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Minister Richard Bruton, TD  
Department of Education and Skills  
Marlborough Street  
Dublin 1

7 March 2018

Dear Minister

The Institute of Physics (IOP) is a scientific society working to advance physics for the benefit of all.

We are writing to express our concern about the numbers of qualified physics teachers in Ireland. We very much welcome the STEM Education Implementation Plan 2017-2019 and, based on it, we would like to offer some suggestions on initial physics teacher education.

IOP membership comprises current physics teachers, academics, and those who work in physics-based industries. The recommendations outlined in this document reflect the diversity and experience of our community.

The Institute provides considerable support for the teaching and learning of physics in Ireland. Much of this work is done through the Professional Development Service for Teachers and in collaboration with other organisations such as the Irish Science Teachers Association. The Institute has also worked closely with NCCA on curriculum development.

With this background we would very much welcome the opportunity to work with the Department of Education & Skills and other agencies to grow the number of physics teachers in Ireland and would welcome the opportunity to discuss this further with you.

Yours sincerely



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Prof. David Riley  
Chair  
Institute of Physics in Ireland

## **Recommendations from the Institute of Physics for Increasing the Number of Physics Teachers in Ireland**

### **Background**

Physics has a critical role to play in Ireland, with physics-based industries providing over 287,000 jobs and €38bn annually to the Irish economy.<sup>1</sup> This is reflected in the world-class research and innovation carried out in Ireland and various government initiatives and policies that support it.<sup>2</sup> It is a gateway subject to many other areas such as engineering. To sustain these efforts and ensure they positively impact Irish society, government policies recognise the need to grow the number and diversity of those studying physics.<sup>3</sup> This in turn requires a steady-stream of motivated, high-quality, physicists to teach those students.

As the representative body of physicists in Ireland, we are concerned with the numbers of physics students in second level, gender imbalance and the low numbers of new physics teachers entering the profession. These problems are inter-related and the relevant statistics as outlined in Appendix 1 are alarming.

For physics to continue to play a pivotal role in Irish society, we need more physics teachers. This document outlines our suggestions to grow the number of physics teachers in both the short and medium term.

### **1. Strategies to address the short-term supply of physics teachers**

1.1 Learning from our neighbours. The situation in Ireland is not unique with many countries seeking to address declining number of physics teachers. In England, physics teacher recruitment had hovered at about 400 each year from 1970 reaching an all-time low of 200 in 2001, while entries for physics A-level had declined by 40 % in the 20 years to 2006. However, following significant Government intervention, in partnership with the Institute of Physics both trends have reversed in England with physics teacher recruitment figures reaching an all-time high of 920 in 2012 and an average annual recruitment over the last five years of 750.

These successful interventions encompassed three areas:

#### **Marketing**

The government agency charged with teacher recruitment was given a substantial marketing budget and adverts appeared on prime-time television promoting teaching as a profession. Teacher recruitment events were organised in major cities and telephone helplines were set up. The IOP developed its own programme of visits to university physics departments and extensive email campaigns, which persist to this day – with 430 prospective physics teachers personally contacted over the last academic year alone.

#### **Financial incentives**

A variety of financial incentives were offered to student physics teachers. The IOP pioneered a government-funded physics scholarship scheme. This currently disburses £28,000 per head to 140 physics trainees.

We propose a partnership between the IOP and the Irish Dept. of Education & Skills could result in similar successes.

1.2 State funding bodies (e.g. Irish Research Council) provide significant funding to support the education of PhD students in physics. We believe these state funding agencies should offer top-up funding for any of their current or recent scholars who choose to enrol in a physics teacher education course.<sup>4</sup>

1.3 Ireland's informal learning sector is world-class (e.g. BT Young Scientist Exhibition). More could be done to use this to celebrate teaching and teachers, where appropriate. Current media attention on teaching as a career is negative and we believe more needs to be done to promote the transformative effect good teachers can have on young people. State agencies that fund informal initiatives could incorporate this aim into their structures.<sup>5</sup>

1.4 Undergraduates who take part in formal or informal teaching experiences are more positively disposed to teaching as a career. We believe universities should offer and encourage physics students in this area (e.g. modules could be offered on co-teaching with local schools or volunteering with informal learning initiatives).<sup>6</sup> A recent IOP survey of final-year university physics students showed only 5% of them had given serious consideration to teaching as a career. We believe that to increase this value, more needs to be done of offer genuine teaching experiences to physics undergraduates.

## **2. Registration requirements and population data**

2.1 We welcome the Teaching Council's assertion that prospective student teachers must meet high standards to register as a teacher. We agree that it is inappropriate for 'out of field' experts to be teaching physics. That said, we would welcome a review of the Teaching Council's requirements to register as a physics (and Junior Cycle science) teacher. A better balance needs to be found between content knowledge, pedagogical content knowledge, and previous experience. The IOP would be happy to work with the Teaching Council on this.<sup>7</sup>

It is also essential to enhance the physics skills of Junior Science teachers, the majority of whom have a biology background. As noted in the 2016 report STEM Education in the Irish Education System<sup>8</sup> the imbalance in physics teacher numbers leads to the situation that the majority of students do not encounter a specialist physics teacher at Junior Cycle level which contributes to the lack of popularity of the subject at Leaving Certificate level. Urgent attention needs to be given to professional development of existing teachers in this area.

2.2 Entry routes to the profession are not clear to prospective student teachers. We frequently speak to students who are unsure if their degree would allow them register as a physics teacher. The Teaching Council's requirements are too granular and module-focused. This unnecessarily excludes groups of people who may be excellent physics teachers. As an example, a student could graduate with an engineering degree, then a PhD in physics, and not meet the registration requirements to be a physics teacher. Associated with this, universities and private providers need to simplify applications to their post-graduate teaching degrees.

The vast majority of new physics teachers in Ireland are graduating from 'concurrent' undergraduate degrees where students combine their primary science degree with education modules and placement. Universities should be supported in promoting and growing these degrees.

2.3 Population data for physics teachers, those who teach physics, and student physics teachers, is very poor, difficult to access, and distributed across various state agencies. We believe that if we are to address the shortage of physics teachers, we need to set targets and they must be based on solid data (administered by one agency).<sup>9</sup>

### **3. Perceptions of teaching within the physics community**

3.1 For most physicists, teaching physics is not seen as *doing* physics. We recognise that our community needs to challenge that perspective and value physics teachers as integral to our community. We will endeavour to strengthen connections between physicists who teach and those based at universities, in industry, and in public service. We believe the SFI Discover scheme to be an appropriate way to support this work.

### **4. Working terms and conditions for physics teachers**

4.1 Prospective physics teachers look to the pay and conditions of people in the teaching profession. When compared with other options open to them at graduation, take-home pay, cost of further education, and working conditions do not make teaching an attractive profession. We believe huge efforts are required by government if they wish physics graduates to see teaching as a financially viable, or indeed valued, profession. We call for an end to pay inequality and short-term, few-hour, contracts offered to many recently qualified teachers.

4.2 Physics is an experimental science. As such, schools require facilities such as laboratories, equipment and technical staff to effectively teach it. These facilities are currently not available in many Irish schools and this limits the take-up of the subject as well as the availability of the subject in many schools.

4.3 We welcome the reformed Junior Cycle Science specification and, in particular the emphasis it places on *doing* science in the classroom. It is our hope that this research-informed reform is extended to the senior cycle, where physics teachers and their students can do science in their classrooms and not just read about it.

4.4 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.

### **Conclusion**

We recognise the issues raised in this document are complex. We call on all stakeholders to work with us to agree a target-based, research-informed, plan that will grow and sustain the number of physics teachers in Ireland.

## Appendix:

Number of new physics teachers registering in 2017	41
<i>Imbalance in physics teachers compared with other science teachers</i>	
Number of registered physics teachers	1259
Number of registered chemistry teachers	2376
Number of registered biology teachers	3878
Percentage of students taking Leaving Certificate physics in 2017	13%
Percentage of students taking Leaving Certificate physics in 2017 who are female	26%
Percentage of schools <b>not</b> offering Leaving Certificate physics in 2017	22%

## Routes to physics teaching

### Professional Masters in Education

Following the Sahlberg Report, there have been significant changes in initial teacher education. These include the introduction of a two-year Professional Masters in Education (PME) following a Bachelors degree. PME fees are significant at approximately €11,000 in total over two years. In the current year there were just six physics teacher graduates out of a cohort of approximately 950. A recent IOP survey of 100 final year undergraduate physics students noted that only 5 of them are considering applying for the PME on graduation.

### Concurrent Science & Education Undergraduate degree

Approximately 35 students graduated from concurrent physics and education undergraduate programmes in 2017. The emergence of these programmes has contributed significantly to the number of newly qualified teachers with physics as a subject, While the current situation can certainly be described as a crisis, without the concurrent programmes the situation would be catastrophic.

## References:

1. [The role of physics in supporting economic growth and productivity in Ireland](#)
2. [Science Foundation Ireland 2016 Annual Report](#)
3. [STEM Education Implementation Plan 2017-2019](#)
4. This objective is in-line with [Innovation2020](#) key pillar of ‘education for innovation’, ensuring a pipeline of talent and strong connections between all elements of the STEM education & research system. It is also consistent with [SFI’s Agenda2020](#), Goal C (To have the most engaged and scientifically informed public.)
5. This would link with pillar 3 of The STEM Education Implementation Plan, specifically Objective 1.3; Provide opportunities for all learners to participate in STEM education through informal,

cocurricular and extra-curricular programmes. The SFI Discover call would be an excellent platform to fund associated activities.

6. This has been successfully done elsewhere (see 'A physics department's role in preparing physics teachers: The Colorado learning assistant model' American Journal of Physics 78, 1218 (2010))
7. This is in-line with Pillar 2 of The STEM Education Implementation Plan specifically, Objective 1.1.1 'The Teaching Council will take account of the STEM Education Policy Statement in (a) its review of the impact of the reconfigured ITE programmes and (b) its review of the criteria and guidelines for ITE programme providers'. It also aligns with recent [comments from Minister Bruton](#) given on Jan 26th to IPPN.
8. [STEM Education in the Irish School System 2016](#)
9. This is consistent with Pillar 2. Objective 2.2 (Ensure the ongoing provision of teachers qualified to teach STEM specific subjects at post-primary.) & 2.2.1 (Baseline data collection and analysis will be undertaken in conjunction with relevant bodies including schools, the Teaching Council, the HEA and the HEIs to inform policy on the supply of STEM teachers, as well as the current employment situations of Newly Qualified Teachers in STEM subjects.)