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DEVELOPING KNOWLEDGE CONFIDENCE AND PERCEPTIONS OF PRIMARY SCIENCE TEACHING SKILLS

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Resumen

In the English speaking world, elementary school teachers confidence in their ability to teach science is a major area of research (Murphy 2009). This paper will present data from a cohort of approximately 200 student primary teachers, all of whom have to take modules on teaching science in the primary school. Data will be presented on students' science knowledge, their perceived confidence with which they hold that knowledge, and how that relates to their perceptions of their confidence to teach both science content and processes. The implications for teaching and learning science and for teacher education will be presented.

Objectives

This paper will present

» A review of certainty/ confidence based assessment in science (Gardner-Medwin and Gahan 2003)
» The results of an assessment of primary teachers' knowledge of science and the perceived certainty

with which they hold that knowledge

» Explore the links to their perceptions of their ability to teach science knowledge, understanding and processes; and

» The implications for elementary science teacher education.

Primary school teachers' science knowledge and confidence in science is a major area of research, with lack of confidence as the major issue for teacher development (Murphy, Neil and Beggs 2007). This project draws on assessment for learning to structure science learning for future teachers of primary science. We believed that students knew more than they thought and their low confidence in their level of knowledge often leads them to believe that science is beyond their capabilities. The hypothesis is that by self-assessing both their knowledge and understanding and their level of confidence in their knowledge, student teachers would then be able to increase both their knowledge and their confidence in science (Gardner-Medwin and Gahan 2003). Evidence suggests that teachers who are confident in their knowledge are better able to teach science using a wider range of strategies (Murphy et al. 2007).

Methodology

Approximately 200 student teachers in the second year of a four-year programme of primary initial teacher education completed a 73 item multiple-choice assessment of their knowledge of science. The audit was developed by a professional team of test developers with the assistance of a team of teacher educators. The level is approximately that expected at the end of secondary education. In the version we use, after they have answered each item, they state the level of certainty they have in their, answer, high, medium or low. Gardner-Medwin and Gahan (2003) argue that 'knowledge' depends on certainty in knowing. They see a spectrum of knowing that goes from 'knowledge with certainty', through 'uncertainty', 'ignorance', and 'misconception' to 'delusion'. As you go across this spectrum, they argue that there is a decreasing certainty in what is true and an increasing certainty in what is false. A proper measure of knowledge requires that we help the learner make explicit their confidence in their judgements. Being confident that you are right and yet are wrong has important consequences. Teachers who confidently teach a misconceived view of science may have a significant impact on the future scientific conceptual development of their pupils. We need to ensure that student teachers are aware of their level of confidence of their knowledge. We need to help them to be honest in their statement of confidence, and feel safe in the assessment environment. Furthermore, the marking scheme must motivate them to be honest. Students are introduced to the mark scheme in Table .

Level of certainty	Low <67%	Medium 67-80%	High >80%
Mark if answer correct	11	2	3
Mark if answer is incorrect	0	-2	-6

Table 1 Mark scheme for certainty based assessment.

Where students are right and know they are right they receive higher marks. Where the answer is wrong and where the student has low confidence in their answer, they receive no marks. At the extreme where the student is wrong, yet they have high confidence that they are correct, a situation that is likely to have a high negative impact on their own students' learning, they are penalised heavily. The student teachers also complete an audit of their confidence to teach aspects of science. The audit has 32 items about teaching knowledge and understanding and 14 items about teaching aspects of scientific enquiry,

They use the outcomes of these assessments to devise small group personal study plans as part of their ongoing development. At the end of the course, students repeat an assessment of their knowledge and of their certainty in their knowledge. A small sample of students was interviewed to gather their perceptions of the course and of their science teaching (Clarke and Ryan 2007)

Discussion

Analysis shows that at the start, the student average mark is 56 with a certainty level between low and medium. By the end of the course, the average has increased to 74% with a certainty level between medium and high. This means that students have increased both their knowledge in science and the certainty that their knowledge is correct. Data from their audit of perceptions of their confidence to teach science also shows a similar increase.

We attempt to set the learning environment by working with the students at the start of their careers with the view that teachers as professionals are responsible for, and have a duty to take charge of our own professional development. We provide a range of tasks to support them in deciding their own pathways and trust them to carry it through in an appropriate, professional fashion. Our experience to date is that they respond to this trust and our expectations.

Questions that are generally less well answered relate to concepts known to be difficult such as ‘volt’, resistance, potential, discrete molecular structures, non-equilibrium forces, changes of state and conservation of mass are ones (e.g. Parker 2006).. However, the certainty with which the majority of students hold these is also low. This suggests that the student teachers know they are unsure about these topics and so perhaps are more willing to change their views. These are not ideas that are firmly held and so are less difficult to change (Harlen et al. 1995).

Simply seeing that they know more than they do shows many students that the task of science learning is less daunting. We try to support them in seeing the parallels between their knowing and that of their future pupils. The feedback from these assessments has allowed us to be more specific in targeting areas of difficulty and also areas of low certainty. One task is about developing knowledge and understanding. The other task is supporting them in developing their confidence in their knowledge. For example, students present the outcomes of the small group studies to their peers, where each student teacher teaches four or five students a major outcome of their studies. These student workshops are developed with their tutor, usually within a constructivist framework, to ensure that the science matches the standard science of the textbook and the national curriculum. The workshops are self and peer assessed according to criteria agreed with their tutor, with the assessment moderated by the tutor. While students find the workshop challenging, they are generally invigorated and enthused by the support of their tutees and the success with which they carry out the workshops. Students generally claim that they have increased their knowledge, certainty and enjoyment of science. When given options later in the course, e.g. choice of topic for one of their final assessments, they are much more likely to choose science than the other options of mathematics or language.

In the complexities of teacher development, it is difficult to attribute cause and effect as in any teaching context there are very many variables which affect practice. However, we believe that this certainty-based assessment is a contribution to their development of learners and continue to explore its possibilities.

References

CLARKE H and RYAN C (2007) Developing confident teachers of primary science, Association of Tutors and Science Educators Annual Conference, Institute of Physics, London.

GARDNER-MEDWIN, A.R. & GAHAN, M. (2003). *Formative and Summative Confidence-Based Assessment. Proceedings of the 7th International Computer-Aided Assessment Conference*, Loughborough, UK, July, pp. 147-155 at www.ucl.ac.uk/~ucgbarg/tea/caa03.doc (Accessed 29/11/5)

HARLEN, W., HOLROYD, C. & BYRNE, M. 1995 *Confidence and Understanding in Teaching Science and Technology in Primary Schools.* Edinburgh: Scottish Council for Research in Education, 1995.

PARKER J (2006) Exploring the Impact of Varying Degrees of Cognitive Conflict in the Generation of both Subject and Pedagogical Knowledge as Primary Trainee Teachers Learn about Shadow Formation, *International Journal of Science Education,* 28 (13) pp1545-1577.

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http://ensciencias.uab.es/congreso09/numeroextra/art-693-697.pdf