The Future of Biology Education Research

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Biology education is a relatively young discipline and the field is so ripe for exploration that a researcher may feel like the boy in the parable who put his hand into a pitcher of figs and hazlenuts and grasped so many in his eagerness that he was unable to withdraw his hand and burst into tears.

However, there are other dangers in addition to biting off more than one can chew. One can flit from attractive topic to attractive topic (cf. the confusion effect in animal behaviour), failing to produce a solid and coherent body of work. Or one can be in awe of other research traditions, pushing one's own biology education research into a Procrustean bed.

Where to start?

In determining a programme for biology education research there are three main starting points: biology, education and research.

If one starts with biology, one starts, in an approach that derives from Hirst's (1965) 'forms of knowledge', with the distinctiveness of biology. For a start, biology sits within the natural sciences, which have a methodology that traditionally emphasises knowledge as objective, universal and amenable to rational inquiry (but see Feyerabend, 1993, who is suspicious of the claim that science is as objective as is commonly supposed). Within the natural sciences biology, of course, is the study of life. In a sense we are spoilt for choice – there are some 10 million extant species and each of these, even on its own, can be researched in a myriad of ways. The most important biology research often proceeds by studying a range of species which then enables it to make conclusions or construct new models that are both widely applicable and also amenable to local variation (cf. Darwin, Mendel, the discoverers of the structure of DNA and such ecologists as E. O. Wilson). There is a lesson here for biology education research: we surely want to engage in fine-grained research that is true to the particularities of a particular situation; we also want to be able to extrapolate to broader horizons.

If one starts with education, then one starts with what has sometimes been described not as a discipline but a field. Like medicine and engineering, education draws on a wide range of more fundamental disciplines to make its advances. This is an epistemological point about knowledge production in education. But there is another way of starting with education and that is to do so not from an epistemological standpoint but form a normative one. With John White I have argued that the aims of education are to equip each learner to lead a life that is

personally flourishing and to help others to do so too (Reiss & White, 2013). If one accepts this approach, then biology education research can be seen as serving to contribute to such flourishing (indeed, 'others' would include non-humans).

I have deliberately started with biology and education because in my experience, certainly of supervising doctoral students, researchers, including biology education researchers, often start with research. We are expected to identify a gap in the literature, formulate research questions and then derive a methodology that allows us to address these research questions. However, while such an approach is efficacious in enabling findings to be produced that add to the literature, and so are publishable, such findings are unduly constrained by the accidents of history – what has previously been researched – more than by what needs to be researched.

What is important?

About ten years ago I wrote a paper titled 'Teacher education and the new biology' (Reiss, 2006). In it I argued that recent years had seen a growth not only in biological knowledge but also, and more significantly for teacher education, in the types of knowledge manifested in biology. No longer, therefore, is it adequate for teachers to retain a Mertonian or a Popperian conception of science. Today's teachers of science need also to be able to help their students discuss bioethics and the societal implications of biology, even when these are controversial and contested. Moreover, practical work can no longer be confined to 'pure', 'safe' and 'confined' activities. These are increasingly rejected by students, validly, as boring or irrelevant. Instead, we need to help student undertake a range of activities that help them to develop criticality and the potential for action.

I think this holds even more strongly for biology education research. We need to keep in mind the purpose of our research (cf. Kincheloe & Steinberg, 2004, who encourage researchers to ask the research questions that will make a difference to students' lives). As Karl Marx said 'The point is not merely to understand the world but to change it'. In the UK, there has been more emphasis in recent years on the impact of scientific research, on knowledge transfer and on public engagement with research. Some commentators have understood this shift as the result of a naïve, politician-driven understand of knowledge production, and fear that it may lead to a narrowing of research and a consequent loss of quality. But another way of reading this new emphasis is to see it as a healthy desire for research to make a difference. Given how many of the world's major issues – climate change, species extinction, human well-being, our use of the environment, animal welfare – are ones where biology, education and research all play a key role, there is tremendous scope for the next generation of biology education research to be intellectually stimulating and also of great social impact.

Implications for biology education researchers

So, the implications of the above are that biology education researchers should be encouraged to undertake research that is likely to make a difference. However, in the UK, as in a number of other countries in Europe and elsewhere, such noble sentiments are somewhat overshadowed by the realities. Biology education research is in trouble in the UK for a number of reasons:

1. For all that the present and previous governments are genuinely committed to the notion that school science education is important, their focus is primarily on physics and chemistry as these are the subjects where there are shortages of specialist teachers.
2. Department for Education (i.e. government) funding for research has largely been channelled into random controlled trials undertaken under the aegis of the Education Endowment Foundation. An examination of their website (https://educationendowmentfoundation.org.uk/projects/) shows that the projects they fund are far more likely to be on topics such as reading, numeracy and character development than biology.
3. There has been a collapse in recent years in education funding by the UK Research Council (the Economic and Social Research Council) that funds educational research. Success rates for education grant applications in recent years have been running at about 3-4%!
4. There has been a long tradition of biology education researchers developing their expertise while working in initial teacher education. However, in England since 2010 there has been a persistent government-driven move towards initial teacher training that makes little or no use of higher education. As a result, education posts are being cut back in universities.

Of course, not everything is doom and gloom and some of these trends may well reverse in future years. My advice to those at the start of their biology education research careers is first and foremost to find an area for research about which they feel passionately and then to begin to research it in ways that require little or no funding, ideally in cooperation with others, whether in their own country or internationally. We are fortunate that it is still possible to publish unfunded work in strong science education research journals to an extent that is far greater than in medicine or the pure sciences. In addition, we have a professional organisation – ERIDOB – that I have always found to be wonderfully supportive since I came to my first ERIDOB Conference back in 1998 in Göteborg.

My second bit of advice – and here I return to Feyerabend (1993) – is for biology education researchers simply to use every possible method they can to help them answer their research questions. In my brief career as an academic scientist (Reiss, 1989), this is what I found that the best scientists did. Let me end by commending the work of the prolific science educator Wolff-Michael Roth (http://web.uvic.ca/~mroth/) who embodies the same tendency in his own research.

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