The Institution of Engineering and Technology

Addressing the STEM skills shortage challenge

A guide for local authorities to tackle the UK's science, technology, engineering and mathematics (STEM) skills gap

theiet.org/education-and-skills

Addressing the STEM skills shortage challenge is published by the Institution of Engineering and Technology.

Please note that the views expressed in this publication are not necessarily those of the IET. The guide only intends to identify the relevant issues and to inform a public policy debate around the topic, rather than to provide a definitive solution.

The IET Education and Skills Panel would welcome any comments you may have on the contents of this guide and your ideas for future publications. Please get in touch by emailing **sep@theiet.org**.

The Institution of Engineering and Technology

The Institution of Engineering and Technology (IET) is working to engineer a better world. We inspire, inform and influence the global engineering community, supporting technology innovation to meet the needs of society. The Institution of Engineering and Technology is registered as a Charity in England and Wales (no. 211014) and Scotland (no. SC038698).

© The Institution of Engineering and Technology 2021.

Contents

1. About this report **04**

2. Recommendations **05**

3. Background **06**

3.1 Economic impact 06

3.2 Digital skills for social and economic inclusion 06

3.3 Diversity and equity in the workplace 06

4. Case study one: working towards carbon neutrality by 2030 **07**

5. Industry learning **08**

5.1 Does the education system meet current business needs? 08

5.2 Career advice 08

5.3 What does the future hold? 08

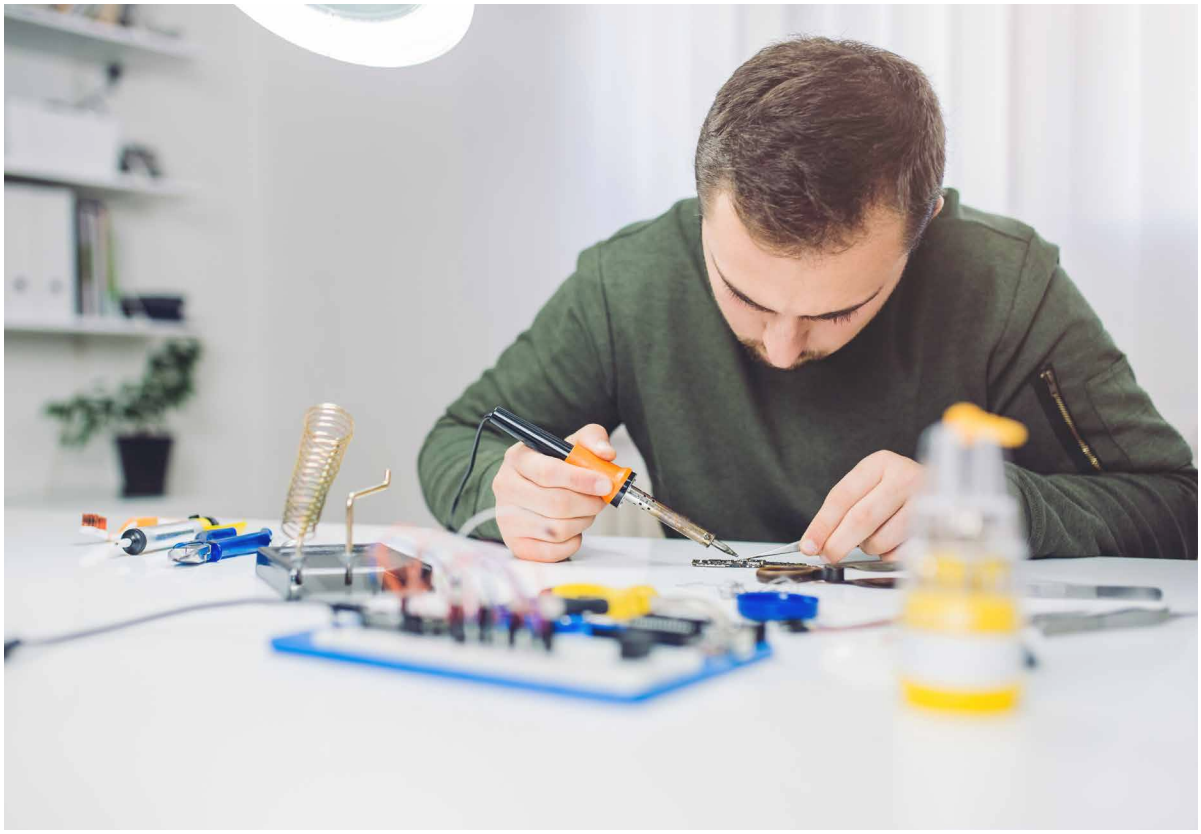
6. Case study two: York – a beacon city for STEM **09**

7. Conclusion **10**

8. Acknowledgements **11**

9. About the IET **11**

1. About this report



The UK economy suffers a loss of £1.5bn per year due to STEM skills shortages[1]. This not only represents a loss in terms of the UK's prosperity, but also for young people and adults of learning skills, working in more skilled employment and potentially pioneering new technologies. It is upon all of us to ensure every person can reach their potential by providing them with the right skillset. In this report, we specifically look at the role local authorities can play in preparing all people with more engineering skills.

Aimed at local government, devolved governments, UK Government, industry and schools, this report shows how local authorities can play a leading role in facilitating regional skills demand and supply. We explore the ways local authorities can help train and equip people with the skills their region needs and examine the related challenges. It highlights areas of importance such as the need to ensure skills diversity, good quality careers advice and provision of relevant work experience.

Jobs will be impacted by the rapid growth of new technologies transforming manual processes and generating new ones that derive economic growth. Industry and government need to adapt to the changing nature of work by focusing on training people for the jobs of tomorrow. Talent development, lifelong learning and career reinvention are going to be critical for the future workforce.

[1] https://www.stem.org.uk/news-and-views/news/skills-shortage-costing-stem-sector-15bn

2. Recommendations

The following recommendations focus on the role of local authorities and central government in providing economic policy direction, focus and leadership. They also point to the critical roles of employers, the education sector and agencies in delivering solutions that address the UK's skills gap and diversity issues.

1	Local authorities should initiate discussions between academic institutions and industry to ensure the right skills and training are available for adoption of new technologies as they emerge.
2	Local authorities should help provide/co-ordinate more training for teachers in areas of computing and engineering to deliver the new information and communication technology (ICT) curriculum.
3	Local authorities should take a lead in encouraging a diverse mix of people into the profession through locally targeted schemes.
4	Professional engineering institutions (PEIs) and industry bodies should work with local government to ensure there's a wider and updated provision of careers advice, particularly around engineering. This should include information on the variety of routes into engineering, such as vocational study.
5	UK Government should work more closely with the higher education sector and training providers to ensure funding is allocated on the quality of courses available, not the quantity of students on each course.
6	UK Government should ensure there's an ability to re-train/reskill those who may be adversely affected by advances in automation or wish to move into science and engineering professions, especially where skills shortages have been identified.
7	UK Government should work with PEIs and industry bodies to research and implement best practice on local skills provision, using examples such as City of York Council and Combined Authority Mayors.
8	UK Government should relax laws to make it simpler for small-to-medium enterprises (SMEs) and start-ups to hire and train work experience students.

3. Background

3.1 Economic impact

A shortage of suitable digital jobs persists within the UK labour market: a recent survey by the IET evidences that 60%[2] of members felt they were unable to deliver the objectives set in the Industrial Strategy[3] due to acute skill shortages. Additionally, 53% of survey respondents were concerned that the UK's shortage of engineers is a threat to their business. This is a major risk to business growth, innovation and broader societal development.

Significant value can be added to the local and wider national economy through better investment in, and promotion of, science and engineering. This not only relates to job creation, but also firm productivity and scaling up markets for companies of all size. Investment in STEM skills would bring a good return on prosperity to the local economy.

3.2 Digital skills for social and economic inclusion

Over the coming years, the UK will witness a rapid move toward digital and automated ways of working. The development of new technologies and robotics may eliminate jobs across some sectors but will help the emergence of new sectors.

This reinforces the point that the UK workforce needs to strengthen its science and engineering skills base so the labour market can adapt to new opportunities involving advanced technologies. It's clear that the rapid rate of technological innovation requires people to continually update their skills in order to be equipped for new roles influenced by technology. In the context of social inclusion and mobility, digital technologies can provide new opportunities. The need for basic digital skills is becoming increasingly important for the delivery of public services both at local and national levels.

Evidence suggests that while information and communication technology (ICT) is extensively used in primary and secondary education, there's still much to be done to ensure that it's effectively used in teaching and learning. Specifically that teachers are digitally skilled, that gender stereotypes are overcome, and that learners are motivated to acquire digital skills through awareness of the career opportunities they offer.

A recent survey[4] found that 60% of teachers didn't feel confident delivering the new ICT curriculum, which suggests that further training should be offered. When surveying the quality of engineering and technology skills within the workforce, the IET found that 73%[5] of respondents had problems with candidates who had academic knowledge but not the required workplace skills. A further 57% reported technical skills gaps at a professional level.

3.3 Diversity and equity in the workplace

There's a lack of awareness of career opportunities within the digital sector, sometimes reflecting skill and gender stereotypes around the types of roles available. Barriers exist for minority groups. Women are underrepresented on higher education courses in computer science related subjects and within the wider industry. Only 11% of the current UK technology workforce is female[6]; within engineering specifically the figure is just 6%[7].

A report by the Office for National Statistics (ONS) on graduates in the UK labour market in 2017[8] found that on average, men earned £4.04 an hour more than women. This can be partly explained by the subjects male and female graduates studied. The report found that of the top five subjects associated with the highest average gross annual earnings, four were subjects which male graduates were more likely to have studied. These were engineering, physical/environmental sciences, maths/computer science and architecture.

There appears to be barriers to undertaking further training and education in science and engineering. Research shows that more needs to be done to raise awareness of STEM careers and to improve the perceptions of the sector, which is often portrayed as not inclusive[9].

[2] https://www.theiet.org/impact-society/factfiles/education-factfiles/iet-skills-survey/iet-skills-survey-2019/
[3] https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future
[4] https://royalsociety.org/~/media/policy/projects/computing-education/computing-education-report.pdf
[5] https://www.theiet.org/impact-society/factfiles/education-factfiles/iet-skills-survey/iet-skills-survey-2019/
[6] https://www.theiet.org/impact-society/factfiles/education-factfiles/iet-skills-survey/iet-skills-survey-2019/
[7] https://publications.parliament.uk/pa/ld201415/ldselect/lddigital/111/111.pdf
[8] https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/graduatesintheuklabourmarket/2017
[9] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/492889/DCMSDigitalSkillsReportJan2016.pdf

4. Case study one: working towards carbon neutrality by 2030

The City of York Council announced a climate emergency in 2019, setting an ambition to become carbon neutral by 2030. To achieve this goal, the council is undertaking a number of positive actions.

Its housing team is building a minimum of 600 homes across eight sites in York to Passivhaus standards[10]. As well as being energy efficient and built with low embodied carbon, the developments will also be designed to address social sustainability with reduced space for car parking and communal gardens to help address isolation and loneliness. The design will also aim to promote biodiversity and encourage sustainable forms of travel such as walking and cycling.

The council's transport team are supporting uptake of electric vehicles (EVs) through its EV charging strategy, released at the start of 2021. This includes providing all council-owned long-stay car parks with 5% electrical charging provision and installing three Hyperhubs in the city, which will provide rapid charging. York is also participating in the Department for Transport's rental e-scooter trials, bringing shared sustainable transport options to the city.

New skills will be required to support these sustainable approaches. Building to Passivhaus standards requires new knowledge and skills, as does installing new heating technologies. An example of this is the refurbishment of the Guildhall building in York, which is installing a water-source heat pump.

A shift in approach to housing design will also need to consider the transport needs of users and residents, with knowledge of how to encourage sustainable and active forms of travel essential. As hybrid and electric vehicles become more common, new skills will be required to maintain these vehicles and their charging network. Similarly, the provision of an e-scooter rental scheme requires skills in maintenance of this relatively new form of transport, as well as data analysis and modelling to ensure e-scooters are distributed where and when needed.

Lucy Atkinson
Sustainability Project Manager,
City of York Council

[10] https://www.stem.org.uk/news-and-views/news/skills-shortage-costing-stem-sector-15bn

5. Industry learning

Research undertaken by STEM Learning[11] indicates that 89% of STEM businesses have found it difficult to recruit staff with the required skills in the last 12 months, leading to a current shortfall of over 173,000 workers – an average of 10 unfilled roles per business.

5.1 Does the education system meet current business needs?

Funding for further education (FE) and skills systems are often highly centralised in England. This means there's often little to no local knowledge when it comes to spending in local areas. Funds can often be misallocated, leading to a gap between what the skills sector is told to provide and what is needed in the local area.

Local businesses require a range of skills and these can vary across the country. Academic institutions and schools should plan to support these. This can be done by using local area intelligence, data, forecasting and organising local provision in education accordingly. This will enable the development of a local, agile, flexible skills system tailored to the needs of the region's employers.

Throughout England there are examples of academia and industry working together but we need a more joined-up approach to develop country-wide best practice.

The IET's 2019 Skills Survey[12] demonstrates that SMEs find it particularly complicated to provide work experience for those in FE or higher education (HE). It's also true that there's less interaction between academia and SMEs, particularly start-ups. Because there are few formal channels between them, there's less influence over provision[13], and because of the centralised approach England takes, there's a lack of regional variety in which skills are taught where. Regional economies and communities suffer as a result.

5.2 Career advice

Another issue for students moving into FE, HE or apprenticeships is the lack of adequate career advice. Options are sometimes poorly understood by those providing guidance, leaving students with the difficult task of doing their own research. This can be a struggle for some.

A lack of publicly available local data on skills needs exacerbates this problem and can lead to a local brain drain as students move to university cities.

Learners need to be empowered to choose their own career path but the inadequate data and advice between a learner's potential pathway and a local area's requirements limits learning options, particularly through vocational and technical courses.

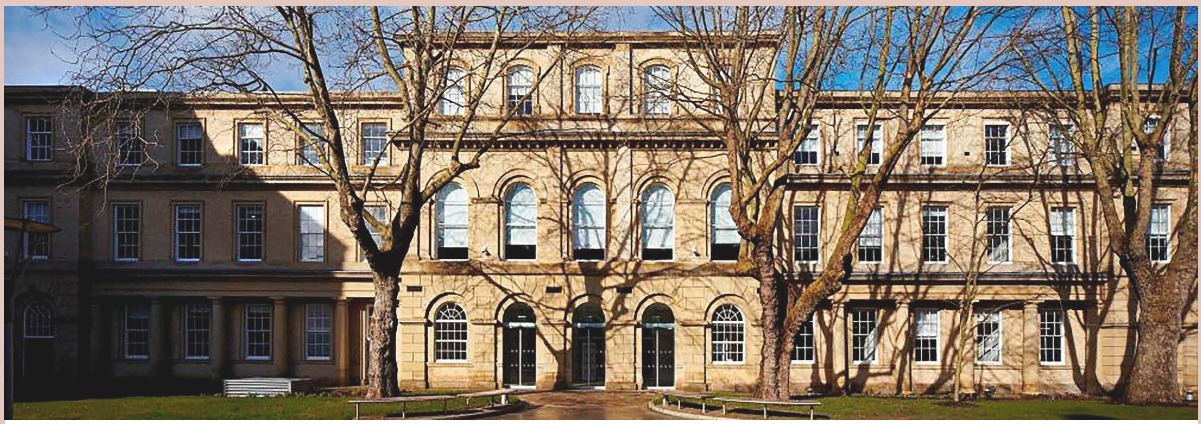
5.3 What does the future hold?

There are reasons to be hopeful. Combined Authority Mayors are implementing innovation strategies to improve the local skills system. Local authorities are also joining to provide students with good, local career advice. There are also examples of these at a wider regional level.

The UK Government currently has no uniform STEM skills programme in England, with provision responsibility split between government departments, local authorities and regional actors. A joined-up approach would enable better localisation, ensuring all students have the opportunity to fulfil their potential.

[11] https://www.stem.org.uk/news-and-views/news/skills-shortage-costing-stem-sector-15bn
[12] https://www.theiet.org/impact-society/factfiles/education-factfiles/iet-skills-survey/iet-skills-survey-2019/
[13] https://www.policyconnect.org.uk/research/skills-commission-englands-skills-puzzle-piecing-together-further-education-training-and

6. Case study two: York - a beacon city for STEM



Businesses across the country report they cannot always find the right talent to fill jobs in key employment and growth sectors including digital, IT, engineering and science. This is also true in York, impacting on service delivery and growth.

As an example, in York half of 18-year olds are choosing to seek local employment over entering higher education. This highlights a clear need for closer alignment between the actual jobs available and the routes into these careers, including apprenticeships and the development of broader employability skills.

There is a need to increase the number of young people studying STEM subjects within York academia. This will have a positive impact on the amount of highly skilled jobs in areas such as bioscience research and development, data analysis and advanced engineering including rail, software development, low carbon and creative technologies.

York suffers from high levels of part-time employment (38%), which is predominant among women. These jobs are lower skilled and lower paid, so that while being in work, many people remain dependant on in-work benefits and are at risk of falling into the in-work poverty trap[14].

Given the local challenges, the STEP into STEM Programme developed by York Council, aims to achieve the following within the next three years:

- Increase the number of young people entering STEM education and employment.
- Increase the number of young women entering STEM education and employment.
- Reduce the number of women leaving STEM professions.
- Re-train/reskill those who may be adversely affected by autonomous machinery or wish to retrain into STEM professions.

They will do this by utilising a partnership model working with local partners. By working with **York St John's University** they are developing the current education offer to ensure its industry relevant and introducing artificial intelligence and augmented reality to primary school students to explore careers in STEM. The **Armed Forces Covenant** is creating a bespoke academic offer to transitioning personnel which will ensure that their skillset is acknowledged and they receive a national qualification upon leaving the Army. **Aviva** is working with people from minority and/or disadvantaged backgrounds in preparation, support and retention within the workplace. Working alongside the York and North Yorkshire **Local Enterprise Partnership**, the council is exploring funding options to ensure there's a pipeline of suitably qualified personnel to enable successful delivery of its electric vehicle projects.

[14] https://www.york.gov.uk/downloads/download/620/york-skills-plan-2017-2020

7. Conclusion

The STEM skills shortage needs to be tackled in order to achieve economic regeneration and ensure sustainable and fulfilling employment opportunities in a post-Covid world.

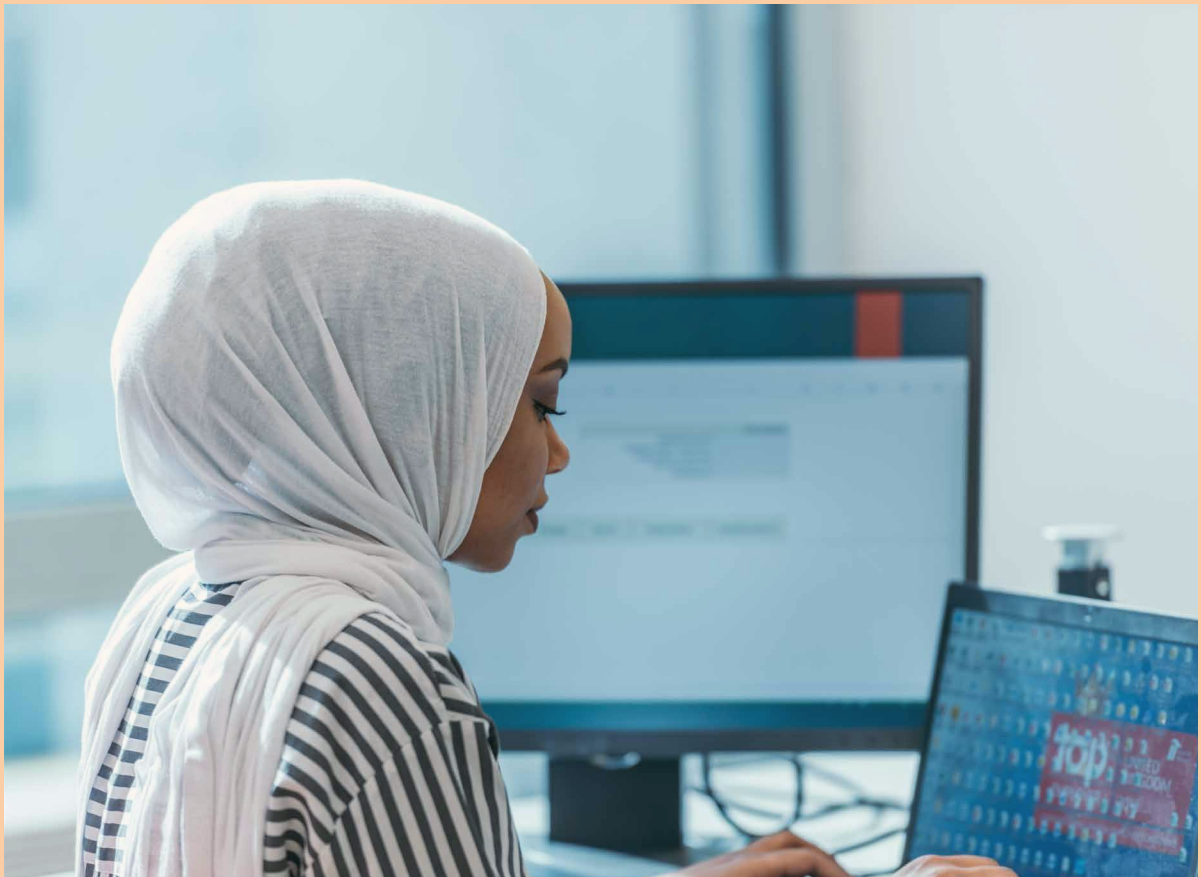
There's a clear need to link skills to current and emerging employment demand and invest in refreshed and refocused science and engineering skills education.

The continued rapid digital transformation and the speed of new technology development will provide new opportunities. Therefore, it's key that the current and future workforce is provided with enhanced science and engineering skills so that the labour market can flex to meet new demands.

While progress has been made regarding diversity within STEM industries, this has been at a slow pace. During recent years a number of high calibre studies have been published (McKinsey, MIT, Deloitte, Kings College London) which all confirm that not only is diversity the right thing to do morally, it also makes sound business sense. A diverse workforce has a positive impact against financial performance and productivity, increases innovation, attracts and retains a talented workforce, and represents the consumer market.

There is clearly a need for a strong partnership approach to tackle the challenges ahead. By involving academia, industry, local and central government, and community and voluntary sectors, major strides forward can and have been taken to tackle employment and skills issues.

By working together, we can ensure the economic vitality and recovery of the UK and provide long-lasting and fulfilling employment for its citizens.



8. Acknowledgements

We would like to thank our IET members, volunteers and their organisations, and others, for their participation in creation of this document. We would like to thank Carrie Brook TMIET, project manager within City of York Council's Smart Transport Team, for authoring much of the document and for the work she has put into the York Delivery Model.

9. About the IET

We are the IET – a charitable engineering institution with over **158,000 members in 150 countries** – working to engineer a better world.

As a diverse home across engineering and technology, we share knowledge that helps make better sense of the world in order to solve the challenges that matter. It's why we're uniquely placed to champion engineering. We bring together engineers, technicians and practitioners from industry and business, from academia and research, and from government and the third sector.

We are member-led, independent and impartial. We cover engineering across industries from design and production, digital and energy to healthcare, transport and the built environment. We champion engineers and technicians by offering networking, volunteering and thought leadership opportunities.

To find out more contact **sep@theiet.org**

The Institution of Engineering and Technology

Our offices

London, UK
T +44 (0)20 7344 8460
E faradaycentre@ietvenues.co.uk

Stevenage, UK
T +44 (0)1438 313311
E postmaster@theiet.org

Beijing, China
T +86 10 6566 4687
E china@theiet.org
W theiet.org.cn

Hong Kong
T +852 2521 2140
E adminap@theiet.org

Bangalore, India
T +91 80 4089 2222
E india@theiet.in
W theiet.in

New Jersey, USA
T +1 (732) 321 5575
E ietusa@theiet.org

@TheIET theiet.org

The Institution of Engineering and Technology (IET) is working to engineer a better world. We inspire, inform and influence the global engineering community, supporting technology innovation to meet the needs of society. The Institution of Engineering and Technology is registered as a Charity in England and Wales (No. 211014) and Scotland (No. SC038698). Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire, SG1 2AY, United Kingdom.

E6D21002/Education/May2021