THE ROYAL SOCIETY

Submission to the House of Commons Science and Technology Committee inquiry examining the digital skills gap

Key points

- The UK has a strong digital economy, built on a proud history of contributions to computing and to computer science. Between 2003 and 2013, digital industries grew over twice as fast as the economy as a whole, contributing £113 billion in value added to the economy in 2013.[1]
- Digital skills are essential across the economy. The UK is experiencing a digital skills shortage that could limit its ability to compete in future. Almost half of UK employers are concerned about IT skills in their current workforce.[2]
- To meet the demand for skilled people, the UK will need to:
    - embrace a bold new approach to computing education to increase digital literacy across the board and develop the specialists that the UK needs
    - improve workforce diversity to ensure new talent is not wasted, and
    - increase collaboration to maximise the impact of the UK's strengths in open data and research.

1. The Royal Society welcomes the opportunity to submit evidence to this inquiry examining the UK's digital skills gap. The Society is the UK's national academy of science. It is a self-governing Fellowship of many of the world's most distinguished scientists. The Society draws on the expertise of the Fellowship to provide independent and authoritative advice to UK, European and international decision makers.

2. This submission draws on the advice of Fellows expert in relevant scientific fields and members of the Society's Education Committee and Science, Industry and Translation Committee. It focuses on the role of increasing collaboration, diversity and education to address the UK's digital skills gap.

Introduction

3. Digital skills are essential for the UK's industries to remain competitive. The UK has a world-leading research base to which digital and computing skills are vital. They underpin new technologies critical to the UK's future prosperity, including cybersecurity, big data, machine learning, genomics and bioinformatics. Nearly one million IT professionals are now employed in the UK, with 600,000 vacancies predicted over the next decade.[3]
4. Data science is an increasingly important field, but will need to be nurtured and promoted, in particular by ensuring the right skills are in place. Currently, 77% of big data roles in the UK are difficult to fill,[4] and demand is expected to rise.[5] Electronic Systems Challenges and Opportunities (ESCO) found that skills shortages were the most common challenge raised by its sector and these are predicted to get much worse in the near future.[6]

5. While education is working to establish a digitally literate population, the UK's aspirations should not stop here. The cost of not taking advantage of new digital technologies is vast, and would have effects beyond the financial. New technologies, data and innovation can improve lives in areas ranging from business to health, and from climate change to civic engagement.

Education

6. The ability to understand the world increasingly depends on an understanding of scientific ideas and technologies. Education can enable people to make informed choices, empower them to shape scientific and technological developments, and equip them to work in an advanced economy.

7. Being digitally literate is particularly important for participation in modern society, including the democratic process. Being able to find and process information using ICT is an extremely useful life skill, since it enables people to access other areas of knowledge. Research also points to a lack of digital literacy skills being linked to social exclusion[7].

8. Every child should be expected to be digitally literate by the end of compulsory education, in the same way that every child is expected to be able to read and write. Every child should also have the opportunity to learn concepts and principles from computing (including computer science and information technology) from the beginning of primary education onwards, and to choose to study towards a recognised qualification in these areas. Young people must also learn to be safe and lawful when using information technology[8].

9. These subjects span the traditional divide between academic and vocational education and therefore represent a valuable spectrum of knowledge and skills – from the most abstract aspects of computer science to the most software-specific skills of digital literacy.

10. Few higher education departments appear to hold the Computing A-level in high esteem and rigorous, high-quality post-16 courses with the label 'Computer Science' are required[9]. Computer science courses in higher education also suffer from a high first-year attrition rate – possibly because students arrive without a clear understanding of what computer science is at a university level.

11. There appears to be a shortage of specialist Computing teachers able to teach beyond basic digital literacy, which may affect delivery of the new computing curriculum. In around half of all European countries, digital literacy is taught mainly by specialist teachers at secondary level, highlighting the importance of specialist knowledge and pedagogy.[10]

12. There is a lack of support for continuing professional development (CPD) in this area, particularly in computer science[20]. This needs to be addressed – teachers need high quality CPD that deepens subject knowledge and subject-specific pedagogy, particularly given the lack of specialist teachers and the new curriculum being introduced in schools.

Diversity

13. The Royal Society's 2014 report[11] on the UK scientific workforce found that diversity in the sciences is complex. For mathematics, computer sciences, engineering and technology, men are more likely to be employed in graduate level science occupations than are women. While women are not underrepresented in the overall scientific workforce, they are highly underrepresented in senior roles. Black and minority ethnic groups are overrepresented in the

digital/IT sector, as are those with a disability; but underrepresented at senior levels. Socio-economic background strongly affects whether an individual enters the scientific workforce.

14. Some digital sector companies are taking steps, including extensive unconscious bias training, to overcome the imbalance in their workforce. This is welcome, but declining diversity begins early, and the decline continues throughout education.

15. A recent Institute of Physics report[12] explored girls' subject choice experience in school. The report identifies sexist, racist and homophobic language, as well as simple comments that reinforce gender prejudices. The prevailing bias is that science is for boys.

16. The pattern persists for university students. The ECU 2014 statistical report[13] finds that while 56% of all students are female (including 51% of SET students), only 17% of computer science and 16% of engineering and technology students are female – the two lowest levels of female representation across all subjects. To address the skills gap the UK it is imperative that all graduates have digital skills training.

Collaboration

17. Government will need long-term strategies to build and maintain its capacity to take advantage of new technologies. The UK is a leader in open data, and should continue to support open data and open science, in order to strengthen its science base and allow innovative, data-driven businesses to grow.

18. Business-university collaboration fosters skilled people who are vital to the UK's knowledge economy and whose knowledge facilitates the absorption of ideas from abroad[14,15]. These cross-sector collaborations need to be encouraged by high-quality career guidance and a richer dialogue between academia and industry[16].

19. Technology and innovation centres, such as Catapult Centres, can help overcome barriers to innovation, including through skills development. Having made a substantial investment in establishing the Catapult centres, the UK should continue to support them over the long term to maximise the returns on this investment.

20. Graduates who gain work experience during their studies are highly valued by many employers, but these opportunities are often costly or difficult to find. Students, government, universities, and industry should work together to take advantage of the mutual benefit arising from such opportunities.[17] [18]

21. The UK's competitiveness will depend on a home-grown, reliable and increasing supply of highly skilled graduates with deep knowledge in computing disciplines, and the skills to operate in multidisciplinary and fast changing environments across industry and research. A high level of digital literacy across the workforce is also important. Acute skills gaps must be filled by recruiting from overseas to maintain UK companies' ability to innovate and develop new technologies.

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