Public Accounts Committee: Delivering STEM skills for the Economy

Written evidence submitted by the Royal Society of Chemistry

Summary/ Introduction

The Royal Society of Chemistry is pleased to have the opportunity to contribute to the Public Accounts Committee's call for evidence on 'Delivering STEM skills for the Economy'. This response summarises and brings together relevant representations the Royal Society of Chemistry has made recently on Education, Skills and Industrial Strategy. Consideration of Science, Technology, Engineering and Maths (STEM) skills should include skills learnt in schools, vocational and further education, higher education, research and industry – and the diversity of people learning these skills. In this light, our submission sets out:

- Evidence from our community and elsewhere on STEM skills shortages;
- The need to recruit and retain high-quality chemistry specialist teachers;
- The importance of quality monitoring of apprenticeships and of ring-fencing apprenticeship levy funding from STEM employers to STEM apprenticeships;
- Successes in collaboration between businesses and higher education, which help students to learn transferrable skills employers need as part of their studies;
- The importance of continued access to global talent pools for chemistry research and to develop skills in the most cutting-edge fields;
- The need for further action to increase diversity in leadership positions in Chemistry.

About the Royal Society of Chemistry

With over 55,000 members and a knowledge business that spans the globe, the Royal Society of Chemistry is the UK's professional body for chemical scientists, supporting and representing our members and bringing together chemical scientists from all over the world.

A not-for-profit organisation with over 175 years of history, we invest in educating future generations of scientists, we raise and maintain standards and work with industry and academia to promote collaboration and innovation. We advise decision-makers, including Governments, on policy and we promote the talent, information and ideas that lead to great advances in science.

Evidence on Demand for Chemistry and STEM Skills

Building a clear picture of the economic demand for Science, Technology, Engineering and Maths (STEM) skills is very challenging, yet vital to understand fully how STEM skills, work and businesses contribute to sustainable economic growth. As the National Audit Office's report on 'Delivering STEM skills for the economy' pointed out, data on skills need and employer demand is not collected consistently. This is hampered further by conflicting definitions of what constitutes STEM. In the light of the potential impacts of Brexit on employer demand for skills and the supply of skilled people, it is vital and urgent to understand the UK's skills needs and challenges.

That said, consultations with our chemistry community and employers found anecdotal evidence of skills shortages in sectors that will be crucial to delivering the Government's Industrial Strategy, which we highlighted in our response to the House of Lords Science & Technology Select Committee inquiry into Life Sciences and the Industrial Strategy:

'*We also received feedback that there can be difficulties in recruiting researchers with excellent instrumentation knowledge, data and statistical skills…In addition, process chemistry and physical chemistry were flagged as areas of concern for biopharmaceutical companies, both of which will be critical in positioning the UK as a world leader in advanced manufacturing*[1].

We note that the interim report of the Migration Advisory Committee also cites employer concerns about STEM skills shortages[2].

Looking ahead, some projections of future employer skills needs have been developed by industry. Research by the Science Industry Partnership indicates that the cumulative demand for staff across science industries between 2015 and 2025 will be between 180,000 and 260,000, comprising both graduate-level entry roles and apprentice-level entry roles[3]. The report also identifies five key enablers that cut across STEM industries, which are underpinned by knowledge in STEM; big data, synthetic biology & biotechnology, advanced manufacturing, formulation technology, and materials science. Skills in these areas will be critical across a range of industry sectors. For example formulation is critical in developing new foods with reduced sugar, as well as creating more environmentally friendly paints and drugs that can effectively target illnesses in specific areas of the body.

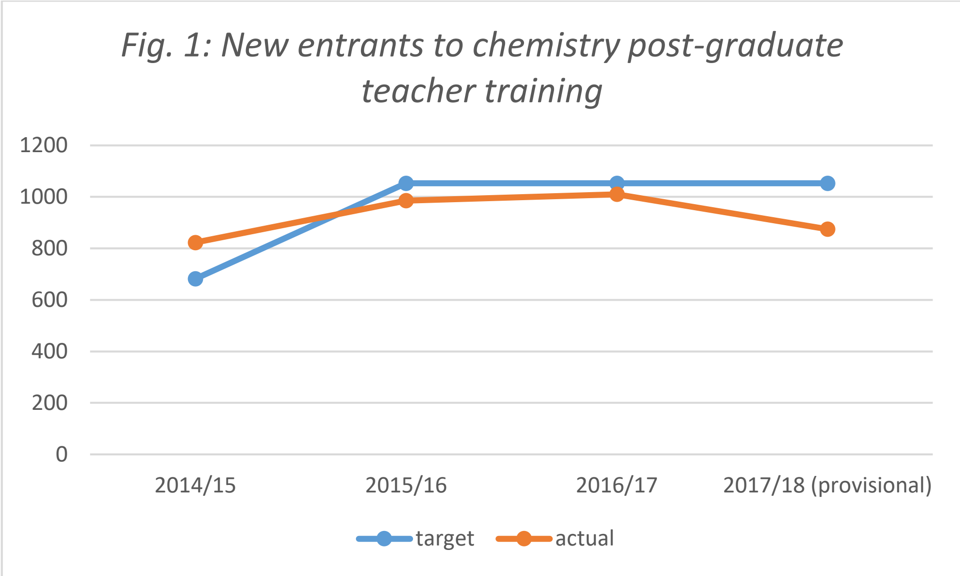
In this context, it is important to consider the diffusion of STEM skills across industry sectors that deliver a range of goods and services. Chemistry skills play an important role across many areas of STEM industry, from manufacturing to life sciences. Our members work in industries including pharmaceuticals, petrochemicals, the nuclear industry, cosmetics, food & beverages and building & construction[4].

High-quality chemistry education in schools

To give all students the high-quality chemistry education they need and deserve, it is vital that we recruit and retain good chemistry specialist teachers. However, there is evidence that retention of chemistry teachers could be improved. A number of recent reports[5] have analysed the latest annual School Workforce census Statistical First Release data[6] to assess trends in the teaching workforce between 2011 and 2015. They have all identified that the 'wastage rate[7]' of teachers across all subjects in secondary schools increased over that period, and that this is driven by a more people moving 'out of service' rather than retiring or dying in service. Between 2011 and 2015 the overall wastage rate for secondary school teachers increased by 1.0 percentage point from 10.2% in 2011 to 11.2% in 2015. Chemistry increased from 11% to 12.5% which is a bigger rise than average as well as higher wastage than average[8].

In both the primary and secondary phases leaving rates are highest within the first five years of qualifying, but analysis of the school workforce census has shown that in secondary schools this is most pronounced for science, maths and language teachers[9].

Recruitment is also of concern: for the past three years, recruitment to chemistry teacher training courses in England has fallen short of the Government's Teacher Supply Model target, with a significant shortfall seeming likely in 2017/18, as Figure 1 shows:



Data source: https://www.gov.uk/government/collections/statistics-teacher-training

In the light of this, we welcome the recognition of the importance of subject-specific professional development and mentoring and proposals for strengthening these in recent Department for Education proposals.[10]

In addition, we continue to advocate a single route through the sciences for all students up to age 16, as the current system of multiple routes for GCSE sciences offers some groups unequal chances of progressing to studying science subjects in Years 12 and 13, for example students from more deprived areas.[11]

Apprenticeships and vocational training

The drive for a step change in the quantity of apprenticeships must not compromise their quality or value to individuals and the economy. We have argued that success should not be measured solely in terms of the headline number of apprenticeships, i.e. the 3 million target, but also on ensuring the creation of high quality apprenticeships in the sectors where the returns are the greatest[12].

The STEM sector provides high value and flexible opportunities for apprenticeships in terms of the value to companies and to the apprentices themselves. We have recommended that any apprenticeship levy funding that is collected from STEM sector employers should remain in the STEM sector. We are concerned that there is no safeguard to prevent funding being taken out of the STEM sector and used in other industries[13].

Furthermore, we have called for improvements to the quality monitoring of apprenticeships. A clear indication on whether apprenticeships are successful is the impact they have upon the macro economy and it is important to measure this impact and ensure published measures enable a judgement to be made on whether apprenticeships meet the skills needs of apprentices and employers[14].

Higher education

Our ‘Open for Business’ report highlighted much good practice in UK university chemistry departments on university-business engagement. This can help the development of transferrable workplace skills employers need, such as business and enterprise awareness and employability skills, including communications, time management and team working[15].

Research and Industrial Strategy

The development and implementation of the Industrial Strategy, with a focus on developing sector deals, combined with the impacts of Brexit, mean the pace of change needed for the UK workforce is likely to be significant. In addition, we also heard some anecdotal evidence from our community regarding challenges posed by new and emerging fields and the crucial role that access to international talent has played here in enabling the UK to capitalise on these areas quickly. Our response to the House of Lords Science and technology Select Committee stated that:

We have heard that in areas such as computational chemistry, bioinformatics and biophysics, access to a global pool of talent (so not only EU or EEA) was essential to find scientists with the skills needed for a company to take advantages of new research fields (e.g. big data) to enable them to innovate further. Building domestic capacity across the breadth of science and innovation (including new and emerging fields) will be essential to delivering an industrial strategy that enables growth. However, for UK science and innovation to continue to advance and make breakthroughs, we must enable researchers, entrepreneurs and innovators from across the world to come to the UK to live and work in both the short and long term. These people bring ideas and knowhow at the frontiers of discovery and application, enable the UK to establish new capability, and train the next generation of researchers and innovators. [16]

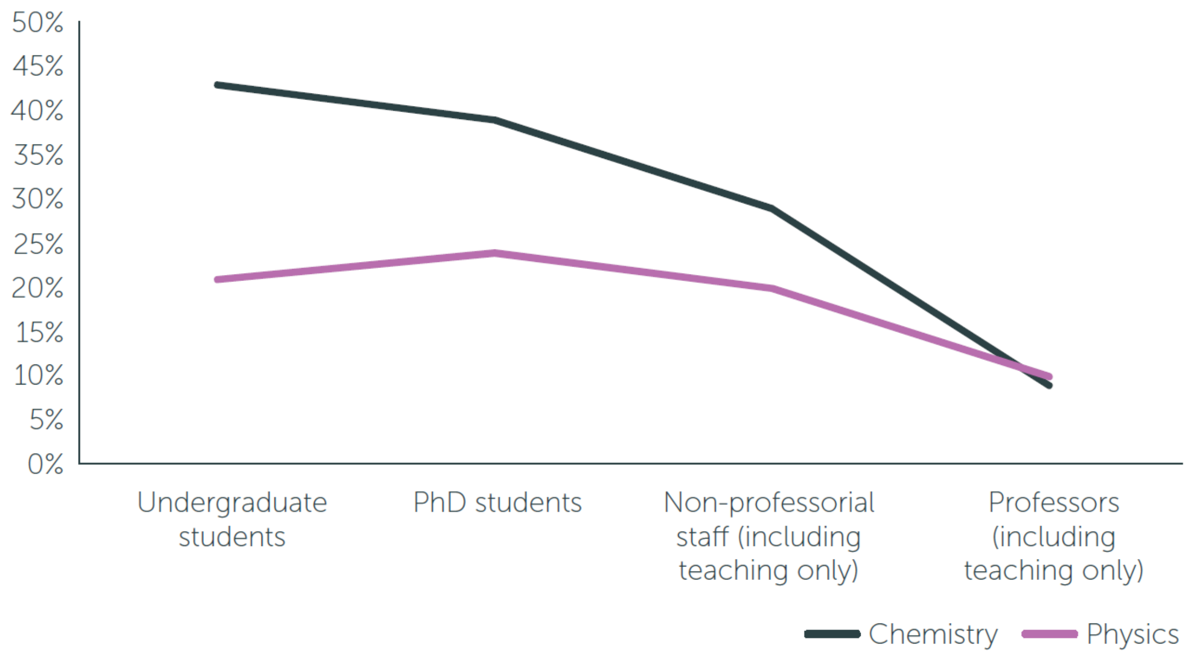
In this context, a clear understanding of skills needs will be critical, as well as the continued ability to draw on a global talent pool in order to take advantage of new research fields, capitalise on scientific discovery and develop skills and capacity.

Diversity and inclusion

At all stages, it is crucial that we have a diverse pipeline of STEM talent and extend opportunities. Our recent report ‘Diversity Landscape of the Chemical Sciences’ showed that there is still a lack of progress in developing and retaining women in leadership positions in the chemical sciences[17].

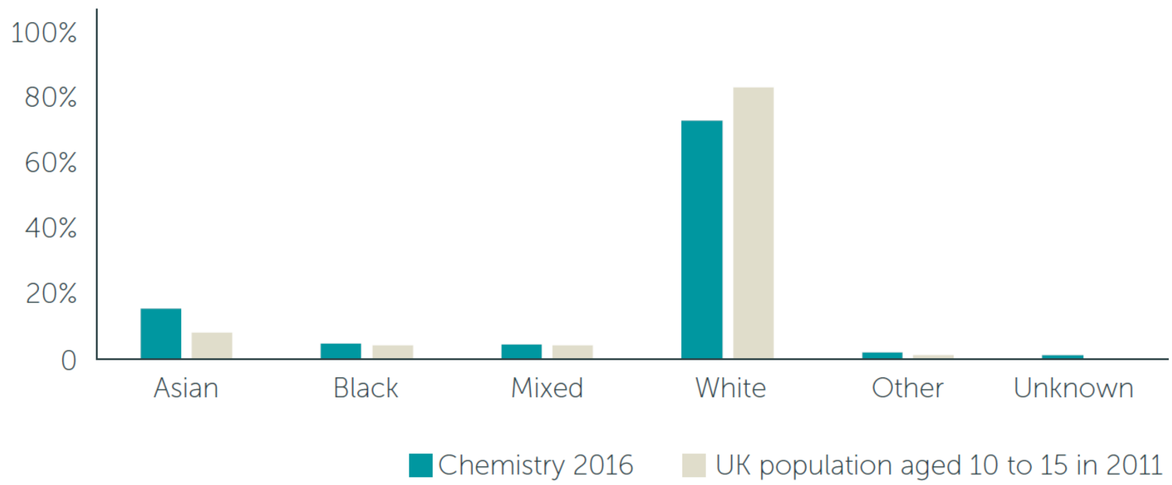
We found there were ‘leaky pipelines’ of both women and BAME students from undergraduates through to professorial roles. Figure 2 shows that the share of women in chemistry departments drops significantly, from 44% at undergraduate level, to just 9% at professorial level, a sharper drop than in physics:

Figure 2: the ‘leaky pipeline’ of female talent.



In the last 10 years, the proportion of UK domiciled BAME chemistry students has increased from 16 to 24%, however at post-graduate level the proportion falls for 14%. Figure 3 shows how the proportion of UK-domiciled chemistry undergraduates from each ethnic group compares to the relevant UK population:

Figure 3: Chemistry undergraduates by ethnic group



Our report makes a number of recommendations and commitments aimed at driving progress on diversity and inclusion. These include the need to address gaps in the current evidence base and for further insight into how the interplay between multiple forms of discrimination can reinforce one another to create a negative impact on people's opportunities and experience, particularly with respect to mental health, disability, sexual orientation, gender identity, ethnicity and socioeconomic background.

Tackling this issue head on is not merely the right thing to do—a more diverse workforce should result in better science and economic benefits. A more diverse representation at leadership level should in turn create longer-term social change.

Further Information and contact details

The Royal Society of Chemistry would be happy to discuss any of the issues raised in our response in more detail. Any questions should be directed to Tanya Sheridan, Policy and Evidence Manager, tel. 01223 438339.

Endnotes

[1] Life Sciences and the Industrial Strategy, A response from the Royal Society of Chemistry to the House of Lords Science and Technology Select Committee, 2017 recommendation 8 - http://www.rsc.org/globalassets/04-campaigning-outreach/policy/rsc_response_hol_st_ls_final.pdf .

[2] 'EEA Workers in the UK Labour Market: Interim Update' Migration Advisory Committee, 2018, pp. 22-3 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/694494/eea-workers-uk-labour-market-interim-update.pdf

[3] Science Industry Partnership, Skills Strategy 2025, March 2016 http://www.scienceindustrypartnership.com/media/1047/5202fd_sip_skills_strategy_2015_final_low.pdf

[4], 'Pay and reward report', Royal Society of Chemistry, December 2017 http://www.rsc.org/images/pay_reward_2017_tcm18-249108.pdf

[5] Small, I., Menzies, L. and Mulcahy, E. (2017) The Talent Challenge: the looming teacher recruitment crisis in England's state schools and what to do about it. LMKco published by Oceanova. https://www.lkmco.org/wp-content/uploads/2017/04/The-Talent-Challenge.pdf
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DfE (2017) Analysis of teacher supply, retention and mobility https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/615729/SFR33_2017_Text.pdf
DfE (2016) Schools workforce in England 2010 to 2015: trends and geographical comparisons. https://www.gov.uk/government/statistics/local-analysis-of-teacher-workforce-2010-to-2015

[6] DfE (2016) School Workforce in England: November 2015. https://www.gov.uk/government/statistics/school-workforce-in-england-november-2015

[7] Wastage rate is the percentage of teachers who have left the profession in a given year divided by the total number of teachers

[8] DfE (2017) Analysis of teacher supply, retention and mobility https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/615729/SFR33_2017_Text.pdf

[9] Worth, J. and De Lazzari. G. (2017). Teacher Retention and Turnover Research. Research Update 1: Teacher Retention by Subject. Slough: NFER. https://www.nfer.ac.uk/publications/NUFS01/NUFS01.pdf

[10] Strengthening Qualified Teacher Status (QTS) and Improving Career Progression for Teachers. DfE December 2017

[11] 'Young people's views on science education' Wellcome Science Education Tracker Research Report, February 2017, section 4.1

[12] See 'Public Accounts Committee: Apprenticeships Enquiry, Written Evidence submitted by the Royal Society of Chemistry' March 2016

[13] As above

[14] 'Commons Select Committee on Education: Quality of apprenticeships and skills training inquiry, written evidence submitted by the Royal Society of Chemistry', January 2018

[15] 'Open for Business', a chemistry department perspective on university-business engagement, Royal Society of Chemistry, November 2016 http://www.rsc.org/globalassets/04-campaigning-outreach/campaigning/university-business-engagement/open-for-business-report-royal-society-of-chemistry-2016.pdf

[16] Life Sciences and the Industrial Strategy, A response from the Royal Society of Chemistry to the House of Lords Science and Technology Select Committee, 2017 recommendation 11 - http://www.rsc.org/globalassets/04-campaigning-outreach/policy/rsc_response_hol_st_ls_final.pdf

[17] Royal Society of Chemistry, 'Diversity Landscape of the Chemical Sciences' 2018 - http://www.rsc.org/globalassets/02-about-us/our-strategy/inclusion-diversity/cm-044-17_a4-diversity-landscape-of-the-chemical-sciences-report_web-2.pdf