

## Closing the STEM skills gap inquiry: Russell Group input

### 1. Summary

- We welcome the Science and Technology Committee's inquiry into the STEM skills gap. Individuals with STEM skills are major contributors to the prosperity of the UK and the provision of these skills leads to significant economic growth, improvements in quality of life and greater innovation.
- A training in STEM at a Russell Group university endows graduates and postgraduates with the skills needed to become the high quality labour force and leaders required for the future development of the UK's economy and society.
- Our universities train the vast majority of the UK's doctors and dentists and a disproportionately high number of scientists, mathematicians and engineers. They invest significant resource in ensuring students on STEM courses are prepared for the workplace and many design their courses with input from business – helping to ensure the UK has the talent pool to meet the future needs of employers.
- Despite these efforts, the UK's pipeline of STEM graduates is at risk as a result of continued underfunding from government. STEM subjects are inherently expensive to deliver and without appropriate funding they could become financially unsustainable – especially if the government wishes to increase the number of students studying these subjects.
- In order to underpin future growth and close the STEM skills gap, increased funding per student is required for universities teaching STEM subjects.

### 2. What are STEM subjects and why are they important?

- 2.1 The Department for Business, Energy and Industrial Strategy (BEIS) and the Higher Education Statistics Agency (HESA) both use the Joint Academic Coding System's (JACS) classification to define STEM subjects. These are: medicine and dentistry; subjects allied to medicine; biological sciences; veterinary science, agriculture and related subjects; physical sciences; mathematical sciences; computer science; engineering; technologies; and architecture, building and planning.<sup>1</sup>
- 2.2 The training of graduates and postgraduates with skills in these subjects is vital for the prosperity of the UK and leads to a range of positive impacts including the delivery of innovative new technologies and products; improvements in health and quality of life; productivity improvements and economic growth. STEM skills are also increasingly important for tackling national and global challenge, and maximising the value of public investments from the UK government:
- Around 20% of UK economic growth (from 1982 to 2005) came from increased graduate skills.<sup>2</sup>
  - Numbers of STEM graduates are strongly correlated with innovation: around 45% of graduates working in innovative firms in manufacturing and knowledge-intensive

<sup>1</sup> <http://www.publications.parliament.uk/pa/ld201213/ldselect/ldsctech/37/3704.htm>

<sup>2</sup> BIS Research Paper 110, 'The relationship between graduates and economic growth across countries' (Aug 2013)

business service industries had a degree in a STEM subject, compared to only about 30% of graduates in non-innovative firms.<sup>3</sup>

- There is an association between hourly pay and the use of STEM skills in the workplace, showing that these skills help to increase earnings and productivity.<sup>4</sup>

### 3. The STEM skills gap

- 3.1 **Despite the importance of STEM subjects, international benchmarking suggests the UK's science and innovation system is disadvantaged by weaknesses in its STEM talent base.** Research shows there is insufficient domestic human capital to exploit science and innovation in the UK, including deficits of domestic STEM talent and of Masters/PhD graduates working in research.<sup>5</sup>
- 3.2 Evidence suggests employers cannot get the STEM skills that they need. According to the UK Commission's Employer Skills (UKCES) Survey 2013, 43% of vacancies for professionals working in science, research, engineering and technology are hard to fill due to skills shortages<sup>6</sup>. This is almost twice the average for all occupations, making it the worst affected of all 25 occupational sub-major groups within the government's Standard Occupational Classification (SOC).
- 3.3 Research by Engineering UK indicates that between 2010 and 2020, engineering companies are projected to have 2.74 million job openings, of which 1.86 million will be workers who are likely to need engineering skills. To overcome the skills shortage, they estimate the UK will either need to double its number of engineering graduates or significantly increase (by around 50%) the number of engineering and technology (and other related STEM as well as non-STEM graduates) who are known to enter engineering companies.<sup>7</sup>

### 4. What are Russell Group universities doing to tackle the STEM skills gap?

- 4.1 Although there are only 24 Russell Group universities UK-wide, our universities taught almost 110,000 of the students studying high cost STEM subjects in 2014/15. In addition to this our universities teach:
  - 82% of all doctors
  - 90% of all dentists
  - 83% of minerals, metallurgy and materials engineers.
- 4.2 **In total, 38% of students at English Russell Group universities study STEM subjects, in contrast to only 16% at other universities.**
- 4.3 STEM programmes at Russell Group universities are renowned for outstanding teaching and research. All of the top UK universities in the Times Higher Education ranking of engineering and technology courses for 2015-16 are Russell Group universities,<sup>8</sup> and all of our universities rank in the top 32 universities in the UK for medicine.<sup>9</sup> The excellent reputation

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<sup>3</sup> Levy and Hopkins, 2013

<sup>4</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/444048/High\\_level\\_STEM\\_skills\\_requirements\\_in\\_the\\_UK\\_labour\\_market\\_FINAL.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/444048/High_level_STEM_skills_requirements_in_the_UK_labour_market_FINAL.pdf)

<sup>5</sup> Ibid.

<sup>6</sup> <https://www.gov.uk/government/collections/ukces-employer-skills-survey-2013>

<sup>7</sup> [http://www.engineeringuk.com/View/?con\\_id=490](http://www.engineeringuk.com/View/?con_id=490)

<sup>8</sup> [https://www.timeshighereducation.com/world-university-rankings/2016/subject-ranking/engineering-and-IT-0#!/page/0/length/25/sort\\_by/scores\\_overall/sort\\_order/asc/cols/stats](https://www.timeshighereducation.com/world-university-rankings/2016/subject-ranking/engineering-and-IT-0#!/page/0/length/25/sort_by/scores_overall/sort_order/asc/cols/stats)

<sup>9</sup> Except LSE and Durham, neither of which have medical schools. <https://www.theguardian.com/education/ng-interactive/2016/may/23/university-guide-2017-league-table-for-medicine>

of Russell Group universities is therefore a primary reason for the desirability of their graduates by employers.

4.4 **In many cases employability is explicitly built into Russell Group course curricula to ensure that STEM graduates leave university “work ready”.** Formal accreditation offers students an important means of demonstrating the skills they have gained through their degree, and placements are an effective way to enhance soft skills and gain hands-on experience with industry-specific technology. The following are a few illustrative examples of how employability is central to STEM courses at Russell Group universities:

- **UCL’s** Department of Computer Science has an external advisory board of industry experts and technology leaders that contribute to the department’s teaching and learning. This ensures the department’s undergraduate curriculum taps into industry needs and is supported by industrial placements to make UCL students more employable. Students also work with industry partners on real world projects.
- In 2012, **Imperial’s** Department of Chemical Engineering opened a £2 million carbon capture pilot plant in partnership with automation and power technologies firm ABB. Created as part of Imperial’s ten year strategic alliance with ABB, the state-of-the-art facility gives undergraduates the chance to control the industrial-standard pilot plant, learn key skills such as how to start up the facility, shut it down, and operate it safely and efficiently. Thanks to this training, Imperial students graduate with unrivalled expertise, making them more employable in an increasingly competitive sector.
- The **University of Nottingham** and GlaxoSmithKline have partnered to develop Nottingham’s Carbon Neutral Laboratory. The £15 million facility serves as a hub to catalyse new collaborations with industry and delivers an innovative education and training programme for young scientists of the future that will ensure new scientists from Nottingham are “industry ready”, with a thorough understanding of the sustainability and environmental impact of their work.
- All students in the College of Engineering, Mathematics and Physical Sciences at the **University of Exeter** are provided with a wide range of employability-related resources designed to help STEM students develop their skills prior to graduation. The department also has a dedicated careers consultant who provides careers workshops tailored to careers in STEM disciplines and offers support with CV writing, completing job applications, preparing for interviews and psychometric tests. Employer-led skills sessions are run to help students develop specific skills, and undergraduates are encouraged to take an optional ‘Commercial and Industrial Experience’ module before their third year.

4.5 Despite the Russell Group’s excellent reputation for STEM courses and the high quality of our graduates, underfunding for STEM courses puts these crucial subjects at risk, and threatens our ability to further expand STEM courses in future.

## 5. Closing the funding gap for high cost STEM subjects

5.1 STEM subjects like medicine, engineering and the sciences are very expensive to teach. This is the case for a number of reasons:

- Subjects such as physics, chemistry, engineering and medicine require access to specialist training facilities, such as medical simulation suites, or laboratories which are expensive to run.
- The equipment associated with the teaching of these subjects is also expensive: electron microscopes, mass spectrometers and airplane engines require initial investment, as well as funding to maintain them. Fieldwork for students involved in the

biosciences or chemical engineering can also be costly, not only in terms of travel, but student supervision, equipment and insurance.

- The small group teaching associated with training students to operate specialist equipment or learn new clinical skills also makes staff costs higher in these subjects. Many of these subjects are also associated with high regulatory costs. In chemistry and chemical engineering, students may need to work with hazardous or radioactive equipment for example.

5.2 In recent years, the government has committed to increase the number of students studying STEM disciplines<sup>10</sup> and the cap on student numbers was removed from the 2015-16 academic year. However, the additional funding for these high cost subjects provided by HEFCE (on top of the standard level of undergraduate tuition fee) has not kept pace with this growth. As student numbers rise, this equates to a *de facto* cut in funding per student when such courses are already heavily subsidised by universities. This effect is compounded for institutions with more students in these subjects, so the shortfall will affect some institutions more than others.

5.3 Indeed, interrogation of HEFCE data shows that within STEM subjects, the shortfall ranges from around £368 to nearly £6,000 per student per year. This funding gap puts pressure on other important activities and is not sustainable. The impact is most acute for Russell Group universities, which represent just 15% of higher education institutions in the UK but educate more than double the number of STEM students taught by non-Russell Group universities. **Our institutions are effectively subsidising the government by teaching these economically important subjects and are make a loss in doing so:**

- Overall, we have calculated that **Russell Group universities currently experience a funding shortfall for home/EU students of at least £72.5 million for all high-cost STEM subjects per year.** This gap continues to grow as additional funding from HEFCE is not keeping pace with inflation and does not cover all of the costs that even HEFCE itself has estimated in its own work on the 'sustainability gap'. Added to this are the costs associated with premises and contributions to tackling the USS pension deficit. The actual shortfall, if fully-costed, could easily exceed £105 million per year just for Russell Group universities in England.

5.4 **With adequate funding, Russell Group universities could be doing even more than they are at present to address the STEM skills gap. In order to underpin future growth, research-intensive universities should be properly funded to deliver excellent education, including in high-cost STEM subjects where there is a high demand for skills by employers.**

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<sup>10</sup> <https://www.gov.uk/government/publications/2010-to-2015-government-policy-public-understanding-of-science-and-engineering/2010-to-2015-government-policy-public-understanding-of-science-and-engineering#issue>