Symposium:
Teachers and tutors: A dialectic through science education

Organizer: Jenny Frost, University of London, and Joan Solomon, Open University
Discussant: Hans Niedderer, University of Bremen, Germany

Science teacher development project
Jenny Frost, Vanessa Barker, Ralph Levinson, Tony Turner, Sheila Turner
Science and Technology Group, Institute of Education
University of London, UK

Abstract.
The Science Teacher Development Project at the Institute of Education aims to identify those features which support ‘research-in-action’ in science teacher development. The context is the one year initial teacher education course for graduate scientists who will teach in secondary schools (11-18). School teachers play a large role in mentoring beginning science teachers (BTs). Evidence to date shows that developing an explicit research agenda takes time, but can be achieved by small scale activities.

At the core of this over-arching study is the idea of research feeding into reflective practice in a manner which supports and enhances pedagogical routines. By routines we mean the varied practices carried out by effective teachers which are underpinned by reflection at a tacit level. The purpose of this project is to make the thinking explicit behind these routines to encourage dialogue, learning from dialogue and reflection between teachers.

The talk will focus on the overall design and evaluation strategies, and be complemented by a poster session focusing on the individual research foci.

Design.
The Project has set up a series of micro research activities which focus on different facets of science teacher development within the course. Each micro-activity involves mentors, Institute tutors and beginning teachers (BTs) in a mutually reinforcing research role. Data will be collected via diaries, video tapes, audio-tapes with participant observation and reflection on practice. Each micro activity will typically last for three to four years to allow time for the development, use and the incorporation of findings into routine practice. There will be a rolling programme of micro-activities as participants take charge of the activity in an ongoing action research context; as one closes another will be started. One Institute tutor is in charge of one micro activity at a time.

A longitudinal study will follow a sample of BTs into the first three years of teaching to find out whether the initial training of ‘teacher as researcher’ carries through to later practice.
Procedures.

Four micro-research activities, each focused on a different facet of science teaching, have been set up. These facets are:

1. Developing reflective teaching and effective leaning in science
2. Pedagogy in science practical work
3. Student teachers’ changing perceptions of their own development
4. Mentoring

1. Developing reflective teaching and effective leaning in science

   (Dr Vanessa Barker)

This study explores how a key science idea, in the first instance, chemical bonding, is taught in secondary schools. Diagnostic tests and novel practical tasks are used to explore pupils’ learning. Strategies teachers use in presenting chemical bonding to their students will be examined. Teachers and beginning teachers will be encouraged to reflect on their practice by examining the effects of their teaching on their learners. A pilot study is being carried out and data from this will be presented. It is planned to extend the strategy to other key areas of science such as aspects of energy and electricity.

2. Developing pedagogy in science practical work

   (Jenny Frost, with Justin Dillon from King’s, London)

The assumptions are that pupils will gain more from practical work in science if teachers can make them ‘think’ as well as ‘do’; and that this can be achieved by pupils within a class taking on a role of monitoring performance and questioning (things that a teacher normally does). This requires a particular pedagogy. The research aims to identify that pedagogy and to find ways in which BTs can recognise it and incorporate it into their own practice. The research began as a pilot in 1996/7. During 1997/8 strategies emerged which BTs perceived as useful. These strategies will be trialled with a wider sample of BTs and mentors in 1998/9. The research involves:

   • using strategies for planning practical lessons (developed in 1997/8)
   • mutual observation of mentors and BTs lessons, with video back-up
   • analysis of lessons and interviews with participants

3. Student teachers’ (BTs) changing perceptions of their own development: tracking science graduates through an initial teacher education course.

   (Dr Sheila Turner and Dr Tony Turner)

The research tracks the progress of one cohort of science graduates, monitoring their perceptions of the qualities needed to be a successful teacher, and their own progress towards that goal during their training year. The study seeks to identify student concerns about the course and their own teaching performance. Data will be collected by questionnaire and interviews. Data are analysed in terms of cultural
and academic background, especially experience of the UK educational system, and previous work experience. The work builds on recently reported research on applicants’ perceptions of interview and selection process for the same course.

4. Mentoring

(Ralph Levinson)

This is an exploration of the characteristics of mentoring in the context of the development of the science subject teacher. The research involves:

- ‘fly on the wall’ observations and notes of weekly meetings between BT and mentor
- discussion of observations between BT, mentor and the Institute tutor
- mentor observation of IT and BT in debriefing session
- self-evaluations and weekly diaries kept by BT
- characterising significant aspects of the participants’ conversations.

Data Analysis and Findings.

The data analysis of the whole project will aim to:

- identify what aspects of discourse different participants find significant;
- situate the different perspectives;
- find a language to build a bridge between the different contexts of BT, mentor, other science teachers and Institute tutor;
- identify how involvement in research affects practice in other areas of people’s work,
- identify the extent to which such research activities are possible within the limited resources of schools and universities in partnership, without additional outside funding.

General Interest.

What are the characteristics and motivations that propel and sustain the development of teacher as researcher? At the core of this over-arching study is the idea of research feeding into reflective practice in a manner which supports and enhances pedagogical routines. By routines we mean the varied practices carried out by effective teachers which are underpinned by reflection at a tacit level. The purpose of this project is to make the thinking explicit behind these routines to encourage dialogue, learning from dialogue and reflection between teachers.

References.

Comparing Open and Distance Learning in Greece and the UK

Vasilis Koulaidis University of Patras, Greece
Joan Solomon and Jeff Thomas Open University, UK

Abstract.

This research focuses on two approaches to evaluating inservice education programmes for science teachers. The approaches have been developed to address the problems of isolated distant students. The research originated from a conversation at the New Hellenic University in Athens in October 1998, which revealed the different philosophies and practices of Open and Distance Learning in UK and Greece. It has continued through the joint development of courses at Higher Degree level through Open and Distance Learning.

The Hellenic Open University (HOU) began by developing a course in Life-Long Learning for potential tutors, many of whom already held a PhD from another university. Next year they will be offering an MSc course by ODL for science teachers. The students will be able to choose eight modules of which four have been developed:- Life-Long-Learning, Multicultural Education and Methods of Educational Research which will become compulsory for a PhD. The students will then pick four more modules from:- Science Education, Psychology, Child Development,
Educational Administration, Mathematics Education, and others. The three education modules may be hiding the goal of changing classroom practice.

In the OUUK MSc students are almost always full-time teachers studying in their free time and at their own expense. As the course is on open-access some of the students may well be less well qualified than others and may find studying difficult. In Greece all teachers are entitled to three years of study at the HOU on full pay, although there is an anticipated shortage of places on the course which means that only the better qualified students are likely to be admitted. From an educational and sociological perspective we can see problems in both systems. While British teachers are short of time for their study and isolated from other teachers who might be studying the same course, the Greek teachers are also isolated from their schools and teaching colleagues, as well as from their pupils. These factors have social implications of several kinds for their studies.

**Method 1. Learning through reflection and action.**

Philosophers as different as Dennett (1981) and Ziman (1978) and Popper(1965) have all agreed that actions are brought about by beliefs, not just by knowledge alone. "We act on our beliefs" (Popper). Handal and Lauvas (1987) have written about what they call teachers' 'practical theory' which is dynamic, and based on felt values, and yet also subject to change as the teacher experiences new situations and new knowledge. Only through practitioner action can they add to this a valuable private and personal perspective.

The practical theory (of teaching) refers to a person's private, integrated but ever-changing system of knowledge, experience and values which is relevant to teaching practice. (page 79)

This may be reinforced by being one of the 'community of practitioners' within a school situation (Lave and Wenger 1991).


As we try to understand the nature of reflection-in-action, and the conditions that encourage or inhibit it, we study a cognitive process greatly influenced by ‘cognitive emotions’ and by the social context....... (page 322)

What would it mean to practice such ‘cognitive emotion’? Schon explains that he uses this term to describe the practitioner’s ‘feelings about his own performance’. We might call them the values s/he holds in the social context of the classroom.

The method of research based on this theory expects the teacher to put into action in the classroom what is being learnt, and to use his/her reactions to this performance to evaluate whether it matches his/her belief system. In this methodology we ask the studying teachers to keep a dairy of their classroom action, and to reflect upon their new practice. The method was originally used by (Tresman and Fox 1994), and is now being adapted for research use to show whether values as well as their knowledge are leading to new beliefs which can be seen in the action of their teaching.
Method 2. Isolated learning and controversial subject matter.

This research methodology is based on the need to support first time ODL students who may have little or no previous experience of adult study and when they are isolated from the social background of colleagues and students which usually supports them as they plan and teach. When they learn new material on their MSc course they have no opportunity to test out their feelings towards it by teaching, as in the previous situation. This matches the situation that Greek students in the HOU face. It is also familiar to undergraduate students in science and other disciplines at the OUUK. This may be especially taxing when the topic is controversial and the teaching materials present different points of view.

A simplistic solution would be to omit any topics which are controversial, but this runs against the ethos of Higher Education which aims specifically to show that the outcomes of argument are not always tightly determined. According to Perry (1968) it is the function of college to allow students to come to terms with conflict or ambiguity. It is also of interest that a new module in the OUUK second year science course, which is about controversial issues such as Genetic Engineering and Nuclear Power, has both been popular, and has also resulted in a the sort of ‘informed ambivalence’ (Thomas 1997) for which one might have hoped. The data from this show little overall movement of opinion which could have been due to indoctrination, but an increased understanding of opposing standpoints.

However in the first year of ODL study students in many countries seem to have a considerable number of problems due to their lack of social or scholarly contact with other students. An understanding of this is based on the social approach to thinking and learning which dates back to the more mature works of G.H.Mead. By 1934 he was writing unequivocally that

'We must regard mind, then, as arising and developing within the social process, within the empirical matrix of social interactions.' (page 133.)

Mead was emphatic that the full process of experience is only possible for a group of interacting individuals who can discuss and reconstruct what has happened and hence develop an understanding of what was experienced by each one of them.

At the OUUK some of this essential social contact is provided at the yearly residential week of summer school. Teleconferencing and teletutoring are also provided. From Australia, Thompson (1996) has made a sharp distinction between teletutoring where the tutor has control, and true teleconferencing where the students join with their peers in real discussion which has, she wrote, 'the potential to contribute to the growth of understanding.' Both she and Edwards (1996) comment on how frequently the students use these opportunities for peer interaction just to reassure themselves that others are suffering from the same problems as they are. Some of their talk, as Edwards from the OUUK interprets it, is for establishing a sense of belonging to a student community.

In the OUUK we are also developing a new method of research where beginning students are brought together for a group discussion of a new controversial issue. So far the results of this are interesting, but show an unexpected degree of unease and indecision. More research is needed here too if Europe’s more distant students,
especially our science teachers, are to succeed in higher education.

References.