



How science teachers use research evidence

Science teachers understand the importance of evidence in their subject. **Mary Ratcliffe** explores how far this extends to their classroom teaching

SCIENCE TEACHERS VIEW SCIENCE EDUCATION as evidence-based. Yet they judge the quality of educational research and the quality of their own practice by

different criteria. They expect robust and rigorous methods in educational research, but tend to use “professional judgement” to evaluate changes in their own classroom

practice. Research evidence may influence their practice, but by itself will not change it.

How evidence-based does science education seem to teachers?

Evidence-based education implies good use of evidence in policy making. It also implies that teachers are able to make good use of research evidence in their day-to-day planning. But how evidence-based does science education seem to classroom teachers?

A group of science education researchers in the UK formed the Evidence-based Practice in Science Education (EPSE) network to explore the design, trial, and evaluation of evidence-based practice. Led by Professor Robin Millar, the network included Professors John Leach, Jonathan Osborne, and myself, as co-directors of projects. At the same time as using research evidence to support focused teaching interventions, we were interested to discover whether, and how, science teachers made use of research evidence in their normal classroom practice. We undertook 62 in-depth interviews with experienced primary and secondary science teachers; and organised six focus groups. This gave a wealth of qualitative data, which we

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The importance of evidence

analysed rigorously to identify common themes.

“Certainly the National Curriculum [is influenced by research], let’s hope so. And that is why, I suppose, we’re continually undergoing a cycle of change, particularly in primary education.”

Yvonne, pseudonym, primary teacher

Yvonne’s interview response was typical of many science teachers, particularly primary, in seeing policy documents as informed by research evidence. The outcomes of our interviews and focus groups showed that science teachers do regard research

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evidence as having an impact on practice. Teachers saw both direct and indirect influences. A few were able to cite direct use of research evidence in making a change to their teaching. More frequently, science teachers saw a more hidden and mediated influence of research: research evidence is behind construction of specific curriculum materials; colleagues can disseminate research they are engaged in or know about; professional development is seen as evidence-based. A few pointed out how some curriculum materials are deficient by their lack of research base:

“On the [examination board] website, there’s now a scheme of work for Key Stage 4 and you won’t see any reference to research in that one because it’s very superficial.”

Simon, secondary teacher

So, if science teachers regard practice as potentially influenced by research, what are their views on the quality of research?

Is the evidence convincing?

While the science teachers we spoke to regarded research as influencing practice, they seemed reluctant to make a deliberate change in practice as a result of clear research evidence. We presented teachers with some vignettes of science education research to discuss the nature of good research and what would make them change their practice. Unsurprisingly, they regarded high quality research as that which had robust methods and clear outcomes. However, even if the evidence

was extensive and suggested that adopting a particular teaching strategy could bring about improvement in learning, many would not necessarily adopt change. The research evidence had to resonate with their existing perceptions of effective practice. If the teaching strategy was not close to their existing views, they were likely to find reasons for rejecting the research findings.

CASE (Cognitive Acceleration in Science Education) is one of the few, very extensive research projects in science education which has shown significant achievements in learning when implemented in a wide variety of schools. Indeed some teachers quoted

the curriculum materials arising from CASE as showing the positive impact of research. However, for some teachers the methods did not resonate:

“The CASE material – the impression that you get from that material is one of two things. Either the people who are doing the teaching are so super-duper that nobody else is ever going to be able to do what they’re doing, or they’ve been done with [smaller than average] classes of 15 or 20. Now, that’s not realistic.”

Ken, secondary teacher

The resonance of research with practice is an important issue in bringing about evidence-based change. Suppose we advocate particular teaching sequences, like CASE or those we investigated in the EPSE projects. Do science teachers believe in the methods being encouraged? Are they going to apply curriculum materials as the designers intended? It seems that faithful delivery of proven approaches is not shown unless teachers have a good understanding of the rationale for the approach and clear evidence of outcomes. Even then, strategies have to accord with teachers’ perceptions of effective practice.

Views of how teachers evaluate change in practice also show that many science teachers are limited in their use of research tools. In contrast to the rigorous methods that science teachers expect in educational research, they adopt a different stance in evaluating their own practice. Science teachers indicated how they use less tangible measures to evaluate classroom

What we know

Research evidence may influence practice, but will not by itself change practice. For research to have an impact it must:

- Be convincing
- Resonate with teachers’ professional experience
- Be easily translated for classroom use
- Be widely disseminated through respected professional networks.

change, articulating what is, in essence, professional judgment:

“It’s difficult to describe it really. Sometimes you really know when it’s really gone well.... the feedback you get from students.”

Pauline, secondary teacher

Although they recognised the importance of formal assessment in showing outcomes of learning, teachers seldom indicated examples of systematic collection of evidence to reach conclusions about effectiveness of teaching.

Outcomes

From the study as a whole, we found that for research findings to make an impact on classroom practice, they must:

- Be convincing – ie, from studies with clear, rigorous methods which seem likely to generalise to other contexts;
- Resonate with, or at least acknowledge, teachers’ professional experience;
- Be easily translated into practical activities and strategies for classroom use;
- Be widely disseminated through respected professional networks.

Research evidence may influence practice, but by itself will not change practice.

About the author

Professor Mary Ratcliffe is Associate Director of the National Science Learning Centre at the University of York, UK. Before joining the Centre in 2009, she was Head of the School of Education at the University of Southampton. Her research and development interests focus on effective teaching and assessment practice, related to scientific literacy and professional development.

Further reading

Millar R, Leach J, Osborne J, and Ratcliffe M (2006), *Improving Subject Teaching: Lessons from Research in Science Education*. London: Routledge.