Gordon House, 29 Gordon Square
London, WC1H 0PP
T: 020 7679 4994
E: info@sciencecampaign.org.uk
W: www.sciencecampaign.org.uk

CaSE
Campaign for Science and Engineering

CaSE response to Lords Inquiry into Higher Education in STEM Subjects

This is CaSE's consultation response to the House of Lords Science and Technology sub-Committee I Call for Evidence: Higher Education in STEM Subjects.

Definition of a STEM subject and a STEM job

STEM subjects can be defined in relation to curriculum requirements and skills developed. However, it can be misleading to define a STEM job in a similar way. While there are jobs for which formal STEM qualifications are a necessity, a STEM qualification has been shown to be a fantastic preparation for a huge range of careers[1]. STEM graduates have been shown to be nearly 90% likely to be in full-time employment or further study three years later. This is in comparison to 73% for the creative arts and 78% for languages and historical or philosophical studies.

16-18 Supply

CaSE welcomed the inclusion of maths and science in the English Baccalaureate (EBacc), as a signal of the importance placed on these subjects by the Government. However, we are concerned that these subjects are being looked at in isolation, rather than as part of a holistic strategy to improve the STEM skills of pupils. We have two main concerns, and both stem from the fact that if schools are being asked to emphasise certain subjects within the EBacc, there will inevitably be a relatively lower emphasis on subjects not included in the EBacc.

The first is that, in order to attain the EBacc, pupils only need two GCSEs in science subjects[2]. CaSE's position is that all schools should be able offer 'triple science' (separate GCSEs in biology, chemistry, and physics) to their pupils; although it may not be appropriate for all pupils to study all three sciences, it is a matter of both principle and pragmatism that all should have the opportunity to do so. There has been growth in the number of pupils studying triple science in recent years, but the EBacc's increased emphasis on two sciences may incentivise schools to refocus on providing GCSEs in Science and Additional Science (similar to 'double award'), at the expense of providing triple science.

The greater expense of science subjects relative to others makes this a particular worry; if a school finds it has to reduce its budget, moving from 'triple' to 'double' science provision would be a way of doing so without harming EBacc scores. Given the importance of these skills, the Government should be increasing incentives for triple science rather than reducing them.

The second concern is that although maths and science have been promoted via the EBacc, engineering, design, and technology have been neglected. We appreciate that the Government is not actively seeking to de-emphasise these skills-based subjects. However, these practical subjects cost schools more to provide than many others, meaning that they may be first in line for cuts during times of budgetary difficulty. Again, the Government should be putting more emphasis on these subjects, not less.

A common theme to both of these concerns is that any negative impact might hit pupils at poorer schools the most. Any effective reduction in provision means that pupils may not have the requisite qualifications support to take the right A-levels which would allow entry into STEM in Higher

Education. For example, the odds of getting an A or B at A-level Chemistry are increased by 76% for pupils in the maintained sector who take triple science rather than double science[3], and the effect extends across science and into higher education[4].

Demand for STEM students and the quality of STEM graduates

The 2011 CBI/EDI skills survey highlighted once again, the concerns of employers with relation to the low level of numeracy, literacy and employability skills of many schools and college leavers. It is important to note that many of the CBI's members aren't recruiting STEM graduates for careers in research (only 5% of respondents to the CBI survey came from the science/engineering/IT economic sector[5]), highlighting a more general skills gap between HEIs and graduate employers.

CaSE member Electroimpact, a global provider of factory automation and tooling solutions with UK bases in Wales and Bristol, reports that the number of graduates passing their in-house pre-employment tests each year is decreasing. Electroimpact currently employs 85 graduates and recruits approximately 12 graduates each year. CBI/EDI skills survey respondents face a similar situation, with 43% of employers currently having difficulty recruiting STEM skilled staff at some level. At graduate level, 39% of employers are short of STEM graduates. We agree with the CBI that this demonstrates a clear business need for an increase in the number of graduates studying STEM subjects.

In addition, Cogent, the Sector Skills Council for the Chemicals, Pharmaceuticals, Nuclear, Oil and Gas, Petroleum and Polymer Industries have also reported that employers find it difficult to attract high quality skills graduates. In their Cogent Skills Oracle Report 2011, 57% of employers agreed that universities need to further develop CPD programme relevant to industry, 55% agreed that universities need to improve employability and 52% agreed that the practical skills of students need to be improved before entering industry[6]. It is hoped that new initiatives such as the Society of Biology's accreditation scheme and a new kite-marking scheme from STEM-focused sector skills councils will help students understand better which courses are valued by employers.

Information about accreditation and kite-marking schemes will be included in the new Key Information Set. Access to high quality careers advice for all prospective undergraduate students is crucial if students are to fully understand where a degree level qualification can take them. CaSE has voiced concerns over the proposals for the Key Information Set (KIS) and how careers in science and engineering are portrayed. Will the KIS take account of the relatively lower earnings of research academics under the salary indicators to avoid a skewed perspective? In the absence of AimHigher, schools will now deliver careers advice through independent providers. It is our understanding that there is no framework for this provision and it won't be comprehensively audited. As a result, schools which provide a below-par careers service cannot be quickly or easily identified, to the detriment of their students.

Graduate supply:

Under the current funding model (pre-introduction of higher top-up fees), higher education institutions (HEIs) receive 70% more funding from HEFCE with which to teach lab-based subjects (primarily STEM)[7], as compared to less resource-intensive subjects. This was reduced from a 100% uplift in 2003-4. After the lifting of the fees cap, HEFCE will give £1,500 to HEIs per student[8] for resource-intensive subjects such as science and engineering. This is the equivalent of a 17% subsidy for HEIS which charge £9,000 per annum, or 20% for those charging £7,500 per annum. We may therefore see a

marked decrease in the financial incentive for HEIs to offer STEM degrees as compared to other courses.

When the new 'core/margin' model was announced[9], we raised concerns that it might adversely affect STEM provision. Universities charging more than £7,500 per annum, but not able to attract sufficient numbers of uncapped AAB+ students, would see a significant year-on-year reduction in the number of students they can admit. This will inevitably create financial pressures on such institutions, and they may look to high-cost STEM subjects as areas for cuts in order to balance their budgets.

However HEFCE recently announced[10] that Strategically Important and Vulnerable Subjects (SIVS) would be exempt from the reduction in student numbers controls as long as they maintain numbers of entrants in those departments. This should help prevent any reduction in STEM provision at those HEIs in the short term, but the trade-off is increased financial pressures elsewhere for the HEI.

For HEIs able to attract mostly AAB+ students, their student number controls are effectively uncapped, and their undergraduate intake will only be limited by their own internal capacity. We hope that many will use this freedom to expand capacity on STEM courses, but are concerned that this may not be the case, as although HEIs will receive £1,500 more with which to teach STEM, such subjects cost much more to teach. Elite HEIs may therefore prioritise student number expansion in lower-cost, higher-profit, non-STEM subjects – potentially to the detriment of other HEIs who are less able to compete for those highly profitable students, and will come under financial pressures as a result.

A HEFCE consultation[11] earlier this year revealed that they have been asked by Government to prioritise Further Education (FE) colleges in the redistribution of the 20,000 places created by the year-on-year contraction in non-AAB student numbers amongst HEIs which charge more than £7,500. The teaching of science and engineering often requires a significant injection of capital funding for equipment, and it is difficult to see how FE colleges will be able to meet national demand for STEM education if provision drops in the HE sector.

In summary, although the exemption of SIVS from the uncapped student number reductions is welcome and will help prevent an immediate decline in STEM provision amongst certain HEIs, we remain concerned that there are not enough incentives for HEIs to increase STEM provision. Current policy is predicated on student choice driving STEM provision, and while we hope that this will indeed occur, we also argue that the importance of STEM graduates to the UK's future is so great that additional safeguards should be put in place. The simplest and most effective change would be to increase the relative subsidy for SIVS from HEFCE.

The full effects of these changes may not be apparent for a number of years. HEIs with some AAB students, but not a majority, may take short-term decisions to increase provision of high-status STEM subjects as a loss-leader in order to be institutionally competitive in a few years time. This does not necessarily mean that the expanded provision is sustainable, and may prove out to be even more unsustainable if the market does not behave as hoped.

Currently there is no commonly accepted and accurate analysis showing the true costing of a high-quality STEM higher education. Such an analysis would make policy decisions much better informed.

Postgraduate STEM education

The policy environment around postgraduate taught education is increasingly similar to undergraduate education. The state has accepted that it has a duty to promote undergraduate education, either through direct funding or subsidised loans, due to the national importance of a well-educated workforce and also for reasons of fairness; if higher education gives social and economic benefits, then it is important that those benefits are accessible by all.

There are a number of sectors reliant on skills obtained through taught postgraduate qualifications. For instance, this committee established there are concerns over the number of skilled nuclear engineers required for the UK's energy needs[12], while the Association of the British Pharmaceutical Industry found that "the UK has a substantive skills deficit in biomedical sciences", particularly in postgraduate-level disciplines[13].

Despite the similarities in social and economic implications, policy itself is markedly different. While undergraduates receive financial support with both fees and living costs, stand-alone Masters students receive neither. Applicants must rely on private wealth or commercial loans in order to meet costs, which restricts access to these important courses. With undergraduate fees rising to up to £9,000 per year, we expect postgraduate fees to rise above that, given they are for higher qualifications. This will exacerbate the access problem if financial support is not introduced.

There is also increasing confusion around the interface between Masters and PhD programmes. Currently, undergraduates can either pursue a standard three year degree, a four year integrated Masters programme, or a '3+1' undergraduate degree followed by postgraduate masters. Each of these initial routes can lead to a PhD – a three year PhD, or a 3.5 year (e.g. EPSRC) PhD, or a four year programme which is now normal in post-doctoral training centres.

There is some concern that higher levels of student debt will deter graduates from pursuing a postgraduate research career, and the lack of clarity about education and career routes may make this even more of an issue.

The geographical spread of STEM and equality of access to STEM education

It is CaSE's belief that STEM courses should be available to all those who wish and are competent to study them. We are concerned that the recent HE reforms may affect the geographical spread of both higher education institutions offering STEM courses, but also the geographical spread of students taking STEM students.

CaSE is concerned that the increase in fees may deter students from poorer backgrounds from moving away from home in order to study, in order to reduce living costs. As a result, their options to study will be limited to those HEIs in their geographical area. There is already evidence of this happening as it has been shown that certain ethnic groups, such as Pakistani, Bangladeshi and Indian students are more likely to live at home[14].This is concerning for two reasons. The first is that students are not making decisions about where to study based on their ability. The second is that student choice will be limited to the courses that their local HEI offers. For prospective physics students in East Anglia, if they are not accepted by the University of Cambridge there are no other physics departments in the region.

The Athena SWAN Charter recognises and celebrates good employment practice for women working in science, engineering and technology (SET) in higher education, awarding departments with bronze, silver and gold awards. By increasing the visibility of senior women in these departments, this may

have a positive knock on effect for younger staff and students who are able to identify role models within their departments.

---

[1] Destinations of Leavers from Higher Education Longitudinal Survey 2006/07 Table 7: http://www.hesa.ac.uk/index.php/component/option,com_pubs/Itemid,276/task,show_year/pubId,1714/versionId,54/yearId,262/

[2] More students study core subjects thanks to EBacc, DfE. Accessed 15/12/2011 http://www.education.gov.uk/inthenews/inthenews/a00197623/more-students-study-core-subjects-thanks-to-ebacchttp://www.education.gov.uk/inthenews/inthenews/a00197623/more-students-study-core-subjects-thanks-to-ebacc

[3] *Science and Innovation Investment Framework 2004-2014: Next Steps, 2006 budget.* HM Treasury, 2006. http://hm-treasury.gov.uk/d/bud06_science_332v1.pdf

[4] *Success in Science,* Ofsted. 2008 (See para 99) http://www.ofsted.gov.uk/sites/default/files/documents/surveys-and-good-practice/s/Success%20in%20science%20%28PDF%20format%29.pdf

[5] CBI *Building for Growth: business priorities for education and skills*. Education and skills survey 2011 http://www.cbi.org.uk/media/1051530/cbi__edi_education___skills_survey_2011.pdf

[6] Cogent Skills for Science Based Industries – Skills Oracle 2011 http://www.cogent-ssc.com/research/Publications/Cogent_Skills_Oracle_Report_2011.pdf

[7] *What are current price group weightings and resource rates?,* HEFCE. Accessed 15/12/2011. http://www.hefce.ac.uk/faq/mainfaq.htm

[8] *Teaching funding and student number controls*, HEFCE. June 2011. (See para 100) http://www.hefce.ac.uk/pubs/hefce/2011/11_20/11_20.pdf

[9] *Teaching funding and student number controls*, HEFCE. June 2011

[10] *Student number controls for 2012-13*, HEFCE. October 2011 http://www.hefce.ac.uk/pubs/hefce/2011/11_30/11_30.pdf

[11] *Teaching funding and student number controls*, HEFCE. June 2011. (See para 133)

[12] *Nuclear Research and Development Capabilities – 3rd Report of Session 2010-12,* House of Lords Science and Technology Select Committee. November 2011

[13] *Skills Needs for Biomedical Research*, Association of the British Pharmaceutical Industry October 2008

[14] Connor, H, Tyers, C, Davis, S and Djan N (2003). *Minority Ethnic Students in Higher Education:* Interim Report, Institute for Employment Studies.
http://www.ligali.org/pdf/minority_ethnic_students_in_higher_education_rr448.pdf