

Towards Evidence-based Practice in Science Education (EPSE)

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Aims:

The central aim of the EPSE Research Network was to improve our understanding of the interface between science education researchers and practitioners, particularly teachers, and hence to promote the use by practitioners of research evidence to inform their practice. Our specific objectives were:

- to develop valid and reliable instruments which teachers can use to collect evidence of pupils' learning in specific science domains and about the processes and practices of scientific enquiry;
- to develop and evaluate examples of teaching approaches, for a range of aspects of science learning, which draw upon research evidence;
- to improve our understanding of the ways in which practitioners in science education draw upon research evidence in taking actions and making decisions.

Significance:

Much research has been carried out on students' understanding of key science ideas. This has identified commonly-held ideas which differ from the accepted scientific ones, and shown that these are often very resistant to change. Although this has implications for practice and policy, it has not had systematic impact on either.

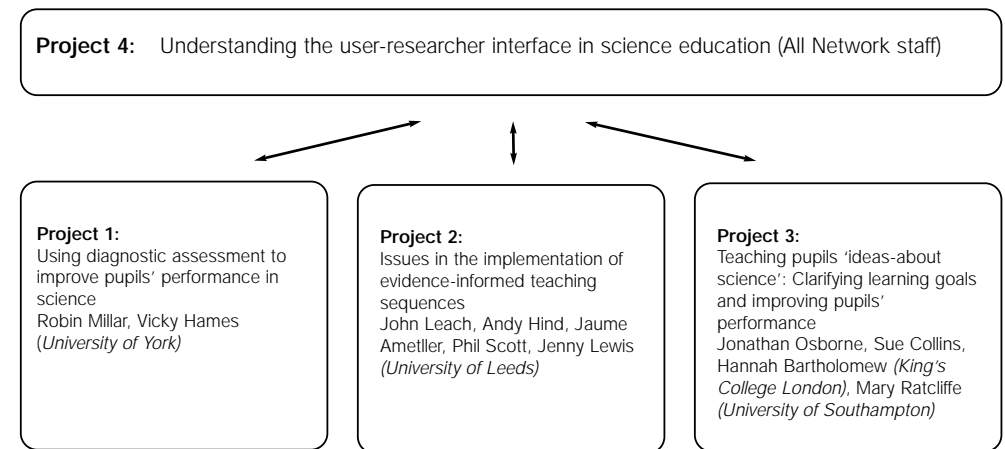
Whilst it is widely agreed that scientific literacy requires an understanding of the 'nature of science', there is little consensus about the 'ideas-about-science' that should be taught, or how these can be taught and assessed effectively.

Practitioners' perceptions of research and its relevance to their everyday practice are clearly critical to the effective uptake of insights and ideas from research, but are not well understood.



Network structure:

Four inter-related projects, exploring issues concerning evidence-informed or evidence-based practice in science education.



Programme of work:

In **Project 1**, we worked with a group of teachers and other practitioners to develop banks of diagnostic questions, based on tools used by researchers, for several core science topics. We then used these to monitor students' understanding of key science ideas, to explore how teachers can use diagnostic materials of this sort and its impact on their practice and on students' learning.

In **Project 2**, we also worked with teachers to devise three short teaching sequences, each dealing with a key science idea. These were evaluated when implemented (i) by the teachers involved in their development, and (ii) by another group of teachers not previously involved.

Project 3, began with a Delphi Study of a panel of 'experts' in science communication. From this emerged nine themes which were generally seen as important for citizens to understand – and should be included in the curriculum. With teachers, we then developed lessons to address these themes, implemented these and evaluated the outcomes.

Project 4, involved interviews with 62 science education practitioners (primary and secondary teachers, including some with and without personal experience of educational research, textbook authors, curriculum developers, ITT and CPD providers, policy-makers) and 6 focus groups with teachers, to tease out views on the current and potential influence of research on practice, and on views of research more generally.

Main findings:

- Research-informed teaching materials can stimulate significant changes in teaching style, and in teachers' approaches to conceptually demanding topics.
- Research-informed teaching materials can influence the discourse patterns in science lessons, in planned ways.
- Teachers using research-informed teaching sequences can obtain significant gains in students' concept understanding. This applied both to teachers involved in developing the materials, and to others not involved.
- There is considerable 'expert' agreement about the important 'ideas-about-science' that all students should be taught. These can be grouped into nine key themes.
- The effectiveness of lessons on these themes depends on five key factors: the teacher's understanding of the nature of science; conceptions of the teacher's role (provider of knowledge or facilitator of learning); the use of discourse (closed/authoritative or open/dialogic); conceptions of learning goals (knowledge only or also including reasoning skills); and nature of classroom activities (contrived or authentic).
- Research findings are appreciably more likely to influence practice if they are 'transformed' into materials and approaches that can be used directly in classrooms;
- Professional networks which enable regular dialogue between researchers and users greatly facilitate the impact of research on practice and policy.

Other significant outputs include:

- Large banks of research-informed diagnostic questions, which have influenced and been incorporated into several important national initiatives.
- Research-informed lesson sequences and teaching materials for several key science ideas;
- Research-informed lessons on 'ideas-about-science'.
- A volume in TLRP's *Improving Learning* services.

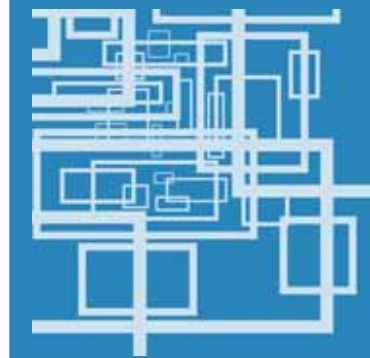
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Teaching and Learning Research Programme



TLRP involves over 30 research teams with contributions from England, Northern Ireland, Scotland and Wales. Work began in 2000 and will continue to 2008/9.

Learning: TLRP's overarching aim is to improve outcomes for learners of all ages in teaching and learning contexts across the UK.

Outcomes: TLRP studies a broad range of learning outcomes, including the acquisition of skill, understanding, knowledge and qualifications and the development of attitudes, values and identities relevant to a learning society.

Lifecourse: TLRP supports projects and related activities at many ages and stages in education, training and lifelong learning.

Enrichment: TLRP commits to user engagement at all stages of research. It promotes research across disciplines, methodologies and sectors, and supports national and international co-operation.

Expertise: TLRP works to enhance capacity for all forms of research on teaching and learning, and for research-informed policy and practice.

Improvement: TLRP develops the knowledge base on teaching and learning and policy and practice in the UK.

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