

IOP Institute of Physics

Consultation on STEM Guidance 2016 Institute of Physics response

The Institute of Physics (IOP) in Wales is a scientific membership society devoted to promoting physics and bringing physicists together for the benefit of all. We have over 1000 members, and are a part of the Institute of Physics, a charitable organisation and leading scientific society. The Institute of Physics in Wales aims to promote the role of physics in society, covering education, health, the environment, and technology. Our membership is wide-ranging and multidisciplinary, including the education, industrial, medical, and general public sectors. We also seek common purpose with other organisations to promote science and science-based learning and to influence science policy. Special emphasis is placed on supporting physics teachers by promoting in our schools the value, joy and benefits of a knowledge of physics and its applications.

The IOP welcomes the opportunity to respond to the Welsh Government's consultation on STEM guidance. We offer some initial thoughts below, and in particular highlight where our expertise and experience may be able to contribute to the most effective development of new STEM guidance.

The IOP has expertise, experience and resources that make us a valuable partner in working with schools to teach physics in an engaging and informed way, addressing challenges in engaging different demographics, and using recognised pedagogy. We have a wide reach, operating a number of networks, as well as running meetings, evening workshops and the Stimulating Physics Network - providing intensive support to teachers.

Cross Curricular Integration

While we recognise the importance of cross curricular integration, it is important that the separate identity of the sciences is recognised within the curriculum, especially within the new areas of learning and experience. This is of particular concern if learners will still be expected to make GCSE choices at the current KS3/4 boundary having not experienced the subjects they are choosing as discreet entities in their own right. The guidance should ensure that the separate sciences are explicitly referred to within the curriculum and that resources are provided to do this.

Wales presents a wealth of opportunity to integrate elements of Welsh culture, history and geography into the science curriculum. To list these here would be beyond the scope of this document, but the IOP is happy to offer support to the Welsh Government in this exercise. However, when integrating these elements consideration should be given to timetabling, and realistic targets set for the extent to which such additional enhancement can be integrated.

Progression to A-Level

As the Welsh education system progresses to the new GCSE offering from the WJEC it is imperative that the message is communicated to teachers, parents, learners and careers advisers that the double applied science qualification does not allow progression onto any of the traditional sciences at A-Level. We have received anecdotal reports of schools entering 100% of their cohort onto this qualification, and there is a risk that we end up retained many

of the problems of the previous system (where the BTEC was used to inflate performance measures). If something is not done to address this immediately we may face a lost generation of students who cannot progress with science careers, which will act to compound the issues above as the pool of scientists to draw on as teachers is reduced.

Gender

The IOP has significant experience in identifying and challenging ongoing issues relating to lower participation of women in STEM, and related gender bias challenges, through a body of work and through a series of reports which we have published on the subject. We would be very interested in providing the Welsh Government with further input on our work in this area and our knowledge of best practice.

In particular, we would prioritise the recommendations from our 2015 report *Opening Doors*¹. *Opening Doors* suggests a number of areas of good practice to counter gender stereotyping in schools, including the stipulation of gender awareness and unconscious bias training as an integrated element of teacher training in all subjects in order to begin to propagate a generation of teachers who are aware of and sensitive to the issues around gender in the classroom.

While addressing this issue within the sciences remains important, it must also be recognised that in order to achieve real change, efforts must be made at all levels to achieve a cultural shift. This in particular, as we recommend in *Opening Doors* and as we have found in our work through the Stimulating Physics Network (SPN), should include a whole school approach to addressing gender issues, not just focusing on the sciences. Addressing gender issues at a whole school level can have a significant impact on the number of girls progressing to physics A-level – far more than by working with science departments alone. In addition, families and even society at large have a role to play and need to make substantial progress on the issues the sector faces.

The guidance should also take account of broader widening participation issues for other demographics, including students from lower socioeconomic backgrounds – we make a number of recommendations in this area in our report *Raising Aspirations in Physics*² - from black and minority ethnic communities and students with disabilities. Many students are also likely to face multiple intersectional challenges of access and participation in STEM.

Learner Key Stage Continuity

It is critically important that we track the progress of every learner at every stage of their education, including progression into employment. It is our understanding that the Welsh Government is currently developing a pupil tracking system which will allow this, and we believe that this should be a priority project. Ofsted have recently placed a requirement on English schools to record pupil destinations, and this would be a welcome stipulation in Wales.

Teacher Professional Development & Subject Knowledge

Wales needs to train enough teachers with specialism in each of the sciences (particularly in physics) to, at a minimum, maintain the current number of teachers, but over time to increase numbers. The current status of the teacher training centres and their recruitment levels in Wales is nowhere near delivering this, and a considerable step change is needed in

¹ http://www.iop.org/publications/iop/2015/file_66429.pdf

² http://www.iop.org/publications/iop/2014/file_64466.pdf

order to address an emerging crisis in this area, including ensuring that the incentives to support PGCE students in Wales are at least on par with those in England.

It is particularly important, given the undersupply of specialist physics teachers in Wales, to focus on improving existing teachers' subject knowledge, employment of pedagogical techniques and confidence in teaching physics and how physics can be made exciting and accessible to young people. Through the Stimulating Physics Network the IOP is working with teachers of science in Wales to build their confidence in teaching physics. Our work includes improving the confidence and knowledge of teachers to teach physics in the classroom. Analysis of our work has shown that better physics teaching has been shown to improve the number of students going on to study A-level physics. In IOP SPN partner schools the increase in the number of pupils progressing from GCSE to AS-level physics has been more than double the national rate and the participation of girls in physics beyond GCSE has doubled compared to the national average.

Through SPN we also provide intensive support for teachers to develop their skills in leading and teaching practical work. We currently run two one day conferences for physics teachers (one on Brecon, one in Bangor) each year. A major element of these conferences is workshops focusing on practical techniques for the latest elements of the curriculum.

However this is managed, teachers must have access to high-quality continuing professional development (CPD) and be given recognition of professional attributes. Specialist physics teachers and providers of physics CPD & initial teacher training (ITT) should be encouraged to work towards (& maintain) Chartered Physicist (CPhys)³ as a mark of their professional status.

Communications

Teachers should be contextualising science in the classroom (regardless of the academic level at which it is taught) and this should not be viewed as an element exclusively for the applied science qualification. Through the Stimulating Physics Network the IOP has access to outstanding teachers of physics who are happy to work with the Welsh Government to highlight best practice in doing this in the classroom and within the curriculum (as well as the work they are already doing on a teacher-by-teacher basis in their roles).

**For further information, please contact
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³ http://www.iop.org/membership/char-sta/chartership/cphys/page_51812.html