encouragingly, there is much good work already happening across industry and education to engage and inspire those from low socio-economic backgrounds to pursue engineering. The government's recent educational reforms and initiatives such as the Social Mobility Action Plan and Careers Strategy also offer significant opportunities for further development in this area.

Yet cultivating talent and aspiration is only one aspect of advancing social mobility through engineering. Within the engineering workforce there are clear differences in the occupational levels employees from low socio-economic backgrounds reach compared with their more advantaged peers. Further work is needed to inspire young people from disadvantaged backgrounds to pursue a career in engineering and to support their careers once in the profession.

- Of individuals in an engineering career, those from advantaged social backgrounds were almost 4 times more likely to work in an intermediate, managerial or professional role at age 30 to 39 than those from disadvantaged backgrounds.
- Differences between these groups are apparent even after accounting for the effects of their highest qualification. This suggests that, over and above inequalities in educational attainment, there are other factors at play preventing those from disadvantaged backgrounds getting ahead.

We also found the effect of social class on engineers' employment outcomes varied with other characteristics, with it being even larger for women and those from a BME (black and minority ethnic) background. This suggests efforts to advance social mobility in engineering should consider how the complex interplay between class, gender and ethnicity may cause cumulative disadvantage.

- Of those working in engineering occupations, white men from advantaged social backgrounds were 28% more likely to hold an intermediate, managerial or professional position by the age of 30 to 39 than their disadvantaged counterparts.
- This 'social class gradient' was even more pronounced among BME men, white women and BME women, with the difference in employment outcomes between those from advantaged and disadvantaged backgrounds largest among BME women.

As a dynamic profession in high demand, engineering has the potential to offer real career opportunities for young people, irrespective of their background. Efforts to widen participation can, in turn, help the community to address its longstanding skills shortage and to harness the significant benefits of a more diverse workforce.

What is the social composition of the engineering workforce?

Less than a quarter of those working in engineering are from low socio-economic backgrounds, though there is some evidence that they fare better in terms of career progression than in other industries. Social mobility, both in terms of participation and progression within the engineering workforce, is a key issue for the sector.

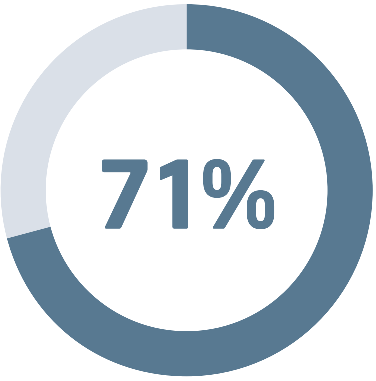
The lack of diversity in the engineering workforce is a longstanding, well recognised issue. As our *Gender disparity in engineering* briefing highlighted, in 2016 women comprised just 12% of the engineering workforce.[1,2] We also know that just 9% of those in engineering occupations are of minority ethnic heritage compared with 12% of the total labour force.[3]

To date, there has been little focus on the extent to which people from disadvantaged backgrounds are represented in the engineering workforce, yet it is apparent from our analysis of the 2017 Labour Force Survey that this also poses an issue, with just 24% of those working in engineering from low socio-economic backgrounds. This compares with 26% in the total labour force.

The need to step up efforts to advance social mobility in engineering was highlighted in the Social Mobility Commission's 2015 State of the Nation report. In its analysis of the efforts by the professions to improve social mobility in their graduate intake, the Commission found engineering and construction to be doing the least. Its analysis was based on 2 factors: the number of recruiters reporting targeted strategies to address socio-economic differences and monitoring the social background of staff.[4]

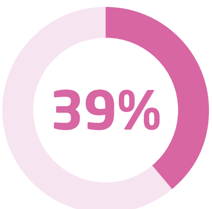
Moreover, a clear link is apparent between an individual's background and their subsequent ability to climb the socio-economic ladder in the engineering sector. Of those aged 30 to 39 in engineering careers in 2017, 71% from advantaged backgrounds were working at a managerial or professional level. This compares with 49% from intermediate backgrounds and just 39% from disadvantaged home backgrounds (**Figure 1**).[5]

This 'social class gradient' appears pervasive across the overall labour force. Indeed, there is some evidence that those from disadvantaged backgrounds fare better in engineering than they do in the labour market as a whole. 39% of those from disadvantaged backgrounds secure a managerial or professional position in engineering by the age of 30 to 39, compared with 33% across the wider labour market. And lower proportions who go into a career in engineering end up in routine or semi-routine occupations (21% compared with 35%).



Within the engineering workforce

71% of those from advantaged backgrounds work at the managerial or professional level.

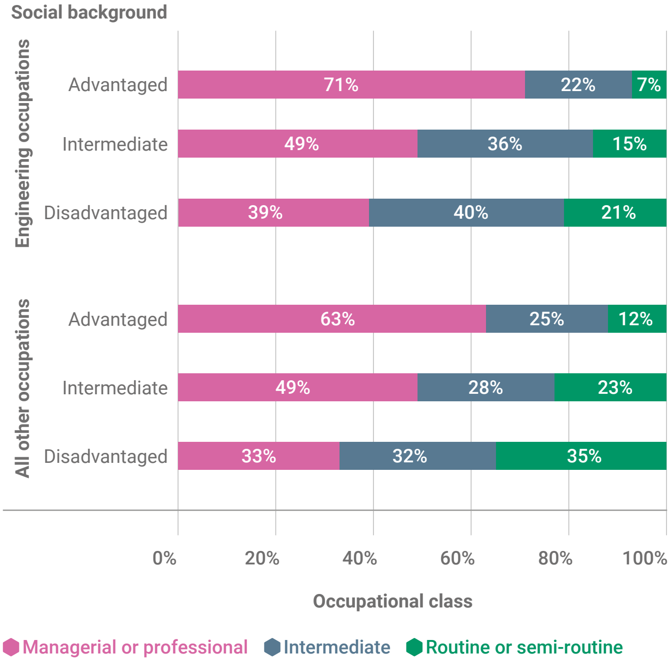


This compares with just

39% from disadvantaged backgrounds.

1 Figures referring to the engineering footprint include both 'core' and 'related' engineering occupations. Core engineering roles are defined as those requiring the consistent application of engineering knowledge and skills to execute them effectively, while related engineering roles refer to those that need a mixed application of engineering knowledge and skill alongside other skill sets. See 'Engineering UK: The State of Engineering 2018 Annex', 2018.
2 EngineeringUK. 'Gender disparity in engineering', July 2018.
3 Office for National Statistics. Labour Force Survey, 2017, Quarter 3.
4 The Social Mobility and Child Poverty Commission. 'State of the Nation 2015: social mobility and child poverty in Great Britain', December 2015.
5 Using Labour Force Survey (LFS) data, we derive a measure of social class background using information on parental occupation, based on the SOC2010 major groupings. These are collapsed into 3 categories: advantaged (SOC major groups 1-2); intermediate (SOC major groups 3-7); and disadvantaged (SOC major groups 8-9), along with no earners. Individuals' own occupational class is measured using the conventional 3-category collapse of the NS-SEC (with those who are unemployed excluded): semi-routine or routine, intermediate, and professional or managerial. See Office for National Statistics: 'The National Statistics Socio-economic Classification' (NS-SEC), 2018.

Figure 1 Proportion of individuals aged 30 to 39 in each occupational class, by social background and engineering occupational marker (2017) – UK



Source: ONS, Labour Force Survey 2017, Quarter 3
Notes: We compare only individuals in the 30 to 39 age range to prevent the results being affected by intragenerational social mobility (i.e. the tendency of individuals to move up the social ladder over the course of their careers). Research shows that there is considerable movement before the age of around 35, after which point individuals tend to reach a point of stability in their social class position (otherwise termed 'occupational maturity').[6]

Social mobility refers to the extent to which individuals move between socio-economic strata, both within one's lifetime and between generations. It relates to the extent to which our society is 'open' or 'fair'.

What do we mean by social class and social mobility?

Social class refers to the stratification of society by social and economic status. As a concept, social class can be difficult to operationalise due to the many dimensions it comprises.

Constrained by the measures available in different datasets, a variety of definitions have been employed in this briefing:

- **Current occupational class of those in the labour force:** Using Labour Force Survey data, we collapse the National Statistics Socio-Economic Classification (NS-SEC), the official measure of social class in the UK, into 3 categories: managerial or professional, intermediate and routine or semi-routine.
- **Social class background of those in the labour force:** To provide a measure of class background, we use parental occupation information, based on the Standard Occupational Classification (SOC 2010) from the Labour Force Survey. These are collapsed into 3 categories: advantaged, intermediate and disadvantaged.
- **Social class background of those undertaking GCSE and A level studies:** Using individual-level National Pupil Database information taken from the Department for Education (DfE) and the Science and Engineering in Education dashboard (SEEdash), we consider whether or not individuals were eligible for free school meals (FSM) while at school.
- **Social class background of higher education (HE) students:** Using POLAR4 information from the Higher Education Statistics Agency (HESA) student record, we consider those from neighbourhoods in the lowest quintile of participation in higher education against those from other neighbourhoods.

Social mobility refers to the extent to which individuals move between socio-economic strata, both within one's lifetime and between generations. It relates to the extent to which our society is 'open' or 'fair'. Education plays a key role in this process.

A helpful distinction can be drawn between absolute rates of mobility and relative rates of mobility. **Absolute mobility** refers to individuals' overall chances of ending up in a different socio-economic position to their parents, while **relative mobility** refers to a comparison of these chances between advantaged and disadvantaged groups. This distinction is important because high absolute rates of mobility can often simply reflect broader economic trends (i.e. an upgrading of the occupational structure, where more white-collar and fewer blue-collar jobs are now needed – a situation in which everyone benefits), while relative rates of mobility reflect the extent of equality of opportunity.

6 Bukodi and Goldthorpe. 'Class origins, education and occupational attainment: cross-cohort changes among men in Britain', Centre for Longitudinal Studies working paper, 2009.

Why does social mobility matter for engineering?

There is a compelling business case for the sector to harness and widen the talent pool. Addressing issues of diversity and inclusion has the potential for positive impact on both the economy and young people facing social disadvantage.

Engineering – far from being limited to the hard hat stereotype so often perceived – is a diverse field that touches every part of daily life, driving forward everything from cleaner air to faster broadband. Increasingly, the fusion between the digital, physical and biological is both leading to new fields of engineering and adding to the already significant demand for highly skilled labour. In our report, *Engineering UK 2018: The state of engineering*, we discuss the considerable demand for engineering skills, with 203,000 Level 3+ engineering-related roles needed to be filled every year through to 2024.[7] Encouraging more young people from all backgrounds, including those that are disadvantaged, to pursue careers in engineering is an important means of addressing this skills shortage – and advancing the UK economy. According to research by the Boston Consulting Group and Sutton Trust, even a modest rise in social mobility could increase the nation's annual GDP by 2% (equivalent to £39 billion).[8]

Furthermore, the business case for diversity in the workforce is well evidenced by the improvements this brings through, for example, enhanced creativity, problem-solving, innovation and financial performance.[9,10,11] Incorporating a diversity of backgrounds is especially important in engineering, given the key role it has in shaping the future. Making sure a range of perspectives is represented among the people who identify and address many of the world's challenges can ensure the solutions they devise reflect the needs of their intended recipients.

Careers in engineering can be extremely rewarding, both in terms of job satisfaction and financial remuneration. Six months after university, engineering and technology first degree graduates earn 18% more than the average graduate, with a mean starting salary of £25,607.[12]

Equalising opportunities for access to engineering professions among all young people is important not only because of the benefits a broader pool of workers equipped with the relevant skills is likely to bring to the economy, but also from a social justice perspective. Engineering, which it has been argued is by its very nature meritocratic since 'a successful technology is determined by its efficiency and effectiveness alone'[13], has the potential to offer real opportunities for young people, whatever their background. It is vital that the engineering sector gives everyone an equal chance to prosper, regardless of the circumstances they were born into.

Recent policy developments that could support social mobility

Unequal educational outcomes are an obvious obstacle to social mobility. Addressing this imbalance via policy reform has the potential to lead to a more equitable society.

There is myriad evidence that young people from disadvantaged backgrounds underperform compared with their peers from more affluent homes across all phases of the English educational system.[14] Furthermore, there are clear differences in the educational choices young people from different socio-economic backgrounds make, with those from disadvantaged homes less likely to pursue further and higher educational qualifications.[15] Educational choices may be easier to influence via policy reform and other interventions than attainment gaps, yet both need to be addressed if we are to advance social mobility.

Growth in demand for STEM skills represents a significant opportunity to promote greater overall social mobility in the UK.

7 Level 3 qualifications are those that demonstrate completion of secondary school or equivalent and are required to work in qualified/skilled employment or for entry to higher education. Level 3 qualifications include, but are not limited to: GCE A or AS levels, Access to HE diplomas, Welsh Baccalaureate Advanced qualifications (Wales), Level 3 and/or Junior Certificates (Ireland), National 3, NPA or National Certificate Awards (Scotland), and certain technical and vocational qualifications. For more information, please see 'Engineering UK 2018: the state of engineering annex'.
8 Boston Consulting Group and Sutton Trust. 'The state of social mobility in the UK', 2017.
9 Kellogg Insight. 'Better decisions through diversity', October 2010.
10 McKinsey and Company. 'Delivering through diversity', January 2018.
11 Royal Academy of Engineering. 'Increasing diversity and inclusion in engineering – a case study tool kit', 2015.
12 EngineeringUK. 'The state of engineering', 2018.
13 Institution of Mechanical Engineers. 'Social mobility and the engineering profession', March 2015.
14 Sutton Trust. 'Subject to background: what promotes better achievement for bright and disadvantaged students?', March 2015.
15 Department for Business, Innovation and Skills.'Socio-economic, ethnic and gender differences in HE participation', November 2015.

The government has expressed a commitment to improving social mobility through education in its Social Mobility Action Plan, *Unlocking Talent, Fulfilling Potential*. This growing focus on social mobility in the wider policy environment is a positive development for efforts addressing the STEM skills shortage, as it may translate into the talents of more young people being recognised and used. Growth in demand for STEM skills likewise represents a significant opportunity to promote greater overall social mobility in the UK.[16] The Action Plan places a strong emphasis on providing young people from disadvantaged backgrounds with 'real choice' in post-16 educational options through the overhaul of the technical education landscape.[17]

A number of reforms are in progress that have been positioned as a way both to address skills shortages and increase social mobility. Alongside the apprenticeship levy and further investment into degree apprenticeships, over 3,000 low-value further educational qualifications will be phased out in favour of T Levels – new technical qualifications hoped to become as 'rigorous and respected'[18] as A levels.

New technical qualifications

T Levels are 2-year level 3 technical study programmes for 16 to 19 year olds, designed to support entry into skilled employment. The content and standards will be designed in conjunction with employers to equip students with relevant skills. As a part of the programme, students will be required to undertake a work placement lasting at least 45 days. T Levels in engineering and manufacturing will be rolled out from 2021.

A **degree apprenticeship** combines aspects of both higher and vocational education and is designed to test occupational competence and academic learning. This can be through a fully-integrated degree programme (co-designed by employers and HE institutions) or a degree plus a separate test of professional competence. Degree apprenticeships are expected to prove highly attractive to students who may be concerned about debt they may accrue to fund a university degree. Many are engineering-focused, including in aerospace, automotive and construction. A survey by Universities UK indicated that among degree apprentices at the institutions surveyed, across the first 3 years, one-fifth were on engineering courses (1,491 at 25 institutions).[19]

The Department for Education's (DfE) Careers Strategy, published at the end of 2017, also intends to address barriers to social mobility with the ambition of delivering world class careers provision for all young people. This includes requiring schools to adopt and demonstrate progress against the Gatsby Benchmarks – a framework for best practice in careers guidance.[20]

To cultivate the skills required in the modern economy, employer needs have been embedded within many of these policy developments.

The DfE also recently announced the introduction of Careers Hubs, where local schools, colleges and higher education institutions work together to improve careers provision. These focus on young people in areas most in need of targeted support,[21] based on a successful pilot rolled out in the North East from 2015 to 2017, which saw most schools in the area meeting most of the Gatsby Benchmarks.[22]

Across the policy landscape, the emphasis is on providing high-quality, tailored guidance to facilitate a smooth transition from education to employment and working closely with employers to develop and deliver new technical qualifications fit for purpose. For example, in November 2017, the DfE launched the Skills Partner programme to enlist the help of business to support the reform of technical education.[23] The ambition to advance social mobility forms a key part of this initiative, with the Skills Partner Action Statement emphasising the vital role of partnerships to 'boost social mobility and reduce inequality'. 'Trailblazer' employers have likewise been closely involved in the design of new apprenticeship standards to ensure apprentices develop the right skills for industry.[24]

16 EngineeringUK. 'The state of engineering', 2018.
17 Department for Education. `Unlocking talent, fulfilling potential: a plan for improving social mobility through education', December 2017.
18 Ibid.
19 Universities UK. 'Degree apprenticeships: realising opportunities', March 2017.
20 Gatsby Foundation. 'Good career guidance', 2014.
21 Department for Education. 'Careers strategy: making the most of everyone's skills and talents', December 2017.
22 Careers and Enterprise Company. 'Twenty new Careers Hubs launched', July 2018.
23 Department for Education. 'Skills partner statement of action for government and employers', December 2017.
24 Institute for Apprenticeships. 'Role of employers', 2018.

The new technical qualifications driving the 'skills revolution': the potential for widening participation

Cindy Rampersaud, Senior Vice President – BTEC and Apprenticehips
Pearson

Recent government reforms will go some way to improving access and progression, but we must continue to promote diversity and address those areas where more needs to be done to ensure students have access to progression routes that suit them best. For the new qualifications to be successful in promoting social mobility, it will be important to:

Ensure T Levels are accessible and support progression

Many colleges and providers will struggle to find enough industry placements for T Level qualifications. Employers have suggested that the impact on production and the additional capacity needed to safeguard and supervise students means they would consider offering only a small number of placements or none at all. We could see regional blackspots where engineering T Levels aren't available, and student choice and mobility are reduced nationally rather than enhanced.

Provide information, advice and guidance

Young people need high-quality information to support their educational learning, along with advice and guidance from an early age. This may take the form of: mentoring, career maps, work experience, or sponsorship of STEM-related curriculum areas in schools.

Support access on a national scale

Engineering courses need to be accessible to all young people nationally. A postcode lottery must be avoided and this is a potential risk with T Levels, where the ability to teach them will be dependent on having the right resources, equipment and expertise.

Promote progression

Students must be able to enter and exit engineering programmes flexibly, taking their achievement or certification with them for a future learning opportunity. One of the challenges with both apprenticeships and T Levels is that there may be no certification of achievement at the end or through the programme. This creates a 'cliff edge' for students who aren't able to complete the whole programme (possibly through no fault of their own) and will leave college after 2 years with nothing.

Actively encourage diversity in STEM

We must continue to support STEM engagement and STEM Ambassador programmes to promote diversity in STEM, finding and building role models that young people – particularly those who don't have these influencers at home – will find inspiring.

How do disadvantaged young people progress along the STEM education pipeline?

Relative to their peers, those from disadvantaged backgrounds are more likely to underperform in school and to opt out of educational pathways into engineering. This poses a clear barrier for disadvantaged young people to gain the knowledge and skills they need to go on to careers in engineering – and to achieve upward social mobility via the profession.

GCSE level

That there are differences in academic performance by social class is a longstanding and stubbornly persistent issue that is not unique to STEM. In the decade leading up to 2016, the attainment gap between advantaged and disadvantaged pupils at GCSE narrowed by just 3 percentage points.[25] And the gap remains considerable: in the academic year 2016 to 2017, there was a 27 percentage point gap in the proportion of pupils eligible and not eligible for free school meals (FSM) who achieved an A*-C grade (or grade 4-9) GCSE in English and mathematics.[26]

Of those eligible for free school meals, 44% achieved an A*-C grade GCSE in maths compared to 71% of those who aren't. The respective figures for physics are 8% compared to 23%.

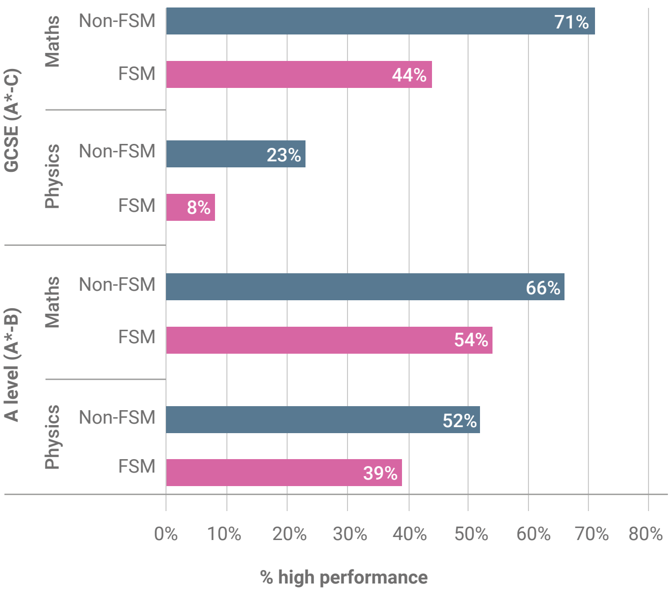
As Figure 2 illustrates, differences in engineering-facilitating subjects are also substantial. In the academic year 2015 to 2016, for example, 44% of pupils eligible for FSM achieved an A*-C grade GCSE in mathematics compared with 71% of non-FSM pupils, and the respective figures for physics are 8% compared with 23%.[27]

A level

Differences in outcomes persist into A levels and other non-compulsory educational routes. Of all young people who entered into an A level exam in 2016,[28] just 7% were eligible for FSM when they were in secondary school, compared with 14%[29] of the total school population in the same year. In mathematics and physics, pupils who were eligible for FSM were even more sparsely represented, at 6% and 5% respectively.[30]

While the attainment gaps at A level are smaller than observed at GCSE level – perhaps unsurprising given that very low performing students are unlikely to continue to study these subjects – they are nevertheless apparent. Of those who sat an A level Mathematics exam in 2017, 54% of those eligible for FSM in school achieved an A*-B grade, compared with 66% of those not eligible for FSM. The corresponding figures for physics are 39% and 52% (Figure 2).[31]

Figure 2 Mathematics and physics attainment at GCSE (2015/16) and A level (2016/17), by free school meal eligibility – England



Source: National Pupil Database 2015/16 and 2016/17
Notes: A*-C for GCSE is compared with A*-B at A level, since the former is a commonly referenced minimum standard for continuation to A level, while to get on to an engineering-related degree, students often need a minimum of two A levels and A or B grades. Maths A level is typically an essential requirement, and many universities also require a second A level in physics.[32]

25 Education Endowment Foundation. 'The attainment gap', 2017.
26 Department for Education. 'Revised GCSE and equivalent results in England, 2016 to 2017', January 2018.
27 SEEdash.org, 2017.
28 This figure includes only those students for whom attainment data has been successfully matched with FSM status.
29 The Guardian. 'Fall in proportion of pupils getting free school meals', June 2016.
30 Department for Education. 'A level attainment by pupil characteristics', March 2017.
31 Ibid.

Vocational routes and apprenticeships

No individual-level apprenticeship data by subject area and social deprivation is publicly available. As a result, this section is necessarily restricted to general evidence on social mobility within these routes. Although these findings are not specific to engineering, it is nevertheless hoped they shed light for the community. This lack of data also underscores the need for subject-specific information about the social backgrounds of apprentices to be made more widely available.

Offering a variety of routes into the world of work is an important way to promote social mobility. For example, high-quality, high-level apprenticeships that result in a qualification equivalent to a degree have been found to lead to significant earnings premia.[33]

We know that vocationally-oriented STEM qualifications often have heightened appeal for those who already have a vocation or trade in mind, are looking for a work-focused qualification, or for those who want to avoid the burden of student debt. In addition, they are sometimes seen as more attractive than their academic equivalents for those who have performed less well during the compulsory years of schooling.[34]

Encouragingly, a Sutton Trust study looking into the relationship between apprenticeships and social mobility among young people aged 16 to 24 showed that engineering was the most popular subject for men on advanced programmes.[35] This was not, however, the case for women, who tend to opt out of engineering and engineering-facilitating subjects at far higher rates than their male peers at all stages along the educational pipeline.[36]

Less promisingly, the research also found that people from disadvantaged backgrounds were underrepresented among those starting all Level 3 apprenticeships. Just 7% of apprentices at this level had been eligible to receive FSM when they were in school, compared with 14% of the population. This stands in contrast to those with other Level 3 vocational qualifications, who are more likely to come from a disadvantaged background.[37]

Thus, although vocational routes and apprenticeships have been touted as vehicles for social mobility, at present there remains a clear socio-economic divide among those who undertake them, with those from disadvantaged backgrounds less likely to progress onto higher-level training qualifications than their more advantaged peers. They are also more likely to undertake other types of vocational qualifications at Level 3 or below than those from advantaged backgrounds.

Because apprenticeship 'cold spots' also tend to be areas with high levels of unemployment and deprivation, many disadvantaged young people simply do not have access to these opportunities.

Geography plays a significant factor in this. Apprenticeship participation is very much dependent upon the availability of opportunity for employer-based training in the area where a young person grows up. Because apprenticeship 'cold spots' also tend to be areas with high levels of unemployment and deprivation, many disadvantaged young people simply do not have access to these opportunities. The Learning and Work Institute, for example, found that in some regions, young people eligible for FSM were half as likely as those not eligible for FSM to take up a Level 3 apprenticeship.[38]

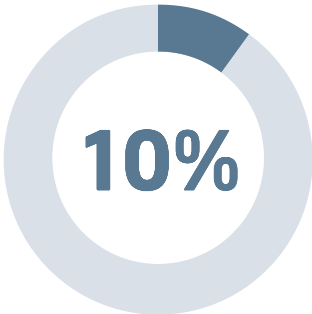
32 UCAS. 'Engineering and technology', 2018.
33 The Careers and Enterprise Company. 'Understanding the careers cold spots', 2016.
34 Houses of Parliament. 'STEM education for 14-19 year olds', March 2013.
35 Sutton Trust. `Better Apprenticeships: access, quality and labour market outcomes in the English apprenticeship system', November 2017.
36 EngineeringUK. 'Gender disparity in engineering', July 2018.
37 Sutton Trust. `Better Apprenticeships: access, quality and labour market outcomes in the English apprenticeship system', November 2017.
38 Learning and Work Institute. 'Three million apprenticeships: building ladders of opportunity', March 2017.

Higher education

Participation in higher education (HE) has traditionally been used as a measure for the overall prospects of young people. The student population has grown dramatically over recent decades, with 33% of 18 year olds in England having entered HE by 2017.[39] UCAS reports that in 2017, entry rates increased to the highest on record for each Multiple Equality Measure (MEM) group.[40,41]

This is not to say this increase in participation has been evenly distributed. In fact, because the largest increase has been among the most advantaged and the smallest among the least advantaged, the entry rate gap has widened to 39 percentage points between the 2 groups.[42]

Figure 3 compares HE entry rates into engineering and STEM subjects between those from areas with low levels of participation in higher education (POLAR4 quintile 1) and those from more advantaged areas by level and subject area. Among first degree entrants, those from disadvantaged backgrounds are underrepresented across all areas of study, making up just 12% of all starts in the academic year 2016 to 2017. While the picture is largely similar across STEM and non-STEM courses, engineering and technology fare slightly worse, with those from disadvantaged backgrounds making up only 10% of all starts. This suggests that the engineering community has significant work to do to encourage participation among young people from disadvantaged backgrounds.



Just 10%
of engineering and technology first degree undergraduate entrants were from disadvantaged backgrounds.

At higher levels, the underrepresentation of those from disadvantaged backgrounds persists, but differences between engineering and technology students compared with other students diminishes among postgraduate taught starts and reverses among postgraduate research starts. This may in part be due to the high degree of selection inherent in more advanced levels of study, with variation in academic ability much narrower among postgraduates than undergraduates.

Figure 3 Higher education entrants by subject area, level of study and POLAR4 quintile (2016/17) – UK

	First degree undergraduate		Postgraduate taught		Postgraduate research	
	POLAR4 quintile 1	POLAR4 quintiles 2-5	POLAR4 quintile 1	POLAR4 quintiles 2-5	POLAR4 quintile 1	POLAR4 quintiles 2-5
Engineering and technology	10%	90%	11%	89%	9%	91%
All STEM subjects	13%	87%	10%	90%	8%	92%
All non-STEM subjects	12%	88%	10%	90%	7%	93%
All subjects	12%	88%	10%	90%	8%	92%

Source: HESA, student record 2016/17
Notes: 'Disadvantaged' refers to those from POLAR4 quintile 1 (areas with the lowest levels of participation in HE) while 'Advantaged' refers to those from POLAR4 quintiles 2-5. The analysis is restricted to those who are in their first year of study in 2016/17.

39 UCAS. 'Equality and entry rate data explorers', 2018.
40 UCAS' Multiple Equality Measure represents individuals' likelihood of entering university, based on multiple indicators of equality (e.g. gender, ethnicity, FSM status, etc). This is split into five groups, with those in MEM group 1 being least likely to enter higher education, and those in MEM group 5 being most likely to enter higher education.
41 UCAS. 'End of cycle report 2017: patterns by applicant characteristics', 2017.
42 Ibid.

Promoting social mobility through higher and degree apprenticeships

Dr Lee Elliot Major, Chief Executive
Sutton Trust

Low social mobility and lack of educational opportunity is arguably the biggest social challenge of our times: the income gap between the richest and poorest in society continues to widen, while education opportunities remain overwhelmingly dominated by children from the most privileged homes. The Sutton Trust is concerned with breaking the link between educational opportunities and family background, so that young people are given the chance to fulfil their potential, regardless of their family background, school or where they live. Although there are significant challenges to doing so, modern engineering, with its high demand for relevant skills, offers great potential to advance social mobility.

As disadvantage starts early and continues through to the workplace, strategies to improve social mobility must span a wide range of areas, including parenting, primary and secondary schooling, access to university and the professions, and apprenticeships. The attainment gap between the most advantaged and most disadvantaged is already present before schooling begins and continues to widen throughout a young person's education, so early interventions are crucial. We believe that young people, regardless of background, should be given the same opportunities as their more privileged counterparts, at every stage of their education.

One key way to advance social mobility is ensuring that young people have all the information needed to make an informed choice about their future. This is particularly crucial when young people are making decisions about their post-16 education. Disadvantaged young people often lack the same knowledge and support that their more advantaged peers receive, either through their schools, parents, or other informal networks, and so may not be aware of the opportunities or future career options that are open to them, or the best routes to take to get there.

Good quality apprenticeships as a vehicle for social mobility

Good quality apprenticeships have the potential to be important vehicles for social mobility and we welcome a renewed focus on vocational education. With lifetime earnings on average better than many degree courses, apprenticeships offer the opportunity to 'earn while you learn' and get a foot on the career ladder. We want to see far more higher and degree apprenticeships available, targeted at younger age groups, to give young people a platform for progression to higher level learning and careers.

With university degrees now leaving graduates with debts of over £50,000, deciding whether to go to university is a tough decision for many young people. Our recent polling found that nearly half of young people who say they are likely to go to university are worried about the cost of higher education, a concern that is particularly pronounced among young people from the poorest families. The most commonly cited financial worry was about tuition fees, followed by repaying student loans for up to 30 years and the cost of living as a student. Of those that said they were unlikely to go into higher education, 44% cited financial reasons. For young people from poorer backgrounds where these concerns are particularly prevalent, undertaking a degree apprenticeship may be a far more attractive option than going to university as they get the opportunity to gain a degree qualification without having to take out a substantial loan, all the while earning money.

> **Our research last year found that despite recent growth, there are fewer than 10,000 degree apprenticeship starts each year for young people compared to 330,000 new undergraduate degrees.**

As well as the immediate benefits that come with earning while you learn and not acquiring student debt, our research has found that the best apprenticeships can have a higher lifetime wage premium than degrees from non-Russell Group universities. Across a lifetime, someone with a level 5 apprenticeship averages earnings of around £1.5m, while someone with a non-Russell Group degree earns just under £1.4m. There are currently not enough of these degree apprenticeship opportunities, however, with most apprenticeships on offer currently at level 2 (GCSE) and level 3 (A level) standard. Our research last year found that despite recent growth, there are fewer than 10,000 degree apprenticeship starts each year for young people compared to 330,000 new undergraduate degrees.

Good quality apprenticeships can also provide young people with marketplace value skills and a foot on the career ladder, which in turn can advance social mobility. A high-quality apprenticeship should provide substantial training to develop new skills and occupational expertise, with both on the job and off the job training. As well as the specific occupation-based skills that apprentices develop, apprenticeships also offer the opportunity to develop soft skills such as teamwork, communication and resilience that are valued by employers. These broad, transferable skills can be invaluable for a young person starting out in their career. While higher and degree apprenticeships open doors to higher-level jobs and occupations, it is important to note that they do not necessarily guarantee a higher quality experience, so it is vital to ensure that apprenticeships are providing substantial training and support.

Current barriers to access for disadvantaged young people

Given the opportunities to advance social mobility that degree apprenticeships present, and since these high-quality apprenticeships are scarcer than university degrees, it is vital to tackle the barriers currently facing young people in choosing this route. Disadvantaged young people are substantially less likely than their better-off peers to take up the best apprenticeships, and for those who do choose an apprenticeship, they are likely to be working in a low-quality setting with little career progression. Our research last year found that the percentage of men and women with an advanced apprenticeship who were eligible for free school meals when in school is 7% and 11% respectively. Employers should recognise the importance of widening the talent pool and having a diverse workforce in addressing skills shortages and advancing social mobility.

One barrier to greater participation in apprenticeships are the negative perceptions surrounding vocational routes. This year, we found that two-thirds of young people say they would be very or fairly interested in doing an apprenticeship after leaving school, an increase of 9 percentage points over the last 4 years. Despite this, only a fifth of teachers say they would advise a high performing student to opt for an apprenticeship over university. Of those teachers unlikely to advise an apprenticeship, the majority (58%) mentioned reasons related to the perceived superiority of university, with 28% saying university offers better career prospects. This suggests that there is still some way to go before vocational routes are given the same status as academic routes, something that needs to be tackled to improve participation. Careers advice in schools should more strongly take into account the benefits of apprenticeships as a route to labour market recognition and educational progression, to ensure that all young people are provided with the information necessary to make an informed choice about their futures.

A further barrier to fulfilling the social mobility potential of apprenticeships is the stark gender divide in sectors. By the time they are 28, men who take a level 3 apprenticeship might expect to earn up to 37% more than their peers who left education with A levels. However, the figure for women is just 9%. Overall, the earnings difference for those with apprenticeships is almost 4 times larger for men than for women. This is largely due to the types of apprenticeships that men and women go into. Men are concentrated in higher-earning sectors like engineering, while women are more likely to undertake apprenticeships in lower-earning sectors like retail and care work. Tackling this gender imbalance is crucial to ensuring that apprenticeships work to advance social mobility. Again, this barrier can be at least partly addressed through careers advice, with guidance that doesn't reinforce stereotypes. Advice should be clearer about the potential careers, salaries and progression prospects that are likely to arise from undertaking an apprenticeship in different sectors. The Sutton Trust runs programmes in specific sectors, such as Pathways to STEM, to help young people gain the knowledge, skills and confidence required to make an informed decision about their future career. Employers should also be aware of the need to diversify the employment pool in the interests of using all available talent and advancing social mobility for all groups.

Apprenticeships, and particularly degree apprenticeships, offer an important platform for progression to higher level learning and careers, and present exciting opportunities for young people. Employers should recognise the benefits that come with having a wider talent pool and a diverse workforce to both address skills shortages and advance social mobility. Given the clear positive payoffs to undertaking an apprenticeship, it is vital that we tackle the barriers, so that apprenticeships can fulfil their social mobility promise.

How does social disadvantage affect labour market outcomes?

Statistically, the higher the level of education the better the outcome in the world of work. However, even when factoring in educational attainment, social background still has a bearing on career progression.

Absolute social mobility

The differences between advantaged and disadvantaged young people in educational attainment and participation have important implications for social mobility. On average, the higher an individual's level of education the better their outcomes when they enter employment.

Disparities in educational attainment drive much of the difference we observe between those from advantaged and disadvantaged backgrounds in the engineering workforce in respect of pay and level. Studies have shown a clear association between level of education and average income later in life,[43] a trend also observed for those working in engineering.

Our analysis of the 2017 Labour Force Survey suggests that, among men aged 30 to 39 in core or related engineering occupations, those with a degree or higher earn, on average, 46% more than those who have no qualifications and 22% more than whose highest qualification is A levels (Figure 4). Among women, these differences are 46% and 12%, respectively.

There is also a wage differential between individuals with academic and vocational qualifications, with the former associated with higher average earnings (for example, Level 3 NVQ qualifications compared with A levels). It is hoped that the recent and upcoming reforms to vocational and technical education may go some way to closing the gap, but to date vocational (non-apprenticeship) qualifications have not always proven particularly conducive to social mobility.

Figure 4 Median annual gross pay for those in engineering occupations at ages 30 to 39, by highest qualification and gender (2017) – UK

Source: ONS, Labour Force Survey 2017, Quarter 3
Notes: Gross pay is known to be underestimated in the LFS because those who earn more than £100 per hour are excluded for quality assurance purposes. The likely implications of this on the patterns presented is that the association between educational attainment and earnings may be underestimated.

43 Statista. 'United Kingdom (UK): average salary by education level 2003-2013', November 2013.

The government has acknowledged that the current system of post-16 education is fragmented and confusing for young people,[44] and the post-16 Skills Plan was developed in response to the 'serious flaws' [45] identified in the current system of technical education.

On the upside for the sector, for all types and levels of vocational qualifications (including apprenticeships), engineering consistently comes out as the subject with the highest payoff in terms of the earnings differential when compared with other forms of education.[46]

Relative social mobility

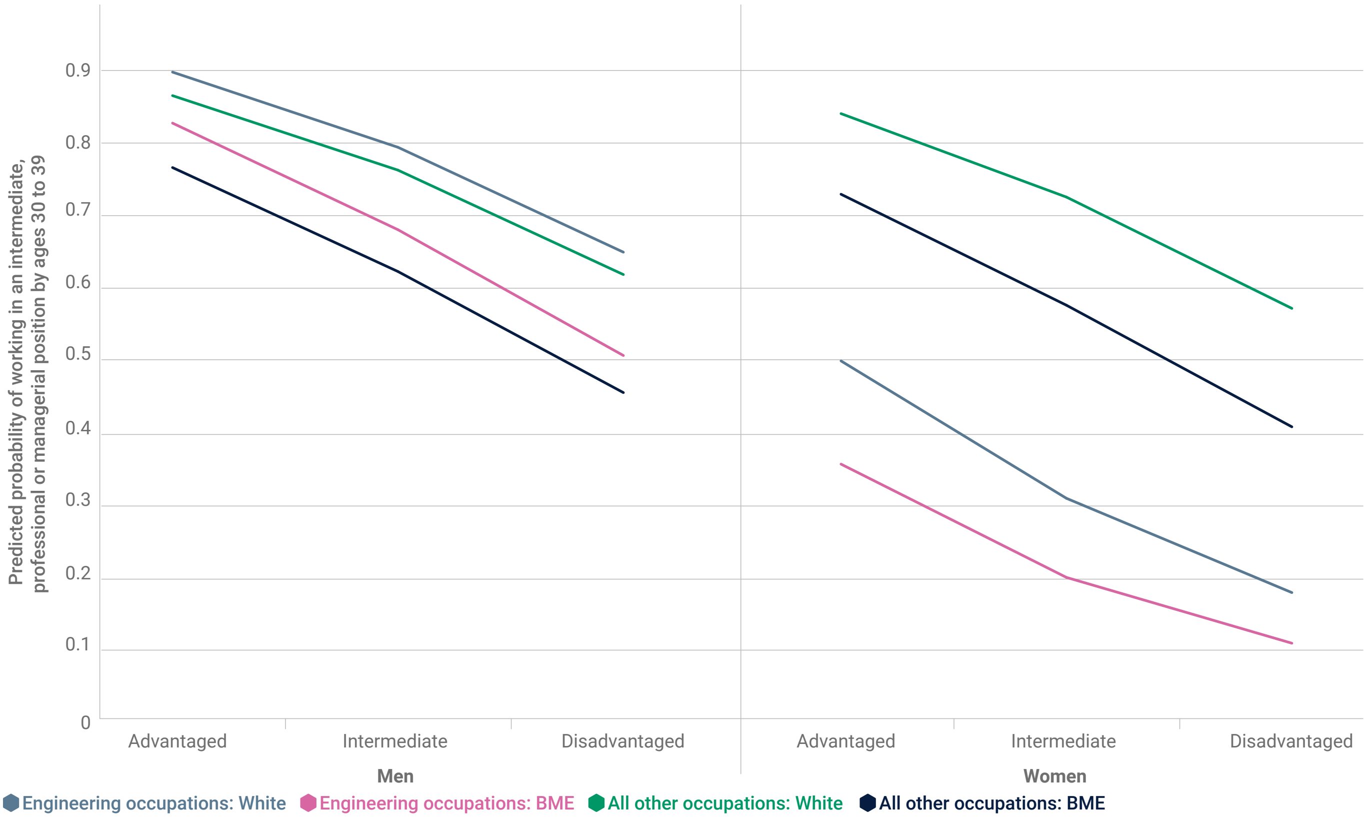
Educational attainment does not explain all the differences we see in employment outcomes within the engineering workforce. An individual's social background factors into the occupational levels they reach, even after taking into account their highest qualification. This social (dis)advantage can be further compounded by other characteristics, such as gender or ethnicity.

While opportunities for educational attainment and career progression have increased across the board, questions remain about how individuals from lower socio-economic backgrounds fare relative to their more advantaged counterparts. In order to achieve *upward* mobility in engineering from a disadvantaged position, individuals need to reach a socio-economic position later in life that represents an *improvement* upon that of their parents' – i.e. an intermediate, managerial or professional occupation.

Of individuals who went on to a career in engineering, those from advantaged social backgrounds were almost 4 times as likely to work in an intermediate, managerial or professional role by age 30 to 39 than those from disadvantaged backgrounds. This suggests that the latter do not have the same chances as their peers from a more advantaged background to reach those occupational levels.

This issue is not unique to the engineering sector, with relative chances of reaching intermediate, managerial or professional levels between those from disadvantaged and advantaged backgrounds similar in magnitude across the labour force.

Figure 5 Predicted probabilities of individuals working in an intermediate, professional or managerial occupation at ages 30 to 39, by engineering occupational marker, social background, gender and ethnicity (2017) – UK



Source: ONS, Labour Force Survey 2017, Quarter 3
Notes: All differences are statistically significant at the 95% level.

44 Department for Education. 'Unlocking talent, fulfilling potential: a plan for improving social mobility through education', December 2017.
45 Department for Business, Innovation and Skills and Department for Education. 'Post-16 Skills Plan', July 2016.
46 Centre for Vocational Education Research. 'Labour market returns to vocational qualifications in the Labour Force Survey', October 2016.

Moreover, among those working in engineering roles, differences between individuals from advantaged and disadvantaged backgrounds in their occupational level at age 30 to 39 remained, even after taking account of differences in their highest qualification. This suggests that over and above unequal educational outcomes, there are other reasons why individuals from disadvantaged backgrounds struggle to achieve upward mobility – both in engineering and the wider labour market.

As **Figure 5** shows, social background is just one of the important predictive characteristics in occupational outcomes, with complex interactions between class, ethnicity and gender apparent.

While women across all social classes and ethnic groups are less likely than men to achieve a position in the higher occupational levels of any sector, the situation is particularly dire in engineering. Having taken into account the effects of ethnicity and social class, men aged 30 to 39 in engineering careers are over 8 times as likely as women to secure an intermediate, managerial or professional occupation. The corresponding figure comparing men and women in other sectors is less than 2.

Individuals of black and minority ethnic (BME) backgrounds are also disadvantaged relative to their white peers in terms of their chances of securing an intermediate, managerial or professional job – though this difference is no larger in engineering than it is in other sectors.

Furthermore, there is evidence that social background has more of a bearing on women's labour market outcomes than it does on men's, particularly for those from BME heritages. The social class gradient[47] among those aged 30 to 39 in engineering occupations is smallest for white men (a 28% difference between those from advantaged and those from disadvantaged backgrounds) and largest for women of BME backgrounds (70%). The corresponding figures for BME men and white women are 39% and 64% respectively.

Nevertheless, there is strong evidence that social class influences later occupational outcomes in the engineering sector, even once we've considered the effects of gender and ethnicity. Having accounted for both, those from advantaged social backgrounds are still 40% more likely to achieve an intermediate, managerial or professional position later in life than their disadvantaged counterparts.

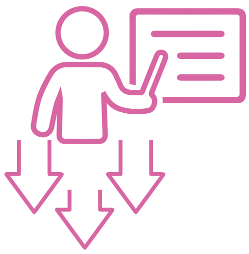
What stops disadvantaged young people from getting into engineering?

From how well they do at school to unequal access to careers advice, work experience and specialist teachers, a number of barriers mean young people from low socio-economic backgrounds are less likely to pursue engineering careers.

Prior academic attainment

Previous research has shown that class differences in the rate of young people studying STEM after compulsory schooling is principally driven by disparities in educational attainment at GCSE.[48,49,50] In other words, once prior academic attainment is taken into account, the difference between advantaged and disadvantaged young people's likelihood of studying STEM post-16 is greatly reduced. One study showed that those whose parents worked in managerial or professional roles were 1.2 times as likely as those from more disadvantaged backgrounds to choose to study a STEM A level, even after taking into account a host of other individual characteristics. Once differences in prior attainment were taken into account, however, the odds for these 2 groups were equal.[51]

This being the case, if we are to overcome differential rates of post-16 take-up in STEM A levels, both issues leading to differences in choice – for example, the perception that STEM subjects are particularly 'hard'[52] or academically challenging[53] – and to disparate exam *performance* must be tackled.



Schools in deprived areas are more likely to face **teacher shortages** and have STEM subjects taught by a non-specialist.

47 Here, the social class gradient is defined and calculated as the difference in individuals' probability of achieving an intermediate, professional or managerial occupation if they are from an advantaged, compared with if they are from a disadvantaged, background.
48 Homer and others. 'Measuring determinants of post-compulsory participation in science: a comparative study using national data', 2014.
49 Codiroli McMaster. 'Who studies STEM subjects at A level and degree in England? An investigation into the intersections between students' family background, gender and ethnicity in determining choice', 2017.
50 Houses of Parliament. 'STEM education for 14-19 year olds', March 2013.
51 Codiroli McMaster. 'Who studies STEM subjects at A level and degree in England? An investigation into the intersections between students' family background, gender and ethnicity in determining choice', 2017.
52 Ibid.
53 Houses of Parliament. 'STEM education for 14-19 year olds', March 2013.

The challenge lies with identifying what drives these inequalities. One potential factor could be the longstanding issue of teacher recruitment and retention, which disproportionately affects schools in deprived areas. 2017 marked the fifth consecutive year in England for which recruitment targets for trainee teachers were missed.[54] This shortfall was especially pronounced in disadvantaged schools, with teacher vacancy rates twice as high in the most deprived areas than other locales.[55]

Differences in attainment are in part driven by unequal access to specialist STEM teaching and academic support inside and outside the classroom.

There is also evidence that schools in less affluent areas have fewer STEM specialist teachers than those in more advantaged areas. According to research by the Education Policy Institute, outside of London just 17% of physics teaching hours in the most deprived schools were delivered by subject specialists, compared with 52% in the least deprived schools – a gap of 35 percentage points.[56]

Studies have furthermore shown that some teachers – unconsciously or not – hold lower expectations of pupils from disadvantaged backgrounds even if they are very bright, and that this could affect academic attainment.[57]

Of course, there are many other factors that could lead to the attainment gap between disadvantaged students and their more advantaged peers. A systematic review of the factors linked to the underperformance of disadvantaged students in science and maths at school, for example, also points to the importance of a rich home learning environment and parental support.[58]

Academic involvement by parents can go a significant way to offsetting the negative influences of living in a disadvantaged neighbourhood,[59] and so attempts to engage with parents or to improve the level of academic support those from disadvantaged backgrounds receive outside of the home environment are likely to be beneficial in closing the attainment gap.

Unequal distribution of science capital

A lack of science capital – that is, an individual's science-related knowledge, literacy, attitudes, experience, dispositions and social networks – can also considerably affect a disadvantaged young person's educational choices and attainment.[60,61] The Enterprising Science Project found that the more science capital a young person has, the higher their likelihood of pursuing science study routes post-16 and of seeing science as 'for them'.[62] The same study showed there was a clear link between low science capital and social disadvantage.

Science capital[63]

Science capital is a concept developed by the ASPIRES (now ASPIRES 2) team led by Professor Louise Archer, to explain why there are disparate rates of participation in post-16 science.[64] Their studies show that the more science capital a young person has, the more likely they are to aspire to pursue science education and careers.

There are 8 key dimensions of science capital:

- Scientific literacy
- Science-related attitudes, values and dispositions
- Knowledge about the transferability of science
- Science media consumption
- Participation in out-of-school science learning contexts
- Family science skills, knowledge and qualifications
- Knowing people in science-related roles
- Talking about science in everyday life

Other research indicates there may also be such a thing as 'engineering capital', where knowledge of, familiarity with and social networks which promote engineering could boost participation, in particular among disadvantaged groups. For example, researchers from the University of Manchester have found that young people with relatives who are engineers are more prepared to go into engineering than their peers.[65]

54 EngineeringUK. 'The state of engineering', 2018.
55 BBC. 'Teacher vacancy rate double in poor areas', September 2017.
56 Education Policy Institute. 'The teacher labour market in England: shortages, subject expertise and incentives', August 2018.
57 Campbell. 'Stereotyped at seven? Biases in teacher judgement of pupils' ability and attainment', July 2015.
58 Banerjee. 'A systematic review of factors linked to poor academic performance of disadvantaged students in science and maths at school', 2016.
59 Ibid.
60 University College London. 'The science capital teaching approach: engaging students with science, promoting social justice', 2017.
61 Archer and others. '"Science capital": a conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts', 2015.
62 King's College London. 'The enterprising science project', 2018.
63 Archer and others. '"Science capital": a conceptual, methodological, and empirical argument for extending Bourdieusian notions of capital beyond the arts', 2015.
64 King's College London. 'Science capital made clear', 2016.

Perceptions and knowledge of engineering

A limited understanding of engineering – evident across young people generally – can also pose a barrier to advancing social mobility through the profession. Evidence from EngineeringUK's 2017 Engineering Brand Monitor (EBM)[66] suggests that young people aged 11 to 19 have relatively low perceptions of engineering, and particularly so in contrast to other STEM subjects. While 68% hold positive views of science, 72% of technology and 62% of mathematics, just 54% do so of engineering and only 43% see a career in engineering as desirable.

Lower levels of knowledge about the sector and the kinds of jobs available could be behind this: just 28% of young people aged 11 to 19 said they know quite a lot or a lot about what people working in engineering do (compared with around 35% for science and technology), and the figure is even lower among certain groups, particularly girls (21%). Among those who didn't see engineering as a desirable career, reasons given for why include that it is 'boring' or 'dull', 'too complicated', 'too difficult' or 'too technical', and that it is 'dirty', 'greasy' or 'messy'. Recent research by the Institution of Engineering and Technology (IET) has similarly showed that children and young people tend to hold outdated images of what a 'typical engineer' looks like, believing them to be 'white, middle-aged and male'.[67]

Research shows young people from disadvantaged backgrounds are more likely to underestimate their academic potential and to not see STEM as 'for them'.

These stereotypes of the profession pose clear barriers to widening participation efforts. Studies have shown that those from disadvantaged backgrounds are more likely not to see STEM careers as a viable option, and to underestimate their academic potential than their more advantaged peers.[68,69,70] There is a significant amount of work underway by the Professional Engineering Institutions, the Royal Academy of Engineering, EngineeringUK and across business and industry to dispel these misconceptions and signal to young people from all backgrounds, particularly those that are disadvantaged, that they belong and can succeed in the field.[71] The government has also focused attention on engineering careers during 2018 as part of its communications campaign, the Year of Engineering.[72]

Unequal access to careers guidance and work experience

Careers guidance is vital for young people to make informed decisions about their future – and yet it is apparent access to high-quality information is lacking for many. More than half of young people aged 11 to 19 say that school careers advisors positively influenced their perception of engineering, [73] but less than two-thirds of Year 11 students report having received careers education – and of those that did, just over half express satisfaction.[74]

Careers provision is patchy, patterned, and socially stratified, with young people from disadvantaged backgrounds significantly less likely to report having received careers education at school than their peers.

And there is evidence that certain groups, including those from disadvantaged backgrounds, have especially limited access to careers guidance. Both the Careers Strategy and research by ASPIRES noted that careers provision across the country is patchy, patterned and socially stratified, with girls, young people from disadvantaged backgrounds and young people of ethnic minority heritage all significantly less likely to report having received careers education at school than their peers.[75,76]

We also know that less than half of all students have had work experience[77] and that opportunities for high-quality work placements are not evenly distributed around the country.[78] Since the removal of statutory work experience (and funding for it), placements are more often organised by families than by schools. This can affect the degree to which disadvantaged young people are able to access work experience opportunities, as they are less likely to have social networks and science capital they can draw on.[79]

65 Harris and Pampaka. 'Why engineering in the UK must embrace change', July 2018.
66 The EBM is a nationally-representative survey measuring knowledge and perceptions of engineering among young people, their parents and their educators.
67 The Institution of Engineering and Technology. 'Middle aged, male, glasses, high vis jacket and a hard hat? Must be an engineer', November 2017.
68 King's College London. 'ASPIRES report: young people's science and career aspirations, age 10-14', 2013.
69 Sutton Trust. 'Believing in better. How aspirations and academic self concept shape young people's outcomes', June 2016.
70 The Guardian. 'How being poor can lead to a negative spiral of fear and self-loathing', June 2015.
71 Tomorrow's Engineers is a community led effort to co-ordinate engineering outreach activities and inspire more young people to consider a career in engineering. The Royal Academy of Engineering lead partners in the This is Engineering campaign, showcasing engineering careers.
72 UK government. 'What is the Year of Engineering?', 2018.
73 EngineeringUK. 'Engineering Brand Monitor', 2017.
74 King's College London. 'ASPIRES 2 project spotlight: year 11 students' views of careers education and work experience', February 2016.
75 Ibid.
76 Department for Education. 'Careers strategy: Making the most of everyone's skills and talents', December 2017.
77 King's College London. 'ASPIRES 2 project spotlight: year 11 students' views of careers education and work experience', February 2016.
78 Department for Education. 'Work experience and related activities in schools and colleges', 2017.
79 King's College London. 'ASPIRES 2 project spotlight: year 11 students' views of careers education and work experience', February 2016.

In recognition of this, there are growing efforts to ensure that all young people, particularly those from disadvantaged backgrounds who arguably need it the most, have access to high-quality careers education. The Careers Strategy, for example, has tasked schools and colleges with providing each young person with a minimum of 7 employer encounters and 2 opportunities for workplace experiences.[80] Across the engineering sector, companies are engaging in this agenda to provide high-quality experiences for young people to learn more about the profession and the variety a career in engineering could offer.

However, one concern is the degree to which the volume of encounters employers are being asked to deliver is sustainable, particularly when considered alongside other aspects of technical reform they have been asked to inform and shape, such as the development of apprenticeship standards and T Level placements. The Careers and Enterprise Company (CEC) has noted that to meet the ambitions of the Careers Strategy, at least 4 million employer encounters and 1 million workplace experiences must be delivered each year.[81] This poses significant implications for employer resources and can affect the quality and distribution of resulting encounters: only 37% of young people, according to the CEC, are currently benefiting from the full minimum standard for employer encounters, with some receiving much more and others significantly less.

Concerns regarding the reliance on employer goodwill to deliver these opportunities – and the effect on resourcing and, correspondingly quality and coverage – were similarly articulated by engineering employers at a 2018 roundtable on social mobility hosted by EngineeringUK.

Schools in disadvantaged areas are less likely to afford their pupils the opportunity to pursue triple science. This can in turn affect their ability to study physics at A level.

Unequal provision of STEM by school and region

GCSE choices can constitute a major barrier to participation in engineering-facilitating educational pathways. Young people who take triple science are much more likely to go on to study physics at A level, for example.[82] Yet most students are not given a choice about which science option they take and evidence suggests that schools in disadvantaged areas are less likely to afford their pupils the opportunity to pursue triple science.[83] In some cases, the disparity is stark. For instance, in highly deprived local authorities such as North East Lincolnshire, half of secondary schools do not offer triple science.[84] In comparison, all schools in more affluent areas, such as in the South East, offer triple science.

Access to post-16 education also significantly varies by affluence of region. Previous research has shown that 16 out of 20 local authorities with the scarcest A level provision are among the most deprived 30% in England.[85]

Ensuring all schools are able to provide opportunities to study STEM is critical if we are to increase the number of young people, including those from disadvantaged backgrounds, in the engineering educational pipeline.

A lack of appropriate data to monitor and evaluate

A further constraint to advancing social mobility in engineering is the distinct lack of related information or data. To date, for example, individual-level data on apprenticeship participation and destination by subject area and social deprivation is not publicly available. Without information pertaining to individuals' social origins, their educational achievements and their social destinations, it is difficult to assess just how severe issues of underrepresentation and inequality of opportunity for disadvantaged young people are.

The ambitions set out in the government's Social Mobility Action Plan and the Careers Strategy are well intentioned, but only by measuring and monitoring can we understand the extent of the problem – and whether any progress has been made in response to the various strategies being put forward.

80 Ibid.
81 Careers and Enterprise Company. 'Closing the gap: the level of employer engagement in England's schools and colleges', 2018.
82 Institute of Physics. 'Why not physics? A snapshot of girls' uptake at A level', May 2018.
83 Economic and Social Research Council. 'Increasing the uptake of science in schools', October 2015.
84 The Royal Society for the encouragement of Arts, Manufactures and Commerce. 'Lack of options: how a pupil's academic choices are affected by where they live', 2014.
85 New Schools Network. 'Glass ceilings: access to A levels in England', June 2016.

What is being done to promote social mobility in engineering?

Industry, education, government and the wider engineering community are engaged in a variety of strategies and targeted interventions to break down barriers to the profession and drive social mobility. Underpinning these strategies are the government's recent educational reforms and renewed emphasis on technical education, which have been positioned as vehicles for social mobility.

For example, the CEC, established in 2015 to create careers opportunities for young people by connecting them directly with employers, aims to prioritise provision in areas identified as 'careers cold spots'. Other organisations, such as Brightside and Generating Genius, exist to promote social mobility in STEM by increasing science capital among young people who are less likely to receive it at home. Organisations such as Teach First, the Sutton Trust and the Wellcome Trust are also working towards similar aims.

Many companies in the engineering sector are actively working to increase opportunities for young people from disadvantaged backgrounds.

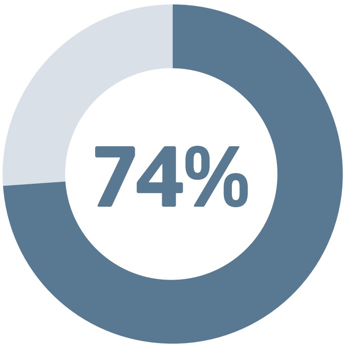
In recognition of the need to encourage more young people to study STEM subjects and pursue engineering-related qualifications, a host of informal STEM engagement and enrichment programmes are provided by the engineering community to inform, inspire and engage young people.

Companies actively working to increase opportunities for young people from disadvantaged backgrounds in engineering include:

- Arm – supporting education and career outreach inspiring excellence in STEM, focusing on young people from disadvantaged backgrounds
- EDF Energy – working in social mobility opportunity areas to help inspire, raise aspirations and create pathways into engineering for young people
- GSK – using its existing apprentices and STEM Ambassadors to reach a greater number of schools and engage with more young people from disadvantaged backgrounds
- HS2 – supporting social mobility through its schools programme which prioritises schools with a high proportion of free school meals, and working with the Social Mobility Foundation on its Aspiring Professionals Programme
- Jacobs – working together with the Social Mobility Foundation
- Network Rail – piloting a pre-apprenticeship with the Prince's Trust in Wales for young people from disadvantaged backgrounds to provide them with the skills required to join its Level 2 apprenticeship programme
- Rolls-Royce – providing a wide range of inclusive STEM education activities, reaching over 1 million young people, teachers and parents in 2017
- Siemens – supporting deprived schools by offering 50% funding for Greenpower Kit Cars, enabling pupils to have hands-on experience in designing, building and racing the cars
- Stantec – deliberately delivering STEM engagement activities in areas with a high proportion of disadvantaged pupils and ensuring its apprenticeship programme provides alternative routes into engineering for pupils from all socio-economic backgrounds

There is encouraging evidence to suggest that these types of STEM engagement and enrichment activities can improve young people's knowledge and perceptions of engineering. For example, participants in the Big Bang programme or Tomorrow's Engineers activities consistently report higher rates of knowledge, understanding and perceptions of engineering than the national sample of young people surveyed in the Engineering Brand Monitor.

Furthermore, of those who attended a Big Bang Fair or Tomorrow's Engineers STEM engagement activity, 74% of young people attending schools with above average FSM eligibility reported positive perceptions of engineering and 63% know what to do next to become an engineer – on par with more advantaged schools.



of young people from disadvantaged schools who attended a Big Bang or Tomorrow's Engineers event reported positive perceptions of engineering.

Jacobs' residential week

Samantha Daly, Inclusion and Diversity Lead & OneWorld UK Lead 2018
Jacobs

Social mobility has been a focus across government for several years and we welcomed the introduction of the Social Mobility Action Plan which outlines renewed focus on technical specialities with greater input from industry. In our experience, we have seen diminishing numbers of those entering the industry when we look at intersectionality of social mobility alongside other factors such as gender and race. Jacobs offers a residential week for 20 students from the Social Mobility Foundation (SMF) Aspiring Professionals Programme. The charity selects the students from across the UK under an application process. As part of this programme, we strive to have 50:50 gender split and 50:50 BME split in each cohort.

Perception of the engineering sector is a challenge. There is a lot of demystifying to be done around the types of roles within the engineering sector and the large variety available. Part of our residential week focuses on meeting employees in different roles, from engineers on site to our Senior Vice President, Donald Morrison, and everything in between. Those who come from more disadvantaged backgrounds would not have the opportunity to meet these people or obtain knowledge that these roles exist as research shows that most career knowledge comes from parents or immediate family. This week of work experience is supported by a mentor for the year for continued support in higher education applications and interview preparation.

STEM engagement that focuses on social mobility as a factor is very important. Finding schools that have a high percentage of free school meals or low level of GCSE Maths and English attainment can support an existing STEM strategy. Other schemes such as the Aspiring Professionals Programme and Industrial Cadets can help provide access to the workplace and experience for students from lower socio-economic background and makes a measurable difference to these students, with 60% of students going to Russell Group universities, an increase of 27% on average.

Brightside's mentoring activities

Paul Clarke, Head of External Affairs
Brightside

Brightside gives young people the support they need to make confident and informed decisions about their future, opening the doors to higher education and professional careers. We connect young people with online mentors who raise their aspirations, and give them practical advice and emotional support to achieve them. Established in 2003, Brightside now supports over 10,000 young people a year across every region of England.

Our mentoring bridges both geographical and social divides. Working online means we can target social mobility cold spots other interventions find it difficult to reach. These are often in rural, coastal and post-industrial areas where young people are not exposed to the same range of employers as those in bigger cities. Many of our mentees are the first in their family to consider higher education or a professional career like engineering. Introducing them to a role model such as an undergraduate or practicing engineer develops their knowledge of potential career pathways and the skills and behaviours required. It also increases their social capital by brokering access to the sort of contacts and informal networks of advice their more privileged peers often take for granted.

Online mentoring, then, is a powerful tool for building science capital in young people with little experience of STEM in their social circle, and whose financial and educational circumstances may mean they struggle to access opportunities to deepen their understanding. Brightside has run mentoring programmes with the Royal Academy of Engineering and we have designed one of our Sector Insight programmes of mentoring and e-learning activities to demystify engineering for school and sixth form pupils.

By giving young people an expert to talk to about STEM, online mentoring directly fulfils one of the core dimensions of science capital, and thus develops others: young people increase their scientific literacy and grasp of science-related values and are introduced to a wider range of scientific media and extra-curricular learning. Most importantly, a mentor serves as an inspiring example of how STEM careers are open to people from all backgrounds and boosts young people's confidence that they can pursue a similarly rewarding career.

Conclusion

A host of barriers can make it difficult for those from disadvantaged backgrounds to get ahead in the labour market. However, this problem is not unique to engineering and there is a clear appetite for change within the sector. There is reason to be optimistic about the engineering sector's ability to promote diversity and inclusion. Technical education reforms, targeted efforts to engage underrepresented groups in STEM and employer-led initiatives represent significant steps to improve opportunities for disadvantaged pupils.

Nevertheless, it is apparent more can be done. Efforts to address the skills gap are rarely targeted directly at young people from disadvantaged backgrounds, and well-resourced schools remain more likely to have thriving STEM clubs, to enter their pupils in STEM competitions and to take their pupils to STEM engagement and careers fairs.[86] A concerted and directed effort is needed to engage and inspire schools in disadvantaged areas.

Moreover, cultivating talent and aspiration is only one aspect of advancing social mobility through engineering. Further work is needed not only to inspire young people from disadvantaged backgrounds to pursue a career in engineering, but also to support their careers once in the profession.

Progress on both these aspects will need to be carefully monitored to ensure that efforts to advance social mobility in engineering have their desired impact.

86 Royal Society. 'Review of SES and science learning in formal educational settings', September 2017.

Who we are

Established in 2001, EngineeringUK is a not-for-profit organisation, funded predominantly via the professional registration fees of individual engineers, as well as the support of a range of businesses, trusts and foundations, and a corporate membership scheme.

We work locally, regionally and nationally with a wide range of organisations across business and industry, education, professional institutions and the third sector to understand the engineering skills required by engineering companies and in the wider economy, and work in partnership to develop and promote effective initiatives to inspire young people to consider a career in engineering.

Driven by data

We base everything we do on evidence and we share our analysis and insight widely. Our flagship publication *Engineering UK: The State of Engineering*, published for the 20th time in 2018, is a detailed examination of engineering's economic contribution and the composition of its workforce, as well as the extent to which the supply through the education and training pipeline is likely to meet future needs and demand for engineering skills. Its findings are used widely by the media, policy makers and employers alike. The *Engineering Brand Monitor* establishes the national benchmark for public perceptions of engineers and engineering.

We evaluate all our activity to help ensure our engagements with young people have as much impact as possible. It is through this evaluation that we have identified the degree to which we are winning hearts and changing minds through our programmes, with positive impacts on young people's understanding of engineering, perceptions of a career in it, and the extent to which they view engineering as a career for both boys and girls. And we have learnt that if young people meet an engineer and know they have done so, they come away with higher levels of knowledge of what people working in engineering do and higher levels of perceived desirability of engineering careers.

EngineeringUK