Research in science education: how do you fit in to the national picture?

Are you an active researcher? Is your research in science education? Upon which topics are you working? With whom are you collaborating? Do you teach research methods or have PhD students? At which conferences do you present your results? Do you work with teachers on their CPD: where? Do you see yourself as a researcher or teacher trainer? Where do you fit into the national picture?

To get the national picture, a survey of science education tutors in the UK was organised by the ASE Research Committee and carried out in the spring of 2006. The questionnaire was e-mailed to 392 science education tutors working in 82 different institutions. These had been identified through GTTR and UCAS course listings and in conjunction with university staff listings on websites. 219 responses were received, a return of about 56%. Read on to see how you fit into the national picture.

What is the extent of science education research amongst science education tutors?

70% of the science education tutors who sent in a return checked the box for being research active. 55% checked the box for being research active in science education. Amongst respondents who have taken up a post as a science education tutor in the last four years, 60% report being research active. The figure rises to 80% for those who have been tutors for between 15 and 19 years, drops back to 67% amongst those who have served 20-24 years, and then jumps to 100% of the small sample of 8 who have been in post for more than 24 years. The most frequent reason cited for tutors not being research active is the pressure of teaching or administrative loads.

It is common knowledge that primary colleagues have larger tutor groups (the average size for those reporting: primary 25, secondary 20); more complicated tutor group arrangements; are generally are less research active (57% responding positively to this question) and make fewer conference presentations (40% asserted that they do present at conferences) than those who teach at the secondary science level (90% and 60% respectively). The survey data provides evidence for this 'common knowledge'. The survey also found that those who are responsible for PhD students are more likely to present at conferences (92%), than those who teach research methods (70%), who in turn are more likely to do this than those who are restricted to teaching secondary (60%) and primary (40%). Can you locate your own research position against this background of the national picture?

If you are cynical, you may already be beginning to think that this survey is stating the obvious. On the other hand, you may recognise that one of the burdens of research is to document 'common knowledge', in order to make it open to inspection and public scrutiny.

Who see themselves as researchers?

Those who teach PhD students are more likely to see themselves as researchers (32%) than those who teach research methods (24%). Of those who teach research methods and regarded themselves as researchers, there were marginally more secondary (12%) than primary (11%) respondents.

Conversely, 72% of those who work with primary; 56% of those who checked secondary; 52% of those who teach research methods and only 28% of those who teach PhD students reported seeing their principal role as being a teacher trainer.

There is definitely a circular feel to this: something of the chicken and egg. Do science education tutors become researchers because they see themselves that way, or do they see themselves that way as they develop research skills and a growing portfolio of papers, presented at conferences and published in academic journals? There are lessons here for career development: to begin a career as a science education researcher you do have to see yourself becoming one.

Is your experience typical of the national picture? Where do you fit in?

Who is researching what?

Interestingly, but with statistical significance as yet unchecked, the data shows that those who teach research methods (48/121) are marginally more likely to cite their research as being in science education than those who teach PhD students (39/121). Whilst recognising that the two groups are not mutually exclusive, could it be that those who teach research methods are confronted by classroom teachers who can be quite vociferous about what they want from research? It often appears that what teachers want are research findings with direct relevance to their classrooms and laboratories.

A collation produced 150 different topics in science education that were cited as currently under research. These were categorised as being about science itself (50 topics, including a study on the way learners' understanding of error in measurement influences their views on the nature of science); science education (23 topics, including comparative studies of primary science in European countries); teachers' learning (37 topics, including a study of the effects of mentoring feedback in science departments on beginning teachers' content

knowledge); and science teachers teaching (46 topics, including a study on the use of spreadsheets on the graphing skills of youngsters in Years 5/6). The Committee's report (note 1) gives a three-page taxonomy. Obviously, a different taxonomy could have been used, but the range of topics is indisputable. There is a wide range of science education research and scholarship going on in the UK at this time.

Who is collaborating with whom?

Research data is hard to come by and good data is even harder to obtain. Working with colleagues can help in terms of data gathering, for instance with those in your department, those working in science education in other institutions and teachers working in schools. Table 1 demonstrates some interesting figures on who works with whom. The first lesson that might be read from the patterning is that, to get ahead in research, you need to collaborate. One might also conclude that the teaching and tutoring load for primary science educators can act as an inhibitor.

Working with colleagues can help in ways beyond data collection. The sharing of analysis, text and paper writing, the development of theoretical perspectives and the task of searching literature, are all enabled by collaboration. Whereas science education tutor colleagues are most likely to be helpful in these areas, teachers working in schools are more likely to be a good source of topics, issues and problems to research. Allott (2006) comments on how in the world of science and science research:

'The top source for new R&D projects was customers, and that government and universities were the second worst source of ideas for new R&D projects. In other words, if you had £1 to invest in new business projects, your best bet would be to invest in a project inspired by customers'.

Such a state of affairs might be used as an explanation of the patterning in Table 1. The most productive science education researchers are those who report most collaboration with teachers in schools.

Table 1. Percentages for sub-groups citing collaboration with research partners.

	N=	Research active	Own institution	Other institution	Schools
Teach PhD	60	97%	78%	70%	50%
Teach res. methods	89	90%	61%	54%	44%
Checked secondary	83	90%	59%	59%	47%
Checked primary	103	57%	38%	24%	23%

Spreading the word at the ASE Annual Conference and through CPD

The benefits of supervising PhD students and teaching on research methods courses are again apparent in the percentages for people making presentations at the ASE Annual Conference shown in Table 2.

Table 2. Percentages of respondents for a sub-category citing the last year in which they presented at the ASE Annual Conference.

	N=	2006	2005	2004	2003	2002	Before 2001	never or no reply
Teach PhD	60	27%	12%	15%	2%	5%	13%	27%
Teach res. methods	89	17%	11%	4%	1%	4%	17%	45%
Checked secondary	83	15%	7%	9%	1%	2%	16%	50%
Checked primary	103	8%	6%	7%	4%	1%	8%	65%

However, one might expect tutors who are involved in research to present at conferences, whilst those who are not involved in research, would not. On the other hand, there is an important and less obvious point, linked to the chicken-and-egg conundrum mentioned earlier. If we are seeking an increase in the number of science education tutors who are both research active and disseminating their findings, simply asking them to do so may not be enough. If their workload does not include teaching research methods or supervising PhDs, then invocation will only produce a marginal increase in research output. To create new researchers, different working conditions need to be created. Here is testimony from a respondent who is making the change:

'There is no pedigree of science education research at XXXX. The science team is small and most have only a teaching background. We have heavy teaching loads and so research is not uppermost on minds or on interests. I have been keen to break into research and have struggled to find a critical mass of colleagues to get started. My European collaboration has done the job and this year we have started a small project with European funding.'

Those who carry out research in science education can find that 'spreading the word' both increases their motivation and improves their own product. Some researchers attend many conferences, where there is an

opportunity to network, keep a watch on contemporary issues and concerns and even find out about alternative career paths. The data displayed in Table 3 shows that those most able to take advantage of these opportunities are those already heavily involved in research. The cliché, *nothing succeeds like success*, appears to hold true in this case.

Those who report making presentations at four or more conferences form an additional sub-group. These are the 'super-researchers', whose professional lives are focused on science education research. 29 have been identified in the analysis and they comprise just 13% of the respondents to the questionnaire. Are you amongst them?

Table 4 shows percentages reporting the location of their CPD work. For the 29 who report having presented at more than four different types of conference, this data shows them to be the most active in delivering CPD.

Table 3. Cumulative percentages of respondents in different sub-groups reporting research findings at different numbers of conferences.

Conferences at which reports made	N=	None	1 or >	2 or >	3 or >	4 or >	5 or >	6 or >
Teach PhD	60	8%	92%	72%	65%	43%	25%	15%
Teach res. methods	89	29%	70%	49%	39%	24%	13%	7%
Secondary	83	41%	60%	48%	33%	17%	11%	7%
Primary	103	60%	40%	25%	13%	6%	4%	1%

Table 4. Percentages of respondents in sub-groups citing CPD work at various locations.

	N=	At SLC	Other venue	On campus	In schools
Reported at 4 or more conferences	29	55%	21%	48%	28%
Teach PhD	60	30%	17%	43%	25%
Teach res. methods	89	24%	16%	52%	29%
Checked secondary	83	17%	15%	39%	20%
Checked primary	103	16%	17%	40%	29%

Moving forward

In the history of teacher training, the expectation that education tutors should all be research active is relatively new. It is even new for people who have served as tutors for a long time and is recognisable in a dip in reported activity, to 67%, amongst those who have been tutors for between 20 and 24 years. Even amongst the 29 super-researchers, there is recognition of the tensions. To quote one:

'I have gained the impression that research in universities is valued over teaching for the purposes of promotion; this leads to conflict in members of teacher training institutions that are part of universities: should I prioritise the failing student or the bid that is due in? Teacher trainers tend to be teachers first and some are stressed by the pressure to identify and conduct relevant research.'

Recognition of the difficulties does not mean all is doom and gloom. One of the 29 recognises the opportunities, with caution:

'One of the benefits both schools and lecturers get from working with teacher trainees is the opportunity to implement, within school, research projects linked to evidence based practice. However, the competency focus of the QTS standards can sometimes chase this from everybody's minds as we seek 'a complete set of ticks' for our trainees.'

If this survey of the state of science education research in the UK in 2006 has produced anything that might approximate to advice to science education tutors as researchers, it might be the following: again taken from the comments of the sub-group of 29:

'Expectations are very high in terms of research. It is hard to teach on PGCE, which is very demanding on time, and achieve expectations of the institution. More of my research has been generic than science based so far but all is embedded in teacher education. Thus, in my view, the teaching and research has to be closely linked to make expectations on research even possible to meet. However, I think it is really important to keep the link between teaching and research. It is all too easy for PGCE to be left behind.'

Perhaps, the quantitative data analysis can be interpreted to give the following advice:

- Find your research topics from talking with teachers in schools;
- Work on data collection and scholarship with colleagues in your department and other institutions;
- Network through the ASE's regional and annual meetings;
- Take opportunities to provide CPD through the presentation of evidence followed by discussion; and
- Make conference presentations and start writing for journals.

A copy of the original report on the data analysis and the quantitative and qualitative data can be obtained from martin.monk@gtep.co.uk

Allott, S (2006) Why spin outs are a bad investment. *Interactions.* Institute of Physics, May 2006: page 4.

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