**0457**

# Teaching the Nature of Science: Supporting Student Teachers' Development Through the Use of Digital Video

Pete Sorensen, Len Newton
*University of Nottingham, Nottingham, United Kingdom*

## Background

This paper reports on research into the use of digital video to support beginning teachers' understandings of how to teach the Nature of Science (NOS). The specific focus is on the collection, editing and discussion of video sequences of their teaching, designed to exemplify strategies to meet particular NOS objectives.

There is broad international consensus that an understanding of NOS is a vital part of developing scientific literacy (Abd-El-Khalik et al., 1998). However, it is only since the 1980s that many countries have started to reflect this and in England and Wales initial attempts to focus more on such aspects met with limited success (Gilbert et al., 1998). More recent revisions of the Science National Curriculum for England (DfES, 2004; DCFS, 2007) have strengthened the commitment to NOS, with an emphasis on 'How Science Works'. However, implementation problems remain, with research suggesting that teachers' own ideas are often naïve and inadequate (Lederman, 2007).

This research focuses on a Post-Graduate Certificate in Education (PGCE) course in a University-Schools Partnership in England, where the student teachers spend 60 days at the university and 120 days in school. In models like this it has tended to be the HEI that is seen as responsible for theoretical inputs on NOS. However, evidence suggests that problems arise in the transfer of theory into practice. One tool that has been having growing significance in seeking to bridge the theory-practice divide has been the use of video.

Brophy's (2004) review of the use of video in teacher development noted little research on the impact of different uses on teacher development. However, arguments have been made for its value in developing reflective thinking and providing authentic illustrations of classroom practice. This research draws on such arguments, together with research on the value of situated learning (Lave and Wenger, 1991) and the social construction of knowledge through dialogic approaches to teaching and learning (Mortimer and Scott, 2003, Alexander, 2008).

## Research Questions

This research is part of a much bigger project, now in its fifth year, which is looking at: PGCE science students' understanding of NOS before they begin the course (RQ1); how their views change on the course (RQ2); which aspects of the course impact on their views (RQ3); the relationship between their views and classroom practice (RQ4); the aspects of the course that impact on their classroom practice (RQ5). This is an iterative project, with outcomes of successive years informing future practice.

In making use of digital video it was decided that learners should:

- use video of their own teaching as a focus for reflective activity - reflecting arguments for authenticity (e.g. Harrison et al., 2006);
- manipulate their video, including the use of editing tools - drawing on the evidence that such engagement promotes deeper level thinking (Sherin and van Es,2002; Calandra and Dias, 2005)
- present the video in a small group discussion with peers - reflecting arguments for the value of video in supporting reflective dialogue (e.g. Powell, 2005).

This approach would enable an examination students' understanding of the NOS framework and ability to put this into practice in the classroom (RQ4) and the effectiveness or potential of this approach for supporting classroom practice (RQ5).

## Methods

The edited videos [N=37], together with further videos taken of the discussion groups [N=8], were used to examine RQ4. The videos of the discussions groups were employed to provide data on their operation and potential impact on teaching NOS (RQ5). In addition, a focus group was set up, with one representative from each of the small discussion groups, to examine views about the way the groups had worked and how this had supported learning (RQ5).

The longitudinal project involves the use of a variety of research tools with each cohort, and the evidence gathered in this way was used to illuminate the data described above.

## Frame

Content analysis of the edited videos and the presentations was carried out using the framework developed by McCarthy et al. (2006). This framework had been developed with two cohorts of PGCE students, starting from a grounded basis and then compared to international frameworks from the literature. The framework supported an examination of RQ4 through looking for evidence of students' capacity to identify specific NOS objectives and put these into practice in their teaching.

The analysis of the focus group discussions probed the student teachers' reactions to the video task and the way the video task had supported learning. The questions were also chosen in a manner which allowed the students to talk comparatively about the impact of different approaches.

## Research findings

The response of the student teachers to the work with video was overwhelmingly positive, despite many initial misgivings. All the individual representatives in the focus group felt that activity had been worthwhile. There had been some ethical and technical issues but these had largely been overcome.

There was clear evidence of focus on NOS objectives associated with issues of scientific methods, evidence and the tentative nature of knowledge. However, few focused on the role of creativity and imagination, the scientific community, cultural, societal and personal factors and the place of theories, laws and models. Although it cannot be assumed that these ideas were not being addressed simply from what students chose to present, this does resonate with earlier work (McCarthy et al., 2006) showing more limited awareness of these areas.

Analysis of the discussion groups showed that most spent at least as much time talking about generic issues teaching and learning as they did on NOS. This accords with research on the use of video suggesting that groups need to build confidence in each other before moving to higher order learning objectives. It might also reflect issues of language and confidence in speaking about NOS.

Overall the research provides support for using video in this way but it also raises questions of time and commitment and the way in which work on NOS is built into course structures. These issues are taken up in the full paper.

## References

Abd-El-Khalick, F., Bell, R. and Lederman, N. (1998) The nature of science and instructional practice: Making the unnatural natural. Science Education, 82(4), 417-436.

Alexander, R. (2006) Towards dialogic teaching: rethinking classroom talk. Third edition. York: Dialogos UK Ltd.

Brophy, J. (2004.), Using video in teacher education. Oxford, UK: Elsevier Ltd

Calandra, B.D. and Dias, L. (2005) Digital Video as a Catalyst for Preservice Teachers' Reflective Practice: An Exploratory Study Paper presented at American Educational Research Conference, Montreal

DfES (2004) The National Curriculum for England: Science Annesley: DfES

DCFS (2007) The National Curriculum for England: Science DCFS Gilbert et al., 1998

Lave, J. and Wenger, E. (1991) Situated Learning: Legitimate Peripheral Participation. Cambridge: Cambridge University Press.

Lederman, N. G. (2007) Nature of Science: Past, Present and Future. In Abell, S. K. and Lederman, N.G. Handbook of Research on Science Education NJ: Erlbaum Publishers

Mccarthy, S., Youens, B., Sorensen, P. and Newton, L. (2006) Professional development beginning at recruitment: a case study of secondary science teachers in the UK. Paper presented at International Society for Teacher Education (ISTE). Stellenbosch, South Africa. April, 2006.

Mortimer, E. F. and Scott, P H. (2003) Meaning making in secondary science classrooms. Maidenhead: Open University Press.

Powell, E. (2005) Teachers' video-simulated reflective dialogues: conceptualising and facilitating active learning Paper presented at American Educational Research Conference, Montreal

Van Es & Sherin (2002) Learning to Notice: scaffolding new teachers' interpretations of classroom interactions Journal of Technology and teacher Education Vol. 10 No. 4