

# Summary of research into people's perceptions of engineering

## Introduction

This document summaries recent research into the public's perception of engineering and the reasons why many young people choose not to take up engineering courses or careers. The findings are drawn from a variety of studies involving pupils, parents and teachers. A list of references is provided at the end of the document.

## What is engineering?

A major barrier to young people taking up engineering courses are deep-rooted misconceptions about the profession. Although there has been a marked improvement in teachers' understanding of engineering in recent years, many misconceptions persist among parents and pupils.

Engineering is a well-regarded profession that is perceived to be worthwhile, rewarding and well paid; but there is very limited understanding of what engineers actually do. Engineering is predominantly associated with the construction, automobile and transport industries; its role in other areas of work is largely unknown or overlooked.

Although people have a vague idea that engineers make things there is very little awareness of the role of creativity, problem-solving, team-working or the use of cutting edge technology in engineering. Instead people strongly associate engineering with:

- Building sites, railway tracks and car workshops
- Routine maintenance and fixing broken things
- Dirty hands and overalls
- Long unsociable hours
- Working in isolation from others
- Work that involves little variety
- Potentially dangerous work

## Attitudes towards STEM subjects

Another barrier to young people going into engineering are the attitudes many of them hold about STEM courses at school, college and university

Although secondary school pupils enjoy science lessons they perceive science to be a difficult subject that is only suitable for the most 'brainy' and that it has little relevance to their lives and interests. Whereas STEM subjects are perceived as geeky and inaccessible, arts subjects are seen as accessible, creative and human-focused. Such views are often reinforced by parents, peers and even some teachers.

By secondary school most pupils have defined themselves as either STEM or Arts focused. Very few perceive that there is any middle ground between these subject areas. As a result, all things to do with 'the other' become irrelevant. Anything strongly associated with STEM is ignored by those who are 'Arts focused'. Engineering is felt to have no relevance for those pupils who perceive themselves as artistic and creative.

Compounding these problems is the misconception that studying science and maths narrows one's career options. Many parents and pupils believe that the only careers open to science graduates are research scientists, science teacher, doctor or pharmacist.

## **Girls & STEM**

The UK has the lowest proportion of women in engineering among the European Union countries. In part this is related to the very low take-up of physics and maths A level courses among girls as well as the male-dominated image of engineering.

Girls are less likely than boys to aspire to STEM careers, even though a higher percentage of them rate science as their favourite subject. Girls are far more likely to aspire to arts-related careers that they perceive to be creative, caring and aligned to a feminine identity.

Girls' misconceptions about STEM courses and careers are often reinforced, intentionally or unintentionally, by their parents and teachers.

## **Careers education – too little, too late**

The lamentable state of careers education only makes matters worse. A third of schools in England provide no careers education and half provide it for pupils in Years 7 and 8. Many schools lack teachers with adequate training in careers guidance.

The provision of careers education is very patchy and often of poor quality. Those who need it the most – girls, working class, black and minority ethnic pupils, and those planning to leave school at 16 – are among the most poorly served.

Parents have a huge influence on their children's choice of courses and careers, yet their understanding of career paths and the future job market is often very limited – based largely on their own experiences.

Pupils do have high aspirations for their future careers, seeking jobs that will provide them with:

- Sense of achievement
- Opportunities to make a positive contribution to society and to individuals (especially among girls)
- Variety with plenty of opportunities for creativity, problem-solving and team-working
- Different working environments (i.e. not just stuck in front of a computer all day) and opportunities for international travel
- A diverse work-force
- Good salary, job security and progression

However, most do not associate engineering with these characteristics, in part because engineering is almost invisible in the school curriculum and in their daily lives.

Even among pupils who are interested in STEM careers there is little understanding of how to become an engineer. It's not that pupils and parents reject the idea of an engineering career, more that it doesn't spontaneously occur to them, unlike other professions such as medicine, pharmacy or the law.

When engineering is considered, it is predominantly perceived as a university degree course. Understanding of apprenticeship routes into engineering is very low, even among teachers.

### **Messages that work**

The most successful STEM engagement activities are those that illustrate how engineering overlaps with pupils' interests and sense of identity. Initiatives that illustrate 'we're like you' are far more effective than those that try to persuade pupils to 'be like us'.

Pupils respond very positively when shown:

- That engineers design products that they value – mobile phones, clothes, sports equipment, computer games
- Engineers work in a vast range of industries - aerospace, computer gaming, energy production, environmental protection, fashion, film and TV, healthcare, music, robotics, sports technology, telecommunications etc
- Engineering is a highly creative process where you use your imagination to solve problems
- Engineering involves team-work and interacting with people
- Engineers use the latest cutting-edge technology
- Engineers are shaping the future (particularly for boys)
- Engineers has a positive impact on society and individuals (particularly for girls)
- Many types of people choose engineering as a career
- Engineers have many opportunities to travel and work abroad

To maximise the impact of these messages it is vital that they also reach teachers, career advisors and parents as well as pupils.

### **References**

#### **Perceptions of engineering**

Most of the data about public perceptions of engineers comes from research commissioned by engineering companies or institutions.

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"We think it's important but don't quite know what it is": the culture of engineering in schools; Institute of Mechanical Engineers (2017)

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Five Tribes: personalising engineering education; *ICM Unlimited* on behalf of the Institute of Mechanical Engineers (2014)

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Engineering our future: inspiring & attracting tomorrow's engineers; *Brunswick Research* on behalf of National Grid (2008)

Influence of high school students' perceptions on their preparation for Engineering; Reyer J, Proceedings of the 37th ASEE/IEEE Frontiers in Education Conference, Milwaukee, WI (2007)

What brings women to the table? Female and male students' perceptions of ways of thinking in engineering study and practice; Kilgore D, Yasuhara K, Saleem J & Atman C, Proceedings of the 36th ASEE/IEEE Frontiers in Education Conference San Diego, CA (2006)

### **Attitudes of pupils and parents towards STEM subjects and careers**

The most recent and extensive programme of research into pupil's attitudes towards STEM subjects and careers is the ASPIRES project led by Professor Louise Archer at University College, London.

You can access a series of reports summarising their research findings and a full list their published academic papers at <http://www.ucl.ac.uk/ioe/departments-centres/departments/education-practice-and-society/aspires>