

UK Deans of Science

Comments on the Secretary of State's Debate on the Future of Higher Education

1. The UK Deans of Science (UKDS) has members in around 70 HE institutions that have significant science portfolios. Our primary aim is to ensure the health of the science base of the UK through the promotion and support of science and scientists and of science research and science teaching in the UK's HEIs.
2. The UK Deans of Science is pleased that the Secretary of State has initiated this debate and given an opportunity for a range of interested parties to give their views. We enter into it on the understanding that it is a serious root and branch review of higher education and will not merely be used to initiate a debate on increasing student fees.
3. The Minister is fully aware that there is much to celebrate about UK science. UKDS would wish to record its gratitude for the major increase in government support for science that has been evident over the past decade which has undoubtedly played a major part in ensuring the beginning of a transformation of the science research base in UK HEIs. However, we believe that it is important to concentrate this response on threats and opportunities so that a future for UK science within higher education is created that is sufficiently robust that it will be able to retain its world class status regardless of the challenges it may face.
4. In preparing this response we have taken careful note of all the commissioned contributions and the later series of reports produced by employers. Many of the issues they raise may affect universities as a whole but are likely to have relatively little direct impact on the agenda for science. In this response *we will limit ourselves as far as possible to issues which we consider to be of particular importance for science in higher education*. These follow below with our main recommendations summarised at the end of this document.

The nature of a university

5. Any consideration of the future of science in higher education needs to take account of the way in which universities are likely to change. In the recent past in addition to the increase in student numbers, university budgets have become significantly less reliant on the government teaching grant and research funding. Science departments have been at the forefront of the changing nature of universities and have increasingly diversified their research and other income and capitalised on their scientific inventions. However, there needs to be a full and open debate on the future nature of a UK university, particularly in the context of science.
6. There has been much discussion about increasing the diversity of university missions. We are pleased to note recently the relative lack of reference to "teaching" or "research" universities. From the point of view of science this is particularly important as we do not believe that undergraduate science can be appropriately learnt in a teaching-only environment. Indeed HEFCE's statement in its submission, that research is so "central to the very idea of a university", is probably the single most defining statement of all contributions to this Debate. It is essential that science degrees include understanding and direct experience of current, scientific research.

Any degree that fails to do this will not enthuse the next generation of scientists. It is also essential that it is recognised that the whole scientific workforce will not be generated by a handful of very research-intensive institutions. These will undoubtedly produce the majority of doctoral and postdoctoral researchers and will be the environment where most of the best scientists will develop and do their cutting edge, world-class research. But there needs to be a broader base to university science than this where others may develop their skills, perhaps before moving onwards and upwards. In this context it is worth noting that David Beckham made his debut in the Premiership only after he had been given the opportunity to have first team experience on loan playing for Preston North End, a club then languishing in the Third Division. We make further reference to the nature of a university in the context of IPR, the universities and industry later (paragraph 11).

The nature of science

7. In considering the future of science in higher education it is essential to begin with recognition of the special nature of scientific subjects. All such disciplines are based on a hierarchy of knowledge, which builds, in educational terms, from primary education upwards. Thus the most basic appreciation and use of numbers which is build upon at each point in pre-university education leads to the higher skills in mathematics that are required for study of the subject in its own right at graduate and postgraduate level and the mathematical competencies required for the study of all other scientific (and engineering) disciplines. However, the linearity goes much further than this in that each level of understanding of a scientific discipline in higher education relies on earlier successful completion of all previous levels. Unlike many other subjects it is simply not possible to take up a Bachelors or Masters degree in science or mathematics *ab initio* and this needs to borne in mind when considering the status of science at undergraduate level and beyond.

Teaching, learning and assessment

8. A further important difference between science disciplines and most other subjects is the need to ensure that graduates and postgraduates achieve a high level of skills in relevant practical techniques in addition to theory and application of the subject. If we are to produce world class science graduates funding must take account of the cost of laboratories and workshops, sophisticated equipment, major health and safety management and sufficient skilled staffing to support the teaching and assessment of practical skills. Any plan for higher education must ensure that these needs are fully costed and integrated into the process of resource allocation. The significance of taking better account of the real cost of teaching science can be judged by the current effect of HEFCE's current additional funding support of very high cost and vulnerable science subjects (chemistry, physics, chemical engineering and mineral, metallurgy and materials engineering) . Deans of Science have found that this has meant many science departments have been able to move much closer to balancing their budgets. However, we would urge that the outcomes of the Full Economic Costing exercise for teaching are used when the next revision of the subject-related price groups for science takes place. We would expect this to result in a reducing of the relative differential between science and medicine (currently 1.7 to 4, excluding the current special additional funding support).

9. Science departments have often been the first to embrace forms of on-line learning and this can bring new understanding to complex aspects of science, for example by modelling of complex systems. However, in spite of a new generation of students who have grown up in the digital age it is questionable as to whether ICT is the learning method of choice at least for those on-campus students who could be said to have such a choice. There is as yet little to suggest that knowledge, skills and understanding achieved through such methods are yet comparable with those from face to face contact. Such contact is well illustrated in the best practical science sessions where students and staff can interact together as a “community of scholars”. While encouraging a commitment to fund further developments in on-line innovation we suggest that there should also be funding of further research into student needs and expectations and the usefulness of on-line teaching and learning to ensure that any investment is based on evidence that it is an effective and cost-efficient tool for science subjects.

IPR, Universities and Industry

10. Scientific disciplines as practised in universities are, almost by definition, aligned to knowledge and skills training that directly feeds the needs of industry and which will ensure that the UK can emerge for the current economic downturn with world-class researchers that will deliver economic and social solutions, making the UK one of the most technologically successful economies. Science departments, particularly in recent years, have increasingly concerned themselves with the impact of their research through a range of technology transfer mechanisms.
11. UKDS are fully committed to such use of the research outputs of our colleagues and we believe that there is scope for an even higher level of such activity. However, it is important that the nature of universities is not hijacked solely for immediate perceived economic or social gain. We believe that the universities are, and should continue to be, the best place for blue skies research and thinking and that the Government should take full cognisance of the views expressed by two “users” of higher education in their contributions to this Debate:
- Marjorie Scardino, CE, Pearson plc: “...the overarching purpose of a university is to teach students to be excited by ideas, and to develop the skills of observation and critical thinking to enable them to develop new skills, fresh knowledge and sound judgement throughout their lives, by themselves and for their own sakes”
 - Sir John Chisholm, Chair Qinetiq Group plc and Chair MRC: “...universities have a distinct and different role from companies and it would not be good value to turn them into corporate look-alikes”. Sir John also makes some very clear and sensible statements about what universities do that companies could not easily do themselves.
12. Our universities continue to attract some excellent home grown talent and are beginning to be even more attractive to some of the best international scientists. It is quite possible that an over-emphasis on commercial impact could discourage the best students - many of whom are initially attracted to science for its intellectual challenge rather than the economic or social benefits it may offer - from entering doctoral and postdoctoral education. Universities must be distinct from business and industry but at the same time there is an urgent need for even better partnerships to be created, which

could be achieved by business and industry understanding better the operational imperatives faced by universities (for example, the implications of the teaching provision) so that they might be able to identify with the strategies of the universities they wish to partner. This will ensure the creation of sustainable agreements and collaborations of long-standing mutual benefit.

Internationalisation

13. As noted elsewhere UK universities continue to be a magnet to many international students, especially those with an interest in science and technology. This has resulted in a very significant dependence on international students in UK full-time Masters and doctoral programmes, which particularly impacts on science and engineering (and business studies) subject areas. Over the past 15 years, the proportion of non-UK domiciled Masters students in science has increased dramatically and, with the exception of the biological sciences, almost all the increase in the numbers completing doctoral degrees has been from other EU and non-EU students. In several subjects UK-domiciled candidates make up less than half the successful PhD candidates. Many Masters courses would not be viable without the international intake creating a suitable critical mass and many university science departments would be in much deeper financial difficulties were it not for the substantial fee income derived from such students.
14. While the success in attracting non-UK students must be a cause for celebration, great caution should be adopted in assuming that this net gain will continue to grow or even stay at its present level. The immediate effect of the current financial crisis and lack of employment opportunities may well encourage more domestic students to continue into Masters and doctoral programmes but it should not be assumed that this will continue when the economy improves. To plan the future supply of the UK's science researchers solely or primarily on a continuing influx of highly able science graduates from outside the UK would be potentially as risky as the assumptions made by financial services companies about their ever expanding portfolios. Almost every developed and developing country has, over the past decade, committed to the development of a high value-added, high technology, knowledge-based economy and all will be competing in the same pool of world class talent. UKDS are very ready to take up this challenge but this must be done within an environment where university research is even more attractive to UK students than seems to be currently the case. This will be particularly challenging as developing nations become more attractive to their own citizens and so many countries create schemes to encourage migration to them (Malaysia's 2020 Vision, Canada Research Chairs Program involving *ca* 1600 university chairs in natural science, engineering and health, the Obama economic stimulus package, etc, etc).
15. We believe that, in the face of the international competition which we have briefly described above, much more attention needs to be given to development of international collaborative partnerships. In this regard we applaud the Government's

support through the Foreign and Commonwealth Office Science and Innovation Network and especially the appointment of its Scientific and Technology officers in embassies and other government offices around the globe. Further strengthening of this resource would enhance the success of universities and UK-based scientific companies in furthering their international partnerships.

Other issues

16. Science graduates have a greater economic effect than graduates in most other disciplines. Since the immediate future must focus on the current economic crisis we would urge the government to recognise the significant effect that science can make by creating a special stimulus package with more funding for university research and an increase of at least 10% in undergraduate places in STEM subjects. There is the possibility of an even quicker payback if there were to be more support for one year Masters courses. The recent increase in students on Masters programmes has been led much more by student choice (often from international students) and does not necessarily reflect the needs of the economy. We believe that a stimulus package that sought to support Masters programmes in strategically important areas would encourage some of our best students to remain in science at a time when the employment situation is extremely challenging. It would also be a very rapid and cost effective way of increasing higher level skills in the wider workforce.
17. The funding support for part-time students needs to be put on a par with that for full-timers and there should be a review of the loss of funding for equivalent or lower level qualifications where it has had a negative effect on science programmes.
18. The future research agenda will continue to be partially fulfilled by discipline-specific work. However, many of the major challenges require multidisciplinary approaches (and international collaborations) that may often not be achievable with teams made up from a single university. To further encourage the cooperation needed requires funding mechanisms that reward *true* partnership and collaboration. An approach to auditing of universities' performance indicators that was less able to be converted into league tables would be likely to replace much of the current competition between universities without reducing the real challenge that excites and motivates our scientists – working at the cutting edge of their disciplines and attempting to solve the most challenging research questions.

[Contd]

Summary

19. The idea of a debate on the future of higher education is inevitably extremely wide. We have attempted to concentrate here on important issues as they relate to the higher education science agenda. We consider that any conclusions reached by Government on the way forward should include the following issues.

- Undergraduate science must be delivered in an environment enriched by research if it is to enthuse the next generation of scientists. Funding needs to allow for a broad range of institutional approaches which give opportunity to the full range of students who could benefit from an education in science (please see paragraphs 5 and 6).
- The hierarchical nature of science subjects make them different from most other disciplines. The demands created by the practical nature of most of the sciences and the consequent need for excellent facilities, supervision and the management of health and safety must be taken into account when calculating an appropriate unit of resource (paragraphs 7 and 8).
- Research is needed before further commitment is given to a major increase in the use of e-learning (paragraph 9).
- University science departments should continue to increase their knowledge transfer activities but any changes in the nature of a university must be made by the universities themselves and not by Government decree or pressure. Universities and business/industry should maintain some of their essential differences but further mechanisms need to be found to increase productive collaborations (paragraphs 10, 11 and 12).
- The major success in attracting large numbers of non-domestic students to study in UK science departments might not be sustainable as other countries invest heavily to attract the world's best scientists. Greater attention and resources need to be devoted to the development of international partnerships and collaborative networks (paragraphs 13, 14 and 15).
- An economic stimulus package is needed that increases the numbers of students reading science, with a particular emphasis on support for Masters degrees in strategically important areas (paragraph 16).
- The funding of part-time students and those taking equivalent or lower level qualifications needs urgent attention (paragraph 17).
- UK Universities should work towards increasing collaboration and reducing unproductive competition (paragraph 18). A change in the nature of the method of auditing universities might be beneficial in this respect.

UK Deans of Science would be pleased to supply further comment and information if required.

**Submitted on behalf of the UK Deans of Science by Professor Ian Haines, Executive Secretary
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