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Reflections on science education research presentations at ASE 2012

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This article aims to highlight some of the events in the Science Education Research series of presentations at the 2012 ASE Annual Conference.

The original call for research papers went out in the summer of 2011 and, by September, there were over thirty abstracts returned for review, from many countries including Hong Kong, Nigeria, Poland, Jamaica, Malta, the United States, Japan, Ireland and, of course, Britain. Of the proposals reviewed and accepted, 21 were finally presented at Liverpool over three days in January. Many of these 30-minute presentations proffered interesting findings, thoughtful interpretations and virtually all suggested ways to develop and improve science education.

A key aim of the research series was to share useful and informative studies with practitioners and educators so they could engage more meaningfully in reflective discussion about what we do in science education, and why. The different approaches taken to research various aspects of science education ranged from small-scale pilot studies to extensive national investigations, illustrative and exploratory case studies, action research projects demonstrating effects of teaching, learning and assessment interventions and critical reviews of current policy and/or practice.

The focus of the papers included: the nature of training in primary and secondary science teaching; the ways in which primary children can be supported to carry out research themselves; current concerns regarding assessment policy and practices, types of practical work, alternate conceptions and ways of teaching to address them; issues in teacher preparation; and specific teaching topics such as

magnetism and enquiry skills. Some of the presentations are reported on further here, to provide readers with some illuminating insights into current or recent science education research.

One fascinating paper focused on thirty Year 6 (age 11) children in a primary school developing their own research projects in June 2011. These students completed a 5-week programme during which they were taught qualitative and quantitative research methods. During the programme, the students developed research questions on the topic of their choice and conducted research in small groups to answer the questions. Questionnaire and interview data were collected to evaluate students' motivation and engagement with the programme. It was impressive how far these youngsters had engaged with research processes and outcomes, illustrating that it is never too early to embark on a research career!

Colleagues from Malta focused on teacher subject knowledge and confidence in primary schools. As in the UK, few have science qualifications, with teachers expressing the least confidence in teaching physics and the most in biology. A questionnaire was given to a representative sample of 257 primary school teachers teaching in all (state, Church and independent) school sectors in Malta. Information was gathered regarding the teachers' qualifications in science, the frequency of science lessons delivered, assessment practices, confidence in teaching science and particular pedagogical skills, as well as specific attitudes towards science and science teaching. Twelve individual interviews with Headteachers and professionals holding prominent positions in the education sector supported the survey findings. Focus group discussions with all the science peripatetic teachers (responsible for supporting teachers in science in state

primary schools) were also held to enable the corroboration of findings from different sources. This issue of teacher knowledge was pursued further with research involving secondary student teachers answering GCSE questions across the sciences, in an attempt to explore the correlation between degree and classroom subject knowledge. The results demonstrated improvement on tests carried out at the onset and end of the training course, albeit from relatively weak positions. A startling result was that physics graduates performed better than biology graduates on biology questions at the course end, and that biologists did not improve to the highest levels compared with physical science graduates, who did. A paper on student teachers' ability to enhance pupil motivation provided evidence to demonstrate that females were more effective but, perhaps more significantly, that images and beliefs about teaching had an important impact on quality of pupil feelings. A session on misconceptions in physics was led by the organisers in place of a delegate who could not attend. It also focused on teachers' knowledge, in this case, explanations of thermal expansion and contraction, based in an A-level class in Malta. This session distinguished between modelled behaviour of particles in a metal solid using different models (hard spheres and clouds) and the difficulties in finding out what is 'really going on' in the sub-microscopic context. Those present found this session challenged some of their basic thinking. Much of the research on teachers' ideas is carried out with student teachers, which is unsurprising since student teachers are readily accessible on set courses, and are usually willing to take part in such research. Parallel research with experienced teachers is a relatively unexplored area, yet would be very useful, not least because it would

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Research FOCUS

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unearth the rich learning that takes place during the teaching process.

Assessment for Learning (Afl) has been a major area for development, largely influenced by the Kings' College seminal study of the impact of formative assessment. One paper, from a member of this study, offered insight into how assessment is perceived by trainee teachers and critically examined how they make sense of learning, in relation to school practice and their own assessment journey within the PGCE course. As both assessor and assessee, PGCE trainees are placed in a unique position where they can view assessment practices through different lenses, with the interplay of these two experiences likely to challenge their beliefs and attitudes towards assessment. The paper presented clarified some of the ideas about Afl and reported on a successful medium term engagement with teachers, emphasising the importance of a persistent and continuing approach if CPD is to successfully support teachers developing their practice. Another study exploring the nature of Afl strategies found that trainees fell into four broad categories: the struggler; the mechanic; the inspirer and the all-rounder, indicating their application of Afl techniques.

Colleagues at Liverpool have been investigating the impact of the varied ways that ICT can be used to support learning across different curriculum areas. They reached the conclusion that a holistic assessment for foundation phase pupils can provide richer evidence of science achievement in enquiry and process skills such as observing, than simply focusing on what would be traditionally seen as science activities.

Recruitment of secondary science specialists was presented as a current concern. Identification of those likely to need support, and provision of such support, was the subject of an interesting paper. There were unsurprising patterns coming out of the data, with males and physicists requiring more help, but they shared their toolkit for recognising these student teachers, rather than leaving it to unsystematic chance. Their findings found agreement from delegates who were in similar positions.

Investigating trainees' views of ways to 'motivate' learners indicated that, from two institutions, they show some sophistication in their understanding of the tasks that will motivate pupils towards science, and the importance of the relationship that they have with their pupils. There is evidence that trainees begin to develop their teacher identity when focusing on ways to motivate students. They are beginning to see the teaching tasks that are given to the pupils through a pupils' perspective, rather than through their own based on prior experience. Initial findings suggested that there are implications for initial teacher education programmes in the way they support trainees in the development of a pupil-centred perspective to motivate learners towards science. Exploring the reflectivity of trainees and the impact of reflection, another study indicated that learner teachers are not always able to discern objective and subjective

perspectives of their own professional learning journey. Another study indicated how pedagogy and the type of learning planned for by trainees appears to change over the course of the PGCE year, with students generally encouraging more collaborative and socially interactive learning later in their teaching.

Finally, the paper from Northern Ireland on cross-level peer tutoring of primary teachers in science found much to commend this for both the tutors and the tutees in developing knowledge and confidence. It changes the position from one 'Sage on the Stage', i.e. the tutor, to one of many 'Sages on Stages', with improvement for all.

This brief overview sets out to provide a flavour of the research carried out by some of the delegates, often small-scale, but nonetheless having a significant impact on the teachers/researchers involved and their work in their classrooms.

The Research Committee would like to thank the other sponsors of the Research Paper Series. This successful new strand of the Annual Conference was also supported by the International Committee, The British Education Research Association, The International Organisation for Science and Technology Education, The International Council of Associations for Science Education, and The Early Years Special Interest Group of The European Science Education Research Association.

We would like to invite readers to begin thinking, now, about how they might share their stories of research endeavours to a wider audience at the Reading 2013 Annual Conference.

Deb McGregor and Fiona Woodhouse are members of the ASE Research Committee and **John Oversby** is Committee Chair.

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