Independent Review of Higher Education and Student Finance

Institute of Physics response to an independent review

A full list of the Institute’s submissions to consultations and inquiries can be viewed at www.iop.org

28 January 2010
Dear Sir/Madam

Independent Review of Higher Education and Student Finance

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 36,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

The Institute welcomes the opportunity to submit its views to the Independent Review of Higher Education and Student Finance. We note from the call for evidence that the focus of the Review is on the English higher education sector; thus we have limited our responses to the questions, accordingly.

The attached annex details our comments on the questions listed in the call for evidence.

If you need any further information on the points raised, please do not hesitate to contact me.

Yours faithfully

Professor Peter Main
Director, Education and Science
Independent Review of Higher Education and Student Finance

What has worked? Which parts of the system should be kept, based on the available evidence? What has not worked? Which parts of the system should be changed, based on the available evidence?

The government’s target to have 50% of 18-30 year olds in higher education by 2010 has had a negative impact on the higher education sector. This policy has indeed increased participation levels, but in degree courses that are unable to equip students with the necessary skills to compete in a highly competitive job market. As a consequence, HEFCE has had to allocate a larger proportion of its teaching funding grant to universities that run these courses. This has resulted in high-cost scientific subjects such as physics and chemistry, whose undergraduate numbers have been steadily increasing in absolute numbers, but decreasing in proportion to the total cohort of university undergraduates, being underfunded in the teaching funding resource.

It is only because of HEFCE’s decision to provide an additional annual allocation of £25m to high-cost subjects of strategic national importance from 2007-08, and from a recurrent basis from 2009-10, that physics departments in England for the first time in over a decade, are breaking even. Any reduction to this targeted allocation, following the cuts announced in HEFCE’s budget for 2010-11, could affect the viability of physics departments (with the potential threat of closure for the smaller ones), particularly as research undertaken by the Institute (yet to be published) has revealed that for a number of departments, their research income is subsidising the costs of their teaching activities.

In addition, the decision taken by HEFCE to withdraw funding for equivalent or lower qualifications (ELQs) is regrettable. At the time of the decision, the Institute urged that in order to safeguard the provision for ELQ learners to study STEM subjects, especially those that are of strategic and national importance, an exemption is required in line with those proposed for foundation degrees and Initial Teacher Training. This would help address the concerns with respect to the severe shortage of physics specialist teachers. Teachers qualified in other subjects must be supported in re-skilling as physics specialists through undergraduate level study; and mature candidates, whether or not they are already qualified to degree level, should be supported in studying physics to prepare for a career change, particularly on courses such as the Open University (OU) Certificate in Physics, which has been commended by the Institute as a suitable preparation for Initial Teacher Training as a physics specialist.

We are concerned about the impact HEFCE’s policy has had on the OU, which is the only provider exclusively delivering bespoke part-time undergraduate degrees in physics (and the only option for studying physics by distance learning). In order to save money, all residential schools that offer subject specific experimental skills are being removed over the next few years because they are too expensive. It is hard to see how this will not result in a reduction in quality of experience for students wishing to take an experimental route.
The government should make it clear to HEFCE that a full and permanent exemption from the funding withdrawal for ELQs is required for all strategically important subjects of national importance.

**How have the participation trends for different groups of students changed since 2006 and to what extent can these be attributed to the 2006 reforms? Please highlight changes that have been positive or neutral as well as changes that may raise challenges for future policy.**

The introduction of the financial reforms in 2006 does not appear to have had any adverse affect on either applications or entry to physics undergraduate degree courses. In fact, the number of students admitted to physics (and astronomy) degree courses in England, according to UCAS figures, has risen each year from 2006 (2216) to 2008 (2597). This reflects the general pattern of undergraduate enrolments by English universities between 2005-06 and 2007-08.

Data we have received from two of England's biggest universities reveals that participation rates for different groups of students (i.e. state schools/colleges; lower socio-economic; low participation neighbourhoods; black and minority ethnic, etc.) have changed very little as a result of the financial reforms. However, this data cannot be concluded to be truly representative of the actual situation across England.

As a general principle, the Institute does not favour a funding system that in any way discourages students from families of modest means participating in higher education if they have the ability to benefit from it.

Given the current regime, it is essential that there is a system of charging that is not financially disadvantageous to those who study subjects like medicine, engineering and laboratory-based sciences such as physics and chemistry. In addition, for subjects like physics, chemistry and engineering a significant fraction of the undergraduate cohort is enrolled on four-year courses, so further financial pressures exist.

If the current cap on £3,000 tuition fees is lifted, a subject-differentiated market could arise. An already fragile population of physics degree applicants could be driven away to cheaper options, which would not be in the national interest. In addition, increased tuition fees may become a disincentive for those intending to continue to PhD and postdoctoral research.

**What can we learn from international trends in participation, in particular are there models of higher education provision elsewhere that deliver higher levels of participation than England with comparable quality and levels of investment?**

A key issue, and one which the Institute has been concerned about for many years, is the Bologna Process for the reform of higher education in Europe, which poses potential problems for the international recognition of UK Masters level degrees. One of the key Bologna objectives is the adoption of a system essentially based on two main cycles, undergraduate (i.e. Bachelors) and graduate (i.e. Masters), which has led to the implementation in the physical sciences and engineering of a 3+2 (+3 for doctoral studies) standard higher education model across Europe.
This development has led to the UK being incompatible with other European countries in higher education, which is a major ongoing issue for subjects, like physics, that have four-year integrated Masters courses for those students that wish to undertake further study and/or follow a STEM career. European universities do not consider our Masters courses to be at a level comparable to their own.

UK students will be less able to find jobs abroad and it is possible that UK employers will also preferentially recruit the better-trained overseas candidates. Such a perturbation of the career prospects of UK STEM graduates would be regrettable to say the least but, despite the best efforts of the professional bodies, the government has refused to address the issue. There are also implications for the recruitment of overseas students, as the UK’s lack of compatibility may deter prospective postgraduate students.

In the continued absence of any sort of leadership from the government on the Bologna Process, there will be no analysis of the potential issues. By the time the problems of employability and, possibly, the reduced attractiveness of our programmes to overseas students are realised, it will be too late. It is important that our concerns relating to the Bologna Process are recognised and addressed.

**Have there been identifiable improvements in the quality of teaching in the period since 2006?**

The Institute accredits UK physics degrees on a voluntary basis\(^1\), and this programme to some extent, provides a guarantee of a high-quality minimum provision in the subject, although there is still considerable variation. The recent experience of the programme is that in general physics undergraduate degrees in the UK are in good shape, and fit for purpose.

Identifying improvements over this period is not an easy task. However, the Higher Education Academy (HEA) published its ‘Review of the Student Learning Experience in Physics’\(^2\), which provides a snapshot of the state of the student experience in UK physics departments in 2008. In relation to the question, a reassuring conclusion from the report is that: “84% of the undergraduates rate the majority of their teaching as “excellent” or “good”.

The financial reforms have led to an improvement in the teaching infrastructure of some physics departments, allowing more innovative teaching approaches to be used. Examples of teaching innovation include, the Physics Innovations CETL\(^5\), which is a joint project between the OU (leading on electronic enhancements to learning) and the University of Leicester (leading on problem-based learning).

Another concern is the impact of research assessment, where many staff with teaching interests have been made to feel second-class. Although some universities have now introduced teaching routes to chairs, the lack of an adequate funding stream and the culture of universities makes it difficult for teaching and research to be seen on an equal footing. The Institute would like to see every department, certainly every physics department, to have at least one member of staff specialising in teaching innovation, which is common practice in US state universities. Perhaps, a more practical solution would be to encourage a community of such academics which

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1 IOP Degree Accreditation; http://www.iop.org/activity/policy/Degree_Accreditation/index.html
2 Review of the Student Learning Experience in Physics, 2008; http://www.heacademy.ac.uk/assets/ps/documents/subject_reviews/physrev_final.pdf
can cater for a range of universities. Having someone active in pedagogy research available to a physics department would ensure contact with people active in frontline physics research. However, a way to pay for these academics will need to be determined, along with a way to effectively accommodate them in future research assessment exercises.

**Is the higher education system providing the quality and academic standards that students, employers and national economic needs require?**

The HEA’s report on the student experience in physics states that: “Students view the university physics curriculum as well-balanced; neither too academic nor too applied, and including appropriate links to the results of modern research.” Therefore, as far as the Institute is concerned, university physics degrees are providing the quality that students require. This point is supported by the fact that physics graduates are in high demand from employers and that they earn between £185,000-190,000 (compared with the average of £129,000) more during their career than someone with A-levels but no degree. Furthermore, it has been shown that while it costs the state approximately £21,000 to provide one student with an education to degree level, the return to the state in terms of the tax and national insurance associated with earning following qualification is approximately £93,000. Physics and chemistry are expensive subjects to teach when compared with non-laboratory intensive subjects. However, despite the additional costs, the additional taxation revenues to the Exchequer over a graduate’s working lifetime is approximately £130,000-135,000.

However, an issue for physics in recent years has been the recruitment of more overseas postdoctoral researchers and leading academic staff; the latter in particular, has been a consequence of the pressures to be internationally leading for research assessment purposes. Having departments full of world class academics, irrespective of nationality, only helps to improve the student experience. The issue of postdoctoral researchers begs the question of whether UK students are being provided with the necessary training to compete with their international counterparts for employment and postdoctoral positions, both at home and abroad. Some concern has been expressed in the past by physics PhD students that after four years of undergraduate training (i.e. MPhys/MSci degree programmes) they feel less well prepared than their counterparts from other EU countries.

In addition, one of the major expenses for physics departments is their laboratories, particularly in departments that are subject to space charging in addition to the usual costs. Employers need good experimental skills yet a number of departments are finding their laboratory space reduced. The quantity of experimental work is one area that differs quite considerably between different universities as do the quality of their laboratories and therefore the experience of the students.

In terms of the needs of employers, there needs to be a greater expansion of the linkage between undergraduate courses with employers. Currently, there is a lack of quality information available on employers’ needs; it is usually related in the form of anecdotes. The lion’s share of the challenge here lies with universities that are faced with trying to deliver graduates with both employability skills and subject specialism. A major problem is that universities have no incentive to offer subjects in the national

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interest and the current funding system (as discussed earlier) encourages subjects that are not, i.e. that are cheaper to run. If the government wants more people in STEM subjects it should ensure that universities have good financial reasons for recruiting them.

Employers themselves need to be more engaged. There is a need for careers days at schools, sixth form colleges and universities where employers can have the opportunity to explain what skills they need. Students need to know that there are real jobs in STEM subjects which do not close doors to more general careers. At the university-level, the main barriers for employers are the perceived costs of involvement in providing careers information and guidance, particularly as they would like to see a return on their time and effort. Many physics-based businesses are of the view that there are fragmented approaches from universities in using careers information. However, there is also a general perception amongst universities that most businesses only engage in providing careers advice when there is an acute shortage of potential employees.

Therefore, confidence needs to be restored within businesses that their efforts will be reflected in the effective and efficient use of materials by skilled university careers staff and teachers, and that such involvement will put them ahead of the competition for recruitment. One option that could be considered is for them to engage more closely with university departments to advertise positions and to take recommendations of potential students.

What are the key areas where quality needs to improve further? Please focus on those areas where the levers available to this Review of funding and student finance can make a difference.

There are still problems with the pre-university preparation of students in physics, particularly in practical work, problem solving and the ability to apply mathematics, which can result in the non-completion of degree courses, particularly as universities are encouraged to sweep the net wider and allow more access.

The ‘physics’ in A-level physics is not described mathematically but it most certainly is at university. One way of combating this interface problem is to have teacher fellows – schoolteachers seconded for a year or so to university departments – who are able to work with academics on this issue.

In terms of improving university teaching, funds must continue to be provided for the development and delivery of innovative teaching initiatives which will need to take account of the particular characteristics of individual subjects. This would be most efficiently developed at a national level rather than by individual universities. Using physics as an example, methods could be used to deliver laboratory-based skills in a more efficient manner.

How has the added income to institutions from the 2006 changes been used?

The additional income has provided an increase in the funding available to physics departments, particularly as the number of entries to physics undergraduate degree courses has also increased, which has improved the financial position of some physics departments. The income has been used to provide bursaries for students from low income backgrounds, investment in a range of widening participation and outreach activities, improved academic pay (which has helped physics departments
to retain and recruit with international teaching and research profiles) and investment
in teaching facilities and laboratories.

What cost pressures do institutions envisage arising in the future if they are to
continue to deliver progress in participation and quality?

Increased participation, with maintained or improved quality, will almost certainly
require maintaining or reducing the current staff-student ratio, with its attendant
increase in salary costs. There are also the obvious costs associated with increasing
the capacity of lecture rooms and laboratories. Maintaining the current participation
rate, but targeting more students from current areas of low participation will require
additional teaching resource, to give such students the additional support they are
likely to need in the early stages of their university career.

In addition, there will be constant cost-pressures on laboratory-based subjects, both
through the expense of having well-equipped teaching laboratories, and from having
them properly staffed with both teachers and with appropriate technical support.
There are also considerable costs associated with ensuring that the laboratories and
other teaching support methods are modern and fit-for-purpose, as physics
departments aim to provide students with an international standard of education to
ensure that they are fully competitive. Thus, there is a concern that the prospects for
the future financial position of teaching are less good for a number of reasons:

- The prospects for further increases in teaching income per student are not
  bright. Even if the current review of variable tuition fees recommends a raising
  of the cap it is difficult to see how in the current public expenditure climate this
  can be achieved without significant additional contributions from individuals
given that the current loans system requires cash up-front.

- At the same time there are significant upwards pressures on costs, including
  the new pay framework for university staff with its increased opportunity to
  pay key staff market supplements coupled with two recent above inflation pay
settlements. In addition, from 2010, there are prospective increases in
  employer national insurance rates and increased pension contributions to the
  Universities Superannuation Scheme.

- Finally, unless physics departments can increase their share of total new
  entrants, the number of undergraduates may decline in the face of the
  reduction in the number of 17 and 18 year olds in the population between
  2010 and 2019.

Students do remain concerned about the costs of higher education. What
evidence is there to demonstrate the impact of these concerns on decisions
made about participation in higher education and progression from higher
education into further study, research or work?

Despite widely expressed fears, it appears that the introduction of variable tuition
fees has not inhibited students from entering university, although one of the biggest
disincentives to postgraduate study is the level of debt accumulated from
undergraduate study (which is a serious issue as certain industrial sectors require
specific skills that only PhD study can provide). This impacts most on students who
come from lower socio-economic groups.
Anecdotally, we are aware of the inequality between students from different economic backgrounds at university. Students who receive no financial help from their families are doing a considerable amount of paid work during their course. In a number of cases the amount of time a student spends on paid work leads to them dropping behind in their work and in extreme cases, dropping out. It is most probable that financial circumstances played a significant part in determining the class of degree as well as the student's ability to engage in other activities, for example, sport or drama.

In engineering and physical sciences, four-year first degrees are now the norm for those who are taking the subject seriously – financial constraints are certainly a factor in some able students choosing to do the BSc, and not take-up the extra year which means another year of debt accumulation. Furthermore, PhD courses are now drifting towards four years and, while these may not cause students to accrue further debt, they do not allow loans to be paid off either. There is the prospect of STEM PhD graduates emerging at the age of 26 or 27 with no money and substantial debt.

One way of countering these effects is for the students to be better informed about career choices. Market research undertaken by the Institute has shown that it is a commonly held view that a physics-based educational trajectory is highly restrictive in career terms relative to a subject like English, whereas, of course, the opposite is true. In addition, an Institute survey of careers advisors in schools has shown that they are rarely scientists and the vast majority of them do not feel competent in offering advice about careers from physics.

This problem will not be solved by the production of more materials; there are already many excellent resources, including web-based material such as Future Morph. Three courses of action might yield dividends. First, careers information could be implicitly incorporated into lessons by the development of resources to support teaching that include real people working in real applications; the Institute is producing resources along these lines.

Second, there is an urgent need for an independent study of career prospects from various degree subjects. The studies to date have tended to be based on the Labour Force Survey, which is reliable but does not have a large enough database, or first destination data, which are highly unreliable. The government has access to data via the Inland Revenue, the National Census and the Student Loan Company. It could, with relatively little effort, provide a vast, reliable data set.

For the future, as already mentioned, the implications of the Bologna Process for the reform of higher education in Europe need to be addressed. In response to the implementation in the physical sciences and engineering of a standard higher education model across Europe, some UK physics departments are considering whether they should introduce a 3+2 integrated Masters course. A key issue here concerns student finance, as currently, stand-alone Masters are not eligible for student loans. Students, therefore, must pay upfront fees, which is a deterrent due to the debt accumulated from undergraduate study.

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5 Future Morph; http://www.futuremorph.org/
The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 36,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.