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30th November 2015

Re: Consultation on National Skills Strategy

To Whom It May Concern:

The Institute of Physics in Ireland welcomes the opportunity to submit suggestions for the development of new national skills strategy.

The Institute of Physics in Ireland is a scientific membership organisation devoted to increasing the understanding and application of physics in Northern Ireland and the Republic of Ireland. It has over 2000 members, and is part of the Institute of Physics (IOP).

The Institute of Physics has a world-wide membership of over 50,000 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.

This submission was prepared in consultation with the IOP in Ireland's governing committee, and with input from members of the Institute working in education at all levels and in industry. The attached document highlights key issues of concern to the Institute.

If you require any further information or clarification, please do not hesitate to contact the Institute at the above address.

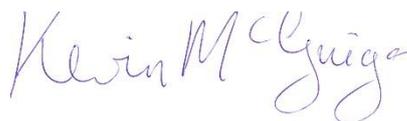
Yours sincerely



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National Skills Strategy Consultation

Response from the Institute of Physics in Ireland

30th November 2015

The Institute of Physics (IOP) welcomes the opportunity to respond to the Department of Education and Skills request for submissions on a new national skills strategy for the period 2015-2025.

This response is confined to issues around the teaching and learning of physics and related skills at all levels.

Skills for the Irish economy

Across Ireland, physics and physics-trained people underpin a wide range of technologies and sectors, from medical technologies to ICT and web services, and many areas of finance. These physics-based sectors contribute more than €7bn annually to the Irish economy – 5.9% of total economic output – and support more than 86,000 highly productive jobs.¹ The robustness of this sector has played a significant role as Ireland emerges from the economic crash of 2008. Hence it is of critical importance to secure the pipeline of well-trained people with expertise in physics. It is of note that skills shortages are arising in these areas as indicated in the consultation document.

School level

Over the past decade and more there has been a sustained effort at government level and from a variety of agencies to increase awareness of the value of science and the wide variety of interesting careers that flow from studying sciences – e.g. the work of Science Foundation Ireland and Smart Futures.² The IOP has put significant resources into providing support for the teaching of physics through its teacher networks and also in the provision of accurate and engaging careers materials³, and has noted a significant increase in the demand for such material over the past couple of years.

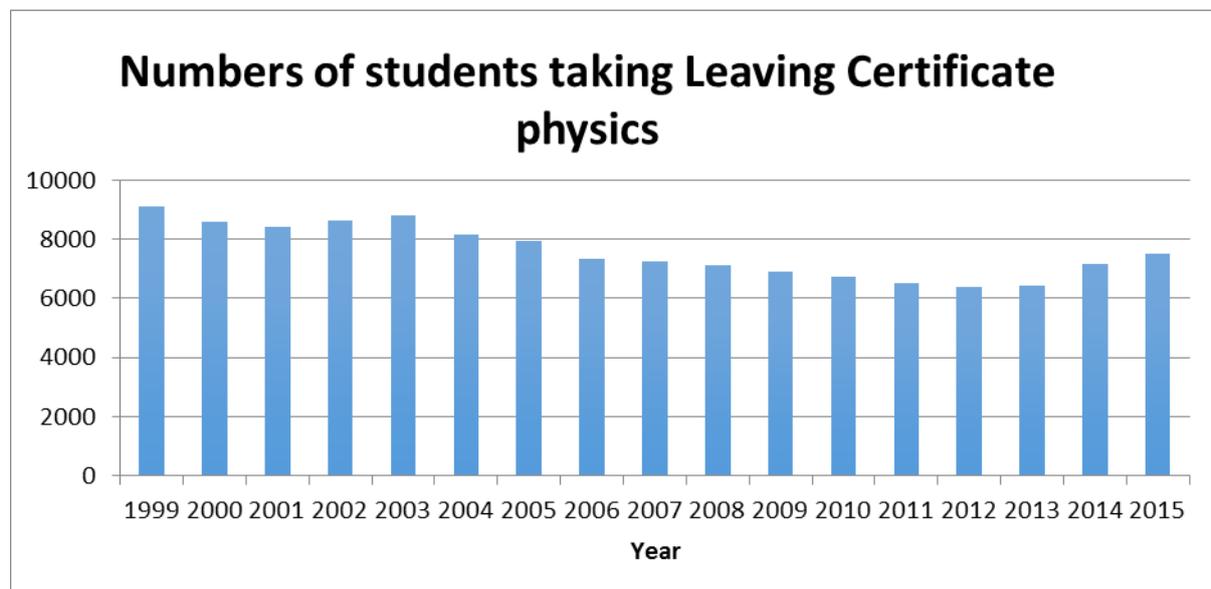


Figure 1 Numbers of students taking Leaving Certificate physics annually

However, while there has been a welcome rise in the numbers taking physics at Leaving Certificate level (up 18% in 2015 from 2012) the overall numbers taking the subject are still low, representing

just 13% of the Leaving Certificate cohort with girls making up only a quarter of physics students. This compares with 58% taking biology, which has a female cohort of 60%.⁴

Gender issues at school

The Institute has produced a range of reports that look into the factors which influence the female uptake of physics.⁵

This research has found:

- Students' interest in science declines as they progress through school, and the decline appears to become steeper after age 14, particularly for girls, and particularly in physics;
- Girls, more than boys, experience a difference between their personal goals for learning and the learning objectives of the physics curriculum. As a consequence, they are less inclined to opt for physics, even if they achieve high grades and enjoy the subject.

The key influences on students' attitudes to physics have been identified as:

- Self-concept – that is, students' sense of themselves in relation to the subject, the value they place on the subject and their willingness to engage with it;
- Views of physics – that is, how students experience physics at school;
- Teacher-student relationships – that is, how personally supportive students find their physics teacher.

Following from this significant body of research, the IOP has recently published a guide to good practice in countering gender stereotyping in schools.⁶ It should be possible to learn from this and implement strategies in school to support the uptake of girls and physics.

Subject availability at school

Nearly one in four of all second level schools do not offer physics at Leaving Certificate⁷, thus denying a substantial proportion of students the chance to further their experience and interest in and knowledge of physics. By missing out on this opportunity, many students will not be able to pursue highly valuable careers in this area.

In order to achieve a sustainable and long-term increase in the numbers of under 18 year olds taking physics, significant support must be given to schools who are under pressure to drop physics altogether. In particular, consideration should be given by the Department of Education to relaxing the conditions with regards to teacher allocation in schools where there is a danger that the subject will be dropped at Leaving Certificate level. For example, physics teachers could be regarded as "ex quota", meaning they would be above the official staffing allocation for the school based on its enrolments. This would allow schools to continue to offer the subject even if class sizes are small.

The IOP has worked with the British government in English schools through the Stimulating Physics Network (SPN), providing significant bespoke support to the career and professional development (CPD) of teachers of physics. In the IOP partner schools⁸:

- The increase in the number of pupils progressing from Key Stage 4 to AS-level physics has been more than double the national rate
- The participation of girls in post-16 physics has doubled compared to the national average;
- In 2012, 82% of pupils achieved grades A*-C in physics GCSE, compared with 69% nationwide.

Surveys indicate that around 60% of Junior Science teachers in Ireland have a background in biology rather than physics; hence it is essential to give teachers the training and tools to increase their confidence in teaching physics⁹. Specialist physics teachers have been shown to improve progression rates of students in physics by the IOP's own internal analysis of its SPN programme and from other research.¹⁰ In addition, specialist physics teachers have also been found to improve student achievement.¹¹

The Institute of Physics in Ireland employ two part-time teacher network co-ordinators to work closely with the Professional Development Service for Teachers to deliver workshops, talks and conferences across Ireland on cutting edge physics and its delivery in the classroom. However, it is clear from the work of the SPN in England how much more could be achieved with more resources in this area and what could be done with an analogous programme in Ireland.

Physics at third and fourth level

As noted in the consultation document, a new strategy for science, technology and innovation is due to be published shortly. The IOP has previously submitted detailed comments¹² on the suggested strategy and looks forward to its release. It is worth noting though that the development of skills at this level is absolutely essential for Ireland's economic recovery. In the context of this consultation, two areas should be highlighted - student numbers and research funding.

The numbers graduating in physics at undergraduate and postgraduate level have increased by over 58% in the past five years¹³. While this increase is very welcome it has coincided with a period of severe financial restrictions in the colleges which has impacted on recruitment of staff. This has likely resulted in a much increased student-staff ratio¹⁴, a matter of considerable concern given the practical nature of physics education.

Alongside this increase in student numbers has been a decrease in the amount of funding available for research, particularly in relation to basic research which is the life blood of physics departments and an essential element in the education of both undergraduates and postgraduates.

A cornerstone of the Irish third level education system is that degree programmes are taught by academics who are research-active. Their research informs their teaching and students gain knowledge at the very cutting-edge of science. In many cases undergraduate physics students undertake original research projects in their final year as part of the research activity of their department. This type of education is the norm not just in Ireland but across all highly developed economies.

However, if academics who are already in position are not able to access research funding they will either become research inactive or more likely will leave the country in order to work where they will be properly supported¹⁵. This will lead to a significant loss of local talent, and inevitably degree courses will suffer, with the knock-on effect of decreasing numbers taking physics.

When research groups are splintered it is very difficult to reinstate them even if more research funding becomes available at a later date. A stop-start approach to funding is fatal for a research community which needs stability, with deleterious consequences for long-term economic development.

The IOP strongly recommends that the government commits to a sustained programme of investment in research. This is essential to allow for the development of a workforce possessing the physics-based skills which are vital to the Irish economy.

References:

1. Institute of Physics. *The importance of physics to the Irish economy*, 2012: http://www.iopireland.org/publications/iopi/page_59020.html
2. Smart Futures: <http://www.smartfutures.ie/>
3. Institute of Physics in Ireland Careers: <http://www.iopireland.org/careers/index.html>
4. State Examination Commission data: www.examinations.ie
5. Institute of Physics; reports on gender balance, 2006-2015: http://www.iop.org/education/teacher/support/girls_physics/reports-and-research/page_63816.html
6. Institute of Physics. *Opening Doors: A guide to good practice in countering gender stereotyping in schools*, 2015: http://www.iop.org/publications/iop/2015/page_66430.html
7. Central Statistics Office data: http://www.cso.ie/px/pxeirestat/Statire/SelectVarVal/Define.asp?maintable=EDA86&ProductID=DB_ED&PLanguage=0
8. Institute of Physics. *The evaluation of the stimulating physics network programme*, 2015: <http://www.stimulatingphysics.org/pdfs/Institute-of-Physics-SPN-Evaluation-interim-report-2015.pdf>
9. Association of Secondary Teachers in Ireland. *Junior cycle science and the impact of budget cutbacks*, 2010: http://www.asti.ie/fileadmin/user_upload/Documents/Science.pdf
10. Alan Smithers and Pamela Robinson. *Physics in Schools IV – Supply and Retention of Teachers*, 2008: <http://www.gatsby.org.uk/uploads/education/reports/pdf/16-physics-in-schools-supply-and-retention-of-teachers-june-2008.pdf>
11. Successful science. An evaluation of science education in England, 2007-2010. Ofsted. 2011. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/413802/Successful_science.pdf
12. Institute of Physics in Ireland. *Response to the consultation on the successor strategy for science, technology and innovation*, 2015: http://www.iopireland.org/policy/submissions/file_65353.pdf
13. Higher Education Authority data: <http://www.hea.ie/en/statistics/overview>
14. The IOP is currently undertaking a review of physics departments in Ireland which will look at the situation in a number of areas, including numbers of students and staff, levels of research income, and costs. This will be published in early 2016.
15. OECD. *Policy Briefing: The Global Competition for Talent*, February 2009: <http://www.oecdbookshop.org/get-it.php?REF=5KSNZ0K5M27G&TYPE=browse>