

IOP Education: Policy and Projects

FOR
SCHOOLS
AND
COLLEGES



The Institute of Physics

The Institute of Physics is a leading scientific society. We are a charitable organisation with a worldwide membership of more than 50,000, working together to advance physics education, research and application.

We engage with policymakers and the general public to develop awareness and understanding of the value of physics and, through IOP Publishing, we are world leaders in professional scientific communications.

Join us

Our affiliation scheme is the simplest way of building a link between schools and colleges and the Institute. For a small annual fee affiliated schools and colleges benefit from:

- the IOP publications *Physics World*, *Classroom Physics* and *Physics Education*
- teaching resources, careers material and posters produced by the Institute and other organisations
- discounts on Institute conferences and teacher CPD events
- information and access to local Institute branch activities.

Becoming an individual member takes your relationship to another level. You can then become more involved with the governance of the Institute and access other benefits, including careers advice and chartered status. There are three grades of membership: associate, member and fellow.

To find out more about the affiliation scheme, visit www.iop.org/affiliation.

For individual membership, visit www.iop.org/membership.

Contact us

For more information about the IOP Education team, visit www.iop.org/education, send an e-mail to education@iop.org or call us on **020 7470 4800**.

Message from Head of Education



The Institute's overriding educational aim is to ensure that all young people get an excellent experience of physics up to (and beyond) the point at which they make a choice. If all students have such a learning experience, then those who have the interest and aptitude to continue with physics are more likely to do so, and everyone will have learned to think and act in ways that will be useful to them whatever they decide to do.

To achieve this aim, we work with teachers, teacher educators, CPD providers, university departments and policymakers. Our activities with these groups are varied, interlinked and based on evidence. They have been devised to improve recruitment, retention, professional development, diversity, the curriculum and assessment.

The quality, reach and impact of those activities rely on us building a strong community of people interested and involved in physics education – above all, teachers. We welcome your participation as a user, a provider or a developer. You can link with us through the School Affiliation Scheme, our CPD networks, our online communities or the Education Forum.

This brochure provides more detail about our activities, and how to get involved and take advantage of them. For more information, please visit www.iop.org/education, get in touch at education@iop.org or get stuck in at talkphysics.org.

Charles Tracy
Head of Education

Teacher recruitment and retention

The Institute seeks to reduce the national shortage of physics teachers in England. We raise awareness of a career in teaching to students, graduates and career changers, and support new entrants into the profession.

Teacher recruitment

Research suggests that the numbers of 16–19 pupils studying physics depends on having a workforce of specialist physics teachers. Currently only 60% of the workforce could be deemed to be specialists, so teacher recruitment is a top priority. In addition, there is an approximate 40% attrition rate among new teachers in their first five years of teaching.

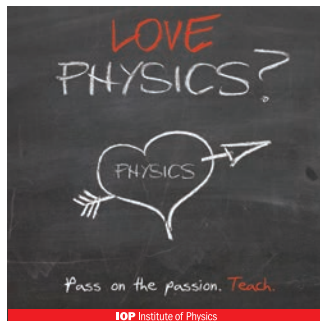
Taking these factors together, we estimate there is a need to recruit 1000 physics teachers per year for the next 15 years to have a full cadre of specialist teachers.

Our work concentrates on improving the numbers and quality of those recruited, and improving the retention rate. Having a higher number of specialist teachers who also possess better teaching skills will enhance pupils' experience and attainment, which will also aid the proportion of girls taking physics, according to research.

Recruitment depends crucially on marketing teaching to both physics undergraduates, and others such as engineers. Our Marketing Initiative for Teacher Recruitment (MITRE) consists of marketing at university campus-based events, as well as direct mailings to our stakeholders, and the use of social media.

The government-funded IOP Teacher Training Scholarships have in recent years acted as a significant marketing tool, and the project has subsumed a significant fraction of the MITRE activity. Scholarships are also aimed at increasing the quality of applicants and thus raising the status of the teaching profession, which international comparisons suggest may increase the numbers recruited in the longer term.

For more information about our teacher recruitment activities, please send an e-mail to teach@iop.org.



Teacher retention

Teacher retention is aided by a number of programmes. The Learning to Teach Physics programme supports early-career teachers (ECTs) with resources, and fosters a sense of community through blogs and e-shots. It aims to reach ECTs in all of the sciences, as many non-specialists will find themselves teaching physics.

In addition we provide two further levels of support for physics specialists. First we provide mentoring support to physics ECTs for the first three years of their career through the Stimulating Physics Network (SPN) programme (see p6).

Second, we not only mentor IOP scholars, but also provide an additional programme of visits and masterclasses to engage those who need challenge and stimulation as opposed to support and encouragement during their training.

For more information visit www.iop.org/education/ltp.



Teacher professional development

The Institute runs several important teacher networks: the Stimulating Physics Networks in England and the Physics Teacher Network throughout the UK and Ireland.

Stimulating Physics Network

The Stimulating Physics Network (SPN) is an important national programme supporting the teaching and learning of physics in schools across England; the current contract ensures that the SPN will continue operating for at least another two years, which is an endorsement of the success and impact that has been achieved to date.

The aim of the SPN is to improve pupils' experience of physics at Key Stage 3 and 4, as measured by an increase in the number of pupils choosing to study A-level physics, particularly girls. We work with schools where these progression rates are historically low, or non-existent; typically, these are also schools with high indices of pupil deprivation.

The SPN is based around a team of 39 Teaching and Learning Coaches (TLCs) who are all highly experienced and successful physics teachers; each TLC provides a bespoke programme of teacher continuing professional development (CPD) and pupil engagement activities for 12 "SPN Partner Schools" for a period of two years, at no cost to the school. Physics teachers in SPN Partner Schools without a specialist background in physics (i.e. a degree or ITT qualification in physics) can benefit from a four-day residential Summer School – again, at no cost to the teacher or school. The project also provides personalised mentoring for more than 400 early-career physics teachers each year, which lasts from the initial training year to the second year as a qualified teacher.



In the next phase of the programme, the SPN will be forging links with schools that are hubs of school-to-school support, particularly Teaching Schools and the Science Learning Partnerships (SLPs), which are managed by Myscience. TLCs will work with these "SPN Link Schools" and will offer free, open CPD workshops for teachers in the associated schools and the local area. These activities will complement and support the Link Schools and their wider objectives.

To find out more about the SPN programme, including how to become an SPN Partner School, visit www.stimulatingphysics.org or e-mail spn@iop.org.

Physics Teacher Network

The Teacher Network offers free CPD, support and advice to teachers of physics. The Network is made up of around 50 Physics Network Co-ordinators (PNCs), located throughout the UK and Ireland. These co-ordinators are all very experienced teachers, or former teachers, who act as consultants to IOP and work to support local teachers on our behalf. This tends to be in the form of twilight sessions or day meetings.

To find your local PNC and for a list of CPD workshops, visit www.iop.org/network.

The Institute supports a number of one-day teacher CPD conferences across the country. These include the Rugby meeting, the Stirling meeting, the Brecon meeting and the Frontiers in Physics meeting in Ireland.



Diversity in schools

The under-representation of girls in physics beyond the age of 16 is a serious issue for the UK and in particular for the STEM community, because A-level physics is a gateway qualification to a variety of careers that make a substantial contribution to the financial and intellectual wealth of the country.

Girls in physics

The proportion of girls among students continuing with physics post-16 has remained at around 20% for many years. The Institute has been working in the area of girls and physics for more than 10 years. The initial focus was on a research review and advice for teachers – *Girls in the Physics Classroom: Review of Research on Girls' Participation in Physics* and *A Teachers' Guide for Action*. These “red books” have been widely used and quoted by others, but work with individual teachers using action research has had limited impact. For success to extend beyond individual teachers, the work needs to be part of a long-term programme involving science departments and whole schools.

In 2012 and 2013 the Institute produced two reports using the National Pupil Database to explore progression to A-level. *It's Different for Girls: The influence of schools* (October 2012) looked at how the proportions of girls and boys progressing to physics A-level varies between different types of English school, using data on students who did A-levels in 2011. The findings included the fact that 49% of maintained co-ed schools sent no girls on to take A-level physics in 2011, but only 12% sent on no boys. The variation in the experience of physics between school types is not gender neutral, it's different for girls.

Closing Doors (December 2013) looked at progression to a range of gendered A-level subjects, including physics, from co-educational establishments. We found a strong correlation between the relative progression of girls to A-level physics and the degree to which a school counters the trend towards gendered participation. The conclusion is that schools are closing doors to both male and female students by apparently failing to challenge external factors that are causing many students to limit their choice of A-levels.

The reports were intended to act as a catalyst for change by bringing the issues to the attention of school leaders, policymakers and parents. Findings were widely reported in the press and have influenced government policy in this area. The Institute has now received external funding for several interrelated projects exploring what will have the most impact in this area. These are: *Improving Gender Balance* (IGB) – as part of the refunding of the *Stimulating Physics Network* (2014–2016), which is DfE funded; the *Drayson Girls into Physics Pilot Programme* (2014–2016), funded by the Drayson Foundation; and *Opening Doors* (2014–2015), funded by the Government Equalities Office.

For more information visit www.iop.org/girlsinphysics.

Widening participation

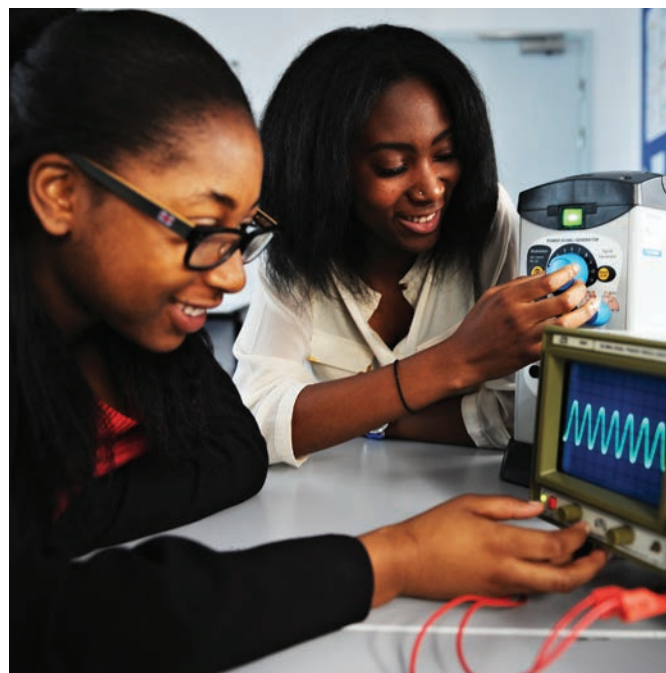
The Institute has run small-scale projects with schools around ethnicity and socioeconomic status. The report, *Raising Aspirations in Physics: a review of research into barriers to STEM participation for students from disadvantaged backgrounds*, provides a sound basis on which to proceed with future projects around widening participation in physics.

Previous research found that students from certain Asian backgrounds were very well represented within higher education (HE) more generally, but were significantly under-represented in physics, despite being qualified to take the subject. The research found that the main reasons for this were ignorance of what physics is and what career options were available to those that studied physics. The influence of family was also a strong factor in many cases. *Opportunities from Physics: interventions in a multi-ethnic school to increase post-16 participation* reports on a project focused on a small group of year 9 pupils progressing to GCSE and their parents.

Raising Aspirations in Physics: a school case study reports on a three-year pilot project based in a school in the North East of England, which sought to investigate the barriers that prevent young people from lower socioeconomic backgrounds choosing to take physics post-16.

We hope to do more work in this area in the future.

For more information visit www.iop.org/diversity.



Education policy and development

We work in policy to try to influence decision makers and improve the educational environment across the UK and Ireland. In order to have influence, we engage in policy consultations and contribute to the debate. Many of our responses to consultations and position papers are developed in conjunction with our SCORE partners.

In recent years we have had some major successes from our policy work, including:

- the introduction of a separate target for physics teacher recruitment, which led to 300 extra teachers being recruited in 2011 and 2012;
- the IOP Teacher Training Scholarships programme, which grew from a consultation response and a pilot project, through to a successful programme now in its fourth year;
- our girls in physics projects, which included two data reports, input to the Perkins review and led to raising the issue up the agenda;
- input to the national curriculum – specifically improving the statements relating to energy.

We have succeeded in building and maintaining a reputation for providing high-quality evidence and analysis. This has been made possible by the links we have with the physics-education community. We are able to convene groups of specialists from all spheres of physics and education to contribute to specific tasks – such as sitting on committees, attending seminars, responding to consultations, running pilot projects, producing reports and providing evidence. One such group is the Education Forum.

Education Forum

The Education Forum gets together once or twice a year to discuss issues of policy. It also has a virtual presence on talkphysics.org, which allows its members to discuss responses to specific consultations. The group is open to members of the Institute and to the named teacher within an affiliated school.

You can find out more at www.iop.org/educationforum. If you would like to join the Education Forum, please e-mail education@iop.org.

PIPER project: Practical Implications of Physics Education Research

The PIPER project has been set up to find ways of identifying, translating and disseminating the important messages from research into the teaching and learning of physics. We are developing a data tool that will help teachers find useful physics education research and explore the messages it has for practice. We are currently identifying pieces of research and putting them into a digestible format to populate the database.

To find out more visit www.iop.org/piper.

SCORE

SCORE is a policy collective of five organisations interested in science education: the Association of Science Education, the Royal Society of Chemistry, the Society of Biology, the Royal Society and ourselves. We work with our SCORE partners in many areas of policy. We usually submit joint responses to consultations on the basis that the combined agreed position will represent a larger community and carry more weight.

You can find out more about SCORE's work on the SCORE website and see previous consultation responses at www.score-education.org/news/consultation-responses.

If you would like further information about our policy development work, e-mail education@iop.org.



Supporting physics in the classroom

We have a strong history of developing high-quality resources to support pre-19 physics education. Teachers know they can trust us for producing reliable and engaging material written by physics education experts.

Resources and curriculum support

Our Supporting Physics Teaching (SPT) website provides teachers with access to activities and material that covers the entire physics curriculum for 11–16 year olds. This, along with the Teaching Advanced Physics (TAP) website to support teaching physics to 16–19 year olds, and the *Practical Physics* website, which provides practical physics activities for 11–19 year olds, gives a comprehensive coverage of support for teachers seeking help in developing lessons on almost any aspect of the pre-19 physics curriculum.

We have collaborated with various partner organisations to develop supplementary curriculum-linked resources in particular areas including astronomy, medical physics and radioactivity.

As well as curriculum-linked resources, we now have a suite of enrichment activities – *Ashfield Music Festival*, *Thinking on your feet: football and physics* and *Exoplanets* – which teachers can use to increase student enthusiasm for physics outside of the classroom.

Many of our resources form the basis for teacher CPD sessions organised through the Stimulating Physics Networks or the Physics Teacher Network (see pages 6 and 7 for more information).

Looking to the future, with the recent changes occurring to the GCSE and post-16 curricula, we will be regularly reviewing and updating our core set of physics-education resources. The SPT website will extend its scope to providing primary resources for science co-ordinators, and it is hoped that all the resources – SPT, TAP, Practical Physics, plus much more – will one day be an integral part of the Institute's evidence-informed Physics Architecture Project.

SPT can be accessed via **supportingphysicsteaching.net**.

The TAP website is available at **tap.iop.org**.

Practical Physics can be accessed at **www.practicalphysics.org**.

For more information about all of our resources, e-mail **education@iop.org** to request a free copy of our resources brochure or visit **www.iop.org/teachers**.

School grants scheme

The Science and Technology Facilities Council, the Institute of Engineering and Technology and the Institute of Physics run a small grants scheme designed specifically for schools and colleges.

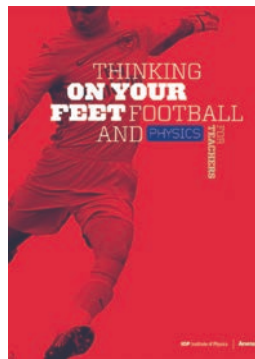
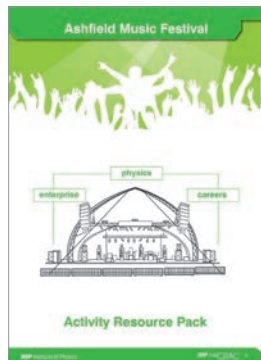
The aim of the scheme is to provide schools with grants of up to £500 for projects or events linked to the teaching or promotion of physics or engineering.

Projects linked to astronomy, space and particle physics are particularly encouraged, as are those relating to engineering in areas such as energy, transport, information and communications, design and production, and the built environment.

For more information and to apply for a grant go to www.iop.org/schoolgrants.

Communities

As well as the Stimulating Physics Network and the Physics Teacher Network, the Institute has a number of virtual communities, where teachers can get help and advice on a wide range of topics and access teaching resources. These include **talkphysics.org**, which has more than 9000 members, as well as e-mail discussion lists, which can be accessed via www.iop.org/education. Our Twitter feed **@TakeOnPhysics** is also used to share events, ideas and resources.



Supporting students

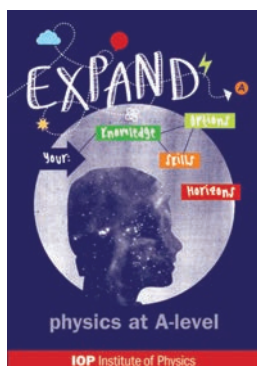
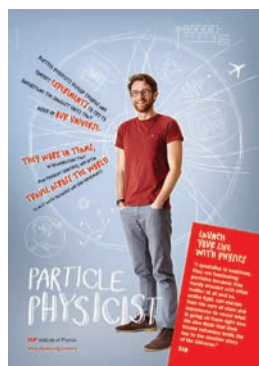
We produce and disseminate pre-19 careers resources and activities for students and teachers to encourage the uptake of physics.

Production of careers resources for the 11–19 age group

The education department works in collaboration with other professional engineering and sister scientific organisations on careers programmes such as Tomorrow's Engineers (tomorrowsengineers.org.uk). The department's own suite of careers resources supports teachers, advisors and university physics departments in providing information to young people. The resources are reviewed regularly to ensure that they are high quality, targeted, up to date and reflect best practice. They include posters and leaflets for students on choosing physics at A-level/Higher and at university.

Online resources include a searchable database of physics degrees, including entry requirements for accredited and recognised degree courses, at myphysicscourse.org and the www.physics.org/careers website, where students can read about options available to those that study physics post-16. Other resources include the STEM careers video clips for embedding careers into lessons, which won the non-broadcast category award at the Learning on Screen Awards in 2012.

For full details visit www.iop.org/teachers.



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The Kitemark is a symbol of certification by BSI and has been awarded to the Institute of Physics for exceptional practice in environmental management systems.

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