Teaching and Learning RESEARCH BRIEFING

Towards Evidence-based Practice in Science Education 4:
Users' perceptions of research

Calls for evidence-based practice raise issues about what constitutes 'evidence' for development of educational policy and classroom practice. This project focused on the experiences of teachers of science and a range of other science education practitioners. Interviews and focus groups explored the nature, influence and potential of research in science education as a public form of evidence impacting on policy and practice. This enquiry identified some of the factors promoting and inhibiting the use of educational research.

- Professional networks are critically important in the use and dissemination of research in policy making and classroom practice. → Developing, strengthening and supporting professional networks is an important mechanism for enhancing the dissemination of research evidence and fostering a culture in which research is valued.

- Science education practitioners have a positive view of research, but tend to evaluate all research using 'natural science' criteria and are relatively uninformed about methods of educational research. → The professional training of science teachers should aim to develop understanding of the strengths and limitations of social science research methods and knowledge claims.

- Weight of evidence is rarely sufficient to change educational practice – claims must also resonate with prior beliefs and experience. → The impact of research in the classroom is likely to be greater if findings are 'transformed' into practical strategies that acknowledge teachers' professional knowledge.

- Teachers do not normally use the rigorous and systematic methods they expect of research in evaluating their own practice. → Careful specification of learning outcomes, and a body of diagnostic tools to assess their achievement, would help improve the evidence base for teachers' judgments.

The research

The EPSE Network

This project is one of four undertaken by the Evidence-based Practice in Science Education (EPSE) Research Network. The Network is a collaboration involving the Universities of York, Leeds, Southampton and King's College London. Its overall aim is to explore ways of enhancing the impact of research on practice and policy in science education, by improving our understanding of the interface between researchers and practitioners. The EPSE Network has developed and evaluated several examples of evidence-informed practice, and has explored practitioners' perceptions of the influence of research on their practice. Whilst focusing on science education, the findings and outcomes may also illuminate the research-practice interface in other subject areas.

Background

The relationship between educational research and professional practice is a complex one. Calls for evidence-based practice (EBP) have raised issues about what constitutes 'evidence' – ranging from the narrative evidence embedded in case studies to outcomes of large control based trials (Hargreaves, 1996; Slavin, 2002). A simple view of EBP is that specific research outcomes that are accepted as rigorously derived and widely validated should, and can, be acted upon in modifying professional practice. However, judging 'what works' requires findings to be interpreted and considered, translated for the local context, and integrated with professional and practical knowledge. In addition, it requires explicit definition of the goals and criteria by which 'success' might be judged. In contrast, professional knowledge is often tacit, and its supporting evidence 'invisible'. Such evidence is communicated through established practices, curricula and resources that embody decisions of the educational community. Given the different evidential bases on which professionals might implicitly or explicitly draw in their day-to-day practice, how significant to the work of science educationalists, we asked, is *research evidence*? Calls for EBP suggest the need to explore the research-practice interface more fully, exploring how practitioners receive and interpret research evidence. Our study thus had the following aims:

a) To obtain a better understanding of the extent to which teachers, and other user groups, recognise and make use of research findings in the course of their normal practice;
b) To explore the factors which promote and inhibit the impact of research in science education on practice.

Methods

We used a combination of interviews and focus groups to explore practitioners' views. Interviews were conducted with 62 science

A group of OFSTED inspectors are observing teaching and documentation in a school, and writing an inspection report.

A researcher is testing a new 'Thinking Skills' course. The course is being taught to several classes. The children's performance on a test of thinking skills is being compared to that of several control classes which are similar to the others, but who have not been taught the course.

A teacher is administering and marking an end-of-topic test, and using the data to produce a spreadsheet showing pupil marks on each question, to discuss with colleagues in the school/science department.

Figure 1 Are these activities research?

education practitioners – 21 experienced science teachers with no formal experience of research (10 primary and 11 secondary), 20 experienced science teachers who had experience of research (8 primary and 12 secondary), and 21 other science education professionals. Six focus groups – three of primary teachers, three of secondary teachers – were set up.

One feature of the interviews was a 'Card Sort' activity in which seven scenarios were presented, with interviewees asked to decide whether or not each constituted research (Figure 1 shows three of these). The purpose was to identify participants' conceptions of educational research, through examining the reasons they gave for classification. In addition, interviews explored the influence of research on current practice and the contribution of research to improving and evaluating practice.

The focus groups examined the extent to which findings from science education research were seen as convincing and persuasive, and might lead to a change in practice. Focus group participants were presented in advance with eight vignettes describing real examples of educational research. Discussion concentrated on the extent to which participants were familiar with the research, found it credible or convincing, and its likely influence on their practice.

Perceptions of educational research

From the interviews as a whole, there appeared no single common, or even dominant, view of the criteria which made an activity ' research' in science education. Rather, different activities were seen as research by different interviewees, often on different grounds. About a third of interviewees saw both a clear purpose and a systematic approach as defining characteristics of research, but the majority of interviewees focused on one of these criteria. In general, teachers without research experience had limited notions of what constitutes educational research despite their general comments on its purpose and methods.

Some features of research which might have been mentioned were notable by their absence. For example, no interviewee suggested that a research enquiry needs a clear theoretical or conceptual framework. The dominant emphasis was on systematic

empirical enquiry – which compared cases and was of large scale.

For me to rate and value … research I've got to be absolutely convinced of the basic reliability, the validity, so sample size is important though that is not the be all and end all … even some of the anecdotes can be absolutely gob smacking …. but for the most part the educational research I trust a great deal is … when that is done with large sample sizes, when it's done across the world …
[Simon, secondary teacher with research experience]

For focus group participants, research was seen as convincing if it appeared generalisable to different contexts and came from studies with clear methods:

It's not a convincing piece of research when you have such a small sample, especially a hand picked sample, presumably. And not necessarily with your ordinary, average teacher either, which in a sense you need if it's going to give us lessons that are transferable across the board.
[secondary focus group 1]

Importantly, it had to resonate with teachers' experience:
I'm not convinced of the one about the less able pupils. I'm less convinced about that because of my experiences being the opposite.
[primary focus group 3]

Development of professional practice

In terms of research design, the emphasis on empirical enquiry and large sample size suggests that the interviewees and focus group participants were using a 'natural science' model of research as an indicator of quality. In contrast, when evaluating a change in their own practice, interviewees applied different criteria of quality - using professional judgement, 'gut feeling', and pupil feedback, mostly of an informal nature, rather than the rigorous methods they demanded of research studies:

It's usually a personal, subjective judgement, when you're actually teaching the subject that you feel they've got a far better understanding of it. And when they do their assessment, the results which they produce.
[Jack, primary teacher without research experience]

Few participants seemed to have a vision of evidence-based practice – either in the sense

that their judgment of their own practice should be based on explicit evidence, or that, if there were empirical evidence that a specific teaching approach led in general to better learning outcomes, they would naturally adapt their own practice. The importance of professional judgement, tacitly acquired through experience, was a theme throughout the discussions..

Many participants could identify professional interactions as both sources of research knowledge and opportunities for influence on practice. Colleagues, in-service education and the activities of professional associations (notably the Association for Science Education) were seen as disseminators, filters and translators of research. For all, a perceived lack of time and the lack of accessibility of research findings through direct and indirect means were seen as barriers to exploring or exploiting research.

Significant influences of research

Participants in this study saw educational research as beneficial and influential on practice. However, as other studies have also noted (Kennedy, 1997; DETYA, 2001), unless research evidence, including that from highly regarded studies, was seen to accord with experience and professional judgement, it was unlikely to be acted on:

When we talk about it we wouldn't think to ourselves 'oh my word we are using research now'. We think this is a good idea and it fits in with our ethos and so we will try it. We will do that first and then we might look at the research findings that have backed it up. But we wouldn't look at research first and say 'oh there are so many more improved results, therefore we will do it'.
[Hazel, secondary teacher with research experience]

Teachers with research experience were generally able to discuss how their own interaction with a research community or specific research evidence had impacted on their practice.

Impact on a national scale was seen to come through curriculum output from research which had a direct bearing on pupils' learning in science - such as teaching materials and in-service training. Thus, major research and developments projects in science education, such as CASE (Cognitive Acceleration through Science Education) fulfilled the criteria which, from our study, are likely to optimise the impact of research on practice. That is:
*   convincing research findings which
*   resonate with professional experience, and result in
*   practical strategies for classroom practice which are
*   widely disseminated through a variety of professional networks.
Yet, even then, there were some teachers who found such a body of evidence unconvincing.

Major implications

This study suggests that educational research does influence practice and policy. However, few participants seemed to have a sense that research can provide evidence to warrant particular actions and choices in specific teaching situations. Rather classroom practice is influenced and changed by practical strategies whose origins may lie in research evidence but whose dissemination has relied on translation by researchers, colleagues and/or in-service training providers. Teachers with first hand experience of a research culture seem better able to view professional practice through a different, 'evidence-based' lens, bringing their understanding of research to bear critically where their professional context allows.

Widespread use of research evidence in the classroom seems to depend on at least two factors:
*   tangible and useful outcomes, such as curriculum materials and teaching approaches, resulting from transformation of research findings into practical strategies;
*   the presence of a professional culture which encourages both exploration of research and changes to practice.

The picture drawn from these findings is that science teachers are willing to consider research evidence, but, unless already experienced in research, have a limited understanding of the processes and claims of much social science research. Many science teachers set demanding criteria for 'research' which studies aiming to show that a teaching approach 'works' may find difficult to satisfy. It would appear that many of our respondents set 'research' on a pedestal, and saw any actions of their own to evaluate changes in practice as a somewhat different category of activity. This dichotomy has implications for efforts to increase evidence-based practice in science education.

There are two possible responses to this dichotomy: either that teacher education (ITT and/or CPD) aim to provide opportunities for teachers to reflect more deeply on the nature of enquiry in education, so as to arrive at a more considered view of what is possible, and what might count as 'sound evidence' as a basis for action; or that researchers adopt more rigorous and challenging designs in order to improve the quality of their findings and the persuasiveness of implications drawn from them. Increasing evidence-based practice is likely to require both.

A rather different vision of evidence-based practice is one in which teachers make more systematic use of data collected on their own practice to inform decisions about what needs to be changed, and whether changes that are introduced do in fact 'work'. Here the issues seem to be raising the status of data as a basis for action and improving the quality of the data that is collected, by providing tools that enable this to be done more thoughtfully, more systematically and, not least, more easily, by busy practitioners.

Models of evidence-based practice which incorporate both knowledge arising from research and more tacit professional knowledge need to be more actively explored.

What of the influence of research on policy?

Comments throughout interviews and focus groups made reference to narrowness of national tests as the current means of measuring educational success and a hindrance to reflection and change in teachers' practice. Policy documents and the assessment regime were seen as very influential on practice and a barrier to research-based innovation in teaching.

We would have to be less results driven. That would be the biggest change. People who get good results are scared to change in case their results go down. Schools who are successful may not see why should they change.
[Hazel, secondary teacher with research experience]

Most primary teachers showed a fundamental trust that policy documents (from QCA, DfES) are based on research, though secondary teachers were more sceptical. Many participants saw the influence of research on science education policy as opaque, implicit, and via the influence of particular people rather than the nature of particular research evidence.

I would presume that the National Curriculum has .. that there has been research involved before the powers that be wrote it.
[Louise, primary teacher without research experience]

References
DETYA (Department of Education, Training and Youth Affairs) (2001). *Educational Research: In whose interests?* Higher Education Series Report no. 39. Canberra: DETYA Higher Education Division.

Hargreaves, D.H. (1996). Teaching as a research-based profession: possibilities and prospects. The Teacher Training Agency Annual Lecture 1996.

Kennedy, M.M. (1997). The connection between research and practice. *Educational Researcher*, 26, 7, 4-12.

Slavin, R.E. (2002). Evidence-based education policies: Transforming educational practice and research. *Educational Researcher*, 31, 7, 15-21.

Further information

Further information on this project, including full text of several articles and conference presentations for both academic and practitioner audiences, can be downloaded from the EPSE Network website (address below).

An interim report on the study can be found in the following paper which is available from the project website. Ratcliffe, M., Bartholomew, H., Hames, V., Hind, A., Leach, J., Millar, R. and Osborne, J. (2003). *Evidence-based Practice in Science Education: The researcher-user interface.* Paper presented at the Annual Meeting of the National Association for Research in Science Teaching (NARST), Philadelphia, March. A full report will be published in Summer 2003, and will be available from the EPSE website.

A TLRP 'gateway' book, in the *Improving Learning* series, is in preparation on the outcomes of all four EPSE Network projects and their implications for efforts to increase the impact of research on practice in science education. This will be published by RoutledgeFalmer, in 2004. Other articles for academic and professional journals on various aspects of the work are also planned.

The warrant

Findings are based on 62 interviews and 6 focus group discussions which were complementary in their objectives. Interview questions explored perceptions of the nature of research in science education, the influence of research on current practice, and the contribution of research to improving and evaluating practice. Discussion in focus groups concentrated on the extent to which participants were familiar with the research and found research credible or convincing; and its likely influence on their practice. A sub-sample of teachers with research experience was included in the interview sample, to compare perceptions of those with (20) and without (21) research experience. The interviews also included 21 other science education professionals – who between them had experience as curriculum policy makers (QCA, OfSTED, DfES), textbook authors, providers of initial and in-service training in HE, LEAs and the independent sector, science curriculum developers, and examiners.

All interviews and focus group discussions were transcribed. We adopted a grounded-theory approach to analysis, scrutinising transcripts iteratively and reflexively and coding major emerging themes. Inter-researcher reliability was established through blind coding which showed that, initially, 80% of codes were used with consistency across researchers. Use of codes with lower consistency was resolved by discussion and comparison of additional transcripts. Mechanics of coding were assisted by use of a qualitative data software package, which also allowed full exploration of emerging themes, particularly in relation to sub-samples of interviewees.

Teaching and Learning
Research Programme
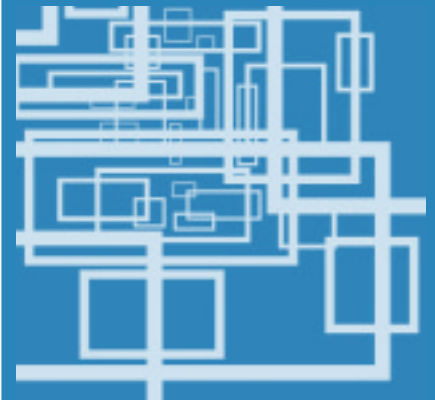
TLRP is the largest education research programme in the UK, and benefits from research teams and funding contributions from England, Northern Ireland, Scotland and Wales. Projects began in 2000 and will continue with dissemination and impact work extending through 2008/9.

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

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

Lifecourse: TLRP supports research 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. The Programme promotes research across disciplines, methodologies and sectors, and supports various forms of national and international co-operation and comparison.

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 collaborates with users to transform this into effective policy and practice in the UK.

TLRP is managed by the Economic and Social Research Council research mission is to advance knowledge and to promote its use to enhance the quality of life, develop policy and practice and strengthen economic competitiveness. ESRC is guided by principles of quality, relevance and independence.

TLRP Directors' Team
Professor Andrew Pollard ▌ *Cambridge*
Dr Mary James ▌ *Cambridge*
Dr Kathryn Ecclestone ▌ *Newcastle*
Dr Alan Brown ▌ *Warwick*
John Siraj-Blatchford ▌ *Cambridge*

TLRP Programme Office
Dr Lynne Blanchfield ▌ *Lsb32@cam.ac.uk*
Suzanne Fletcher ▌ *sf207@cam.ac.uk*

TLRP
University of Cambridge
Faculty of Education
Shaftesbury Road
Cambridge CB2 2BX UK

Tel: +44 (0)1223 369631
Fax: +44 (0)1223 324421

www.tlrp.org