

IOP Institute of Physics

Institute of Physics submission to Royal Society–British Academy joint project on educational research

The Institute of Physics is a leading scientific membership society working to advance physics for the benefit of all. We have a worldwide membership of more than 50,000, from enthusiastic amateurs to those at the top of their fields in academia, business, education and government. Our purpose is to gather, inspire, guide, represent and celebrate all who share a passion for physics. And, in our role as a charity, we are here to ensure that physics delivers on its exceptional potential to benefit society. Alongside professional support for our members, we engage with policymakers and the public to increase awareness and understanding of the value that physics holds for all of us. Our subsidiary company, IOP Publishing, is world leader in scientific communications, publishing journals, ebooks, magazines and websites globally. We welcome the opportunity to submit evidence to the committee.

The Institute of Physics welcomes the opportunity to feed in to the Royal Society and British Academy's joint project. Below, we provide a brief overview of the kinds of use we make of educational research as an organisation as well as the areas we see as priorities in improving the utility of educational research. In particular, we believe there should be greater moves towards subject-specific educational research. We would be very interested to provide further input to the project partners as this work develops.

1. How do educational research findings inform your work?

The IOP relies on educational research to inform our work in three main ways.

1. To develop teaching resources that are informed by evidence;
2. For informing policy and advocacy work;
3. For devising activities for addressing evidenced problems in the system.

The first two cases tend to rely on general educational research and statistical analyses. The third draws on physics education research (PER). Examples of the types of work include:

- The development of our Improving Gender Balance pilot project¹; the introduction of a mentoring programme for early career teachers; identifying gaps in teacher recruitment; and a project to recruit engineering graduates into physics teaching.
- The SCORE position paper: Sciences at Key Stage 4, time for a rethink²; our response (with partners) to the Ofqual consultation on inter subject comparability³; and our response (with partners) to the DfE consultation on a CPD standard⁴.

¹ http://www.iop.org/education/teacher/support/girls_physics/improving-gender-balance/page_63795.html

² http://www.score-education.org/media/17187/des3620_score_sciences%20at%20ks4%20final.pdf

³ http://www.iop.org/policy/consultations/file_67267.pdf

⁴ http://www.iop.org/policy/consultations/file_66632.pdf

- Our main support material is the Supporting Physics Teaching resource. This is an evidence informed tool to help teachers think about the way that they teach physics. Whilst we do not put the referencing within the resource, we do provide lists of typical and recommended PER resources⁵.

2. How easy do you find it to identify, access and make use of educational research, and what are your main sources of educational research findings?

We use a number of printed resources, sources and journals. Relating to the three areas in the answer to Q1, they include:

1. Aspires, UPMAP, CEM centre, Sutton Trust, NFER, Cambridge Assessment, Gatsby (reports by Alan Smithers), Royal Society state of the nation, and the National Pupil Database (NPD), along with our own pilot projects
2. As above.
3. Published books (aimed at teachers and teacher educators), Physics Education, School Science Review, International Journal of Science Education, the Physics Teacher, American Journal of Physics, and Journal of Research in Science Teaching.

Furthermore, we commission research and reports from NPD on the choices and pathways that students follow which we use as both an external and internal tools – to report on trends and concerns, and to benchmark, report on, and inform our own work.

We also attend academic and policy conferences, both as active participants and to take away new knowledge to inform our work. We access the information directly from the conference itself or the subsequent proceedings.

3. What would be your priorities for educational research, and why?

There are significant structural and communication challenges that should be addressed in UK education research.

- Currently, the UK has only a small number of physics education researchers. This is in part due to the lack of a robust structure for developing education researchers: people often end up in subject-specific pedagogy research having followed a path through teaching, teacher training and, finally, research. Within this system there is a lot of very specific research with small datasets being produced at a subject level. This research tends to not be very generalizable and is predominantly carried out by students on a Masters course or by teachers in their classrooms. It would help the education system to have a more systematic approach to developing subject specific education researchers.
- Presently it is very difficult for teachers to progress within their subject area to higher levels of understanding they might attain through, for instance, research. While developing new teachers and those less experienced is in part expanding their

⁵ <http://supportingphysicsteaching.net/SupportersCreate/DocShow/show.html?file=http://supportingphysicsteaching.net/topicEvidenceSource/EnEvidence.md>

pedagogical content knowledge (PCK), for more experienced teachers with a rich PCK there is little available to build upon this knowledge and take it further. To try to improve matters the IOP's Teacher Network has started enrol a small number of Physics Network Coordinators on an annual basis on a Master's course at the University of Oxford⁶. This course will hopefully allow us to move towards a specific solution providing better support for teachers who have largely mastered their professional role. Chartered status may play a part in this solution, building on the IOP Chartered Physicist qualification.

- There is a need to develop improved ways of disseminating the findings of research. In part, this is about translating the research into ideas that can be used in the classroom and putting it into a form that is digestible and meaningful to teachers. Much of the PER in journals is written for a researcher audience rather than a practitioner audience and as such language can be a significant barrier for the research to be translated. This is particularly problematic as teachers are likely the primary audience to translate this research into action.
- There are weak links within HEIs between the education researchers, the subject specialists and the teacher trainers. Often education departments and subject departments (i.e. physics departments) are completely separate entities on a campus. And, increasingly, teacher training will be carried out by a group that is separate from the education research group. This structure means that trainee teachers do not necessarily benefit from research findings, they are not exposed to the power and utility of research activity, and neither the education researchers nor the teacher trainers are linked to the disciplinary department. This final point means that new physics academics are not supporting teacher trainers and, similarly, they themselves are not being supported by pedagogic research in doing their own teaching (either general or subject-specific). In addition to this, there is also evidence of a rising trend in teaching only and scholarship contracts in subject departments⁷, who are under no obligation or have no expectation placed upon them to undertake pedagogic research.
- Much of the research at school level is about whole school issues, general education questions or structural research (e.g. the influence of school uniforms, questioning techniques, three part lessons). There is very little research into subject-specific questions (e.g. 'is it better to learn about power before energy or vice versa?' or 'what is the best way to teach students about potential difference?').

4. Are there demonstrations of effective links between practitioners, policy-makers and researchers in this country, or internationally, that the Working Group should be aware of?

⁶ <http://www.education.ox.ac.uk/courses/msc-teacher-education/>

⁷ https://www.heacademy.ac.uk/system/files/resources/shifting_academic_careers_final.pdf

- The IOP is running a number of projects to support practitioners with accessing or carrying out research. At school level we have the PIPER⁸ project and at university level we are working on a project to open up funding for pedagogic research in HE (SPHERE⁹) and a project to improve conceptual understanding from undergraduate courses (ECUIP¹⁰).
- We disseminate our work through our teacher network (for schools), our HE networks and through the Physics Higher Education Conference (PHEC).

**For further information, please contact
Alex Connor, Head of Policy (alex.connor@iop.org)**

⁸ https://www.iop.org/education/teacher/support/piper/page_62597.html

⁹ http://www.iop.org/education/higher_education/sphere/index.html

¹⁰ http://www.iop.org/education/higher_education/conceptual/index.html