What Impact does Philosophy of Science have on Current Science Education Research?

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It is important to ascertain the impact of various philosophies of science on science education research. One expects views about the nature and methodology of science to have an impact on the questions and problems to be investigated by science education researchers, on the methodologies employed in research, on recommendations for the 'reform' of science education curriculum and teaching, and on a host of other matters.

However getting a precise picture of the impact of philosophy on science education research is difficult. The amount of research and publications in the field over just the past three decades is enormous. There are at least six major international science education research journals publishing perhaps 300 articles per year, additionally there are numerous national and teacher-focused journals. The Helga Pfundt and Reinders Duit's 4th edition of the *Students' Alternative Frameworks and Science Education* bibliography contains 4,000 entries. However a recent book of Peter Fensham *Defining an Identity* (Fensham, 2004) – provides a rich source of material for at least a partial, if depressing, answer to the question.

Peter Fensham, was the foundation professor of science education at Monash University in Australia; he is a prominent figure in international science education, whose work has been the subject of a recent anthology (Cross, 2003). His *Defining an Identity* is based on interviews with 79 leading science educators from 16 countries (48 being from the USA, Canada, Aus-

tralia and Britain) and their responses to questions about their own major publications and the publications that influenced them. They were asked to respond to two questions:

- Tell me about two of your publications in the field that you regard as significant.
- Tell me about up to three publications by others that have had a major influence on your research work in the field.

In fifteen chapters he then discusses the interviewees' major publications and the publications they nominate as influencing their work.

The interviews do reveal a significant problem with 'The evolution of science education as a field of research': namely researchers in the field are ill-prepared for conducting much of the research. Fensham remarks on many occasions that the pioneer researchers came into the field either from a research position in the sciences or from senior positions in school teaching. For both paths, training in psychology, sociology, history or philosophy was exceptional.

This failure of preparation did not change for second generation or younger researchers. Indeed it has perhaps got worse, as proportionally fewer science education researchers have the experience of scientific research that the founders of the discipline had. The interviews reveal that the overwhelming educational pattern for current researchers is: first an undergraduate science degree, followed by school teaching, then a doctoral degree in science education. As Fensham remarks 'Most researchers in science education have been teachers in schools, usually secondary ones, before their academic appointments' (p.164). Most have no rigorous undergraduate training in psychology, sociology, history or philosophy. At best, as Fensham observes, 'As part of their preparation for the development tasks, these teachers had opportunities to read and reflect on materials for science teaching in schools and education systems that were different from their own limited experience of science teaching' (p.22).

One effect of poor preparation is the extent to which shallow philosophy is so evident in the field. Fensham notes that 'About one fifth of the respondents listed a publication of influence from the history and philosophy of science' (p.56), and he goes on to comment that 'However, only two of these respondents were researchers who began after the 1980s' (p.56). The philosophers of influence among the first generation researchers were James Conant, Joseph Schwab and Thomas Kuhn. Second generation researchers also mention Thomas Kuhn, with one saying 'Thomas Kuhn's *Structure of Scientific Revolutions* is one of the few books I've reread several times … It was extremely helpful in my thinking with all sorts of implications for teacher education and everything I did' (p.56).

The second most influential philosopher for Fensham's 'Top 80' researchers is Ernst von Glasersfeld. Fensham states that 'von Glasersfeld's many writings on personal constructivism have had a very widespread influence on researchers in science education …. In their published research he is regularly cited as a general source for constructivist learning'; he is a person who has had a 'most significant influence' on science education research (p.5).

One interviewee, and enthusiast for von Glasersfeld's constructivism, has written that: 'according to radical constructivism, we live forever in our own, self-constructed worlds; the world cannot ever be described apart from our frames of experience. This understanding is consistent with the view that there are as many worlds as there are knowers' (Roth 1995, p.13). He goes on to state that 'Radical constructivism forces us to abandon the traditional distinction between knowledge and beliefs. This distinction only makes sense within an objective-realist view of the world …' (p.14). And for good measure he adds that: 'Through this research [sociology of science], we have come to realize that scientific rationality and special problem solving skills are parts of a myth' (p.31).

Another indicator of inadequate foundational training is the extent to which the claims of the 'Strong Programme in the Sociology of Scientific Knowledge' (SSK) are uncritically endorsed by interviewees. Fensham reports that: 'One book stood out as an influence about the culture of science and that was Latour and Woolgar's *Laboratory Life*' (p.58). One interviewee said the book 'legitimised the notion that you could study science from an anthropological perspective' (p.77). Another interviewee has stated that contemporary social studies of science reveal science to be: 'mechanistic, materialist, reductionist, empirical, rational, decontextualized, mathematically idealized, communal, ideological, masculine, elitist, competitive, exploitive, impersonal, and violent' (Aikenhead 1997, p. 220). Clearly a lot hinges on the correctness or otherwise of this analysis. If Aikenhead's picture is a correct account of the scientific enterprise, then teaching science is truly a problematic activity.

This paper uses the evidence in Fensham's book to elaborate the claim that a good many of the research programmes in science education have suffered because researchers are not adequately prepared in the foundation disciplines that underwrite these programmes – specifically learning theory (including cognitive science), philosophy (especially the history and philosophy of science) and history. Fensham acknowledges that researchers are ill-prepared, that they 'borrow' from

the foundation disciplines, and that a major problem is that 'Theoretical positions were being presented and used in a form that suited the authors' studies, although this theoretical position had been revised as a result of studies and work these authors had not read or wished to ignore' (p.144). So the work of Kuhn, von Glasersfeld, Latour, Bruner, Lave, Harding, Giroux and others is appropriated but the critiques of their work go unread; it is rare that science education researchers keep up with psychological and philosophical literature. This situation means that the field is susceptible to intellectual and ideological fads that retard the primary business of assisting science teaching and learning, as well as the secondary business of the personal growth of the researchers.

References

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