SUPPORTING TEACHERS' PROFESSIONAL DEVELOPMENT THROUGH ICT
Reflections on two case studies

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Abstract: This paper discusses the potential of two information and communications technology tools designed to support the management of school teachers' professional knowledge. Framed by drawing on experience of teacher education in England, the paper is structured around a consideration of what is meant by teachers' professional knowledge and issues in technology-mediated professional development. Two evaluative case studies of ICT-mediated knowledge management for teacher development purposes are presented. First, an evaluation of a curriculum development project in initial teacher education in several European countries; second, a project to develop more experienced teachers' skills in the teaching of aspects of enquiry-based science in UK secondary schools. Implications of innovative approaches to the management of teachers' professional knowledge using ICT are discussed.

Keywords: Knowledge management, knowledge for teaching, digital video.

1.   INTRODUCTION AND CONTEXT

Recent rends in teacher education in England have focused on models that see teacher education as the development of a set of competences. Simultaneously, centralised control of teacher education curricula and accountability have enabled diversification of routes into teaching and a shift from the traditional role of universities and teacher education colleges, towards more school-based training models.

Arguably, the shift to a more standards-driven and school-based agenda for instruction of student teachers has coincided with a shift from the instructional process being an educative one towards a more training-orientated model. One, perhaps unintended, consequence of this trend has been that opportunities to develop understanding of the theoretical bases of teaching and learning have been eroded as notions of teaching as a technical

process – a set of skills and behaviours to be modelled and developed in apprenticeship training - has emerged.

Emphasis on acquisition of skills at the expense of theory in teacher education may weaken teachers' knowledge of the theory underpinning practice. It may also diminish teachers' roles in reflecting on and researching their own practice. Such diminution threatens teacher autonomy and challenges teaching as a research activity. Significantly, it risks undermining the capacity of the profession to respond to change at a time when the pace and impact of innovations in education has probably never been greater.

Notions of the reflective practice (Schön 1987) have been at the core of ideas about the development of professionals across a range of settings for many years. Paradoxically, as the systems and structures of teacher education programmes have shifted to accommodate a greater element of school-based work, so the opportunities for beginning teachers to engage with a rich diversity of practice and to reflect together as novices and experts on theories of teaching have been squeezed. Thus teacher preparation models which involve singletons or small numbers of novices working in an equally small number of settings is likely to offer a less diverse and professionally rich basis for understanding linkages between theory and practice of teaching.

The following discussion considers two innovative tools that can support professional collaborative reflection through ICT mediated environments.

2. ORIENTATIONS IN TEACHERS' PROFESSIONAL KNOWLEDGE

It is helpful to consider teacher education as a process which seeks to build novices' professional knowledge for teaching. Therefore the subsequent discussion is informed by more explicit categories of knowledge for teaching proposed by Shulman (1987).

Table 1. Categories of knowledge for teaching (after Shulman 1987 p 8)

Knowledge of:	Amplification:
General pedagogy	General principles of classroom management and organisation
Pedagogical content	Understandings of subject teaching for learning

The two case studies discussed later in this paper draw largely on the knowledge areas of general pedagogy (Case 1) and Pedagogical Content Knowledge (Case 2) as detailed in Table 1. Although there is some overlap in each case between types of knowledge represented in Shulman's classification, the categories serve to disentangle the complexities of professional knowledge for the present discussion.

2.1   Orientations on knowledge in action

Schön's (1983) conceptions of reflective practice embrace the notions of reflection-*in*-action and reflection-*on*-action. The former can be described as 'thinking on you feet' (Infed, 2001) and the latter as thinking after the event. These notions remain pertinent to many aspects of contemporary teacher education, not least because the concept of reflection in action acknowledges that much of professional knowledge is exercised or 'situated' in complex contexts where there is a high degree of ambiguity (Pakman, 2000). Beginning teachers in England spend many hours in teaching practice and so, in principle, there is ample opportunity for development of skills of reflection-in-action. Schön also noted that professionals develop their own theories of action which could be articulated and critiqued in collective discussion (Pakman, 2000). This has been described by Schön as "*Reflection-ON-reflection in action*" (Schön 1987: 4). The importance of the situated and collaborative nature of professional learning has been highlighted by Lave and Wenger (1991) and more recently the close linkages between practice and theory have been conceptualized as 'praxeology' (Roth and Tobin, 2004). However in the context of technology-mediated knowledge management, some theoretical challenges have been raised over the locus of practice and learning in virtual communities of practice (Lueg, 2000).

From the perspective of education management, it is noteworthy that there has been considerable focus on system level developments in education (Fullan, 2000) and the arguments have been made for fostering a focus on collective learning for educational improvement (MacGilchrist et al, 1997), especially in turbulent educational environments. However, it needs to be born in mind that notions of organisational learning, whether at the level of the whole organisation or departmental level, are predicated on the learning of *individuals*. Therefore teacher professional development which emphasises individual learning can be viewed as a concomitant of collective learning at the department and school level.

The foregoing arguments serve to highlight the close interconnections between management of profession knowledge for personal professional development, school improvement agendas and collaborative learning.

3.   IMPLICATIONS FOR SOFTWARE EVALUATION

Opportunities for collaborative professional reflection have the potential to build teachers' collective professional knowledge. ICT tools designed to support teacher development might therefore be expected to be deployed in situations that have at their core the opportunity for collaborative reflection. This can present a challenge for designers of ICT-mediated teacher development materials since software is often developed outside its context

of use or considered for use by individuals working alone. Evaluation of educational software has become more refined, moving from simple descriptions of intrinsic features and usability issues to embrace consideration of end-use contexts. So evaluation tools have been developed which adopt a more situated approach that seeks to take account of the mode and context of use of software (Squires & McDougall 1996; Squires and Preece 1996). This alignment is useful in considering the potential impact of software for knowledge management.

4.   CASE STUDIES IN KNOWLEDGE MANAGEMENT FOR TEACHER EDUCATION

This section describes two examples of innovative approaches to development of teachers' professional knowledge. The first case study is a synopsis of an evaluation carried out by the author for a European Community funded project in teacher education. The second case study reports work in progress which is developing novel approaches to facilitating reflective discussions between teachers, on aspects of science education practice.

4.1   Case Study 1: The TICEC Project

This case study was an evaluation of a *Socrates Comenius 2.1* project: *Professional Training of High School Teachers*. The project led to the development materials for use in teacher education that focused on the use of case studies as the pedagogic tool, presented through the medium of ICT. The broad aim of the project was to '*develop a methodology which uses case studies along with IT to enhance initial teacher training*.' (http://ticec.cliro.unibo.it/). The outcome of the project was a suite of CD-ROM materials and a training conference.

The titles of the CD-ROM materials covered a range of curriculum contexts and classroom practice. Some topics were generic in nature and so had potential application across a range of specific subject disciplines; for example, 'beginning and ending a lesson' and 'teachers' questions'. Others, such as 'drama' had a stronger subject focus and were therefore likely to be of less value outside their specific curriculum areas.

As argued above, best practice in teacher education involves novice teachers in a carefully constructed mix of observation of exemplary practice, model teaching, and practical classroom experience; ideally these are theoretically framed and critically evaluated. As such these experiences serve to support novice's critical reflection on their own and others' professional practice. The richer the novice teachers' experience and exposure to these learning opportunities, the more successfully embedded are their professional knowledge, skills and understanding of teaching: this accords with Schön's views of professional knowledge set out earlier. In the

TICEC project, the team produced sequences of digital video of teaching episodes and presented these integrated with commentary in the CD-ROM format. The design of the materials within each CD-ROM reflected the underlying pedagogy developed by the project team. Each CD-ROM typically comprised of the video sequences, supporting documents (for example lesson plans), discussion prompts, a glossary of terms and a bibliography. In addition there were reflection points for users' consideration that served to summarise issues raised in the materials and set up points for future consideration. The video episodes of teaching and classrooms provided a useful complimentary source of materials for novice teachers to reflect upon and to discuss with their peers and more experienced professionals.

Digital video sequences were contextualised through introductory video sequences or text-based commentary. These resources sat independently in the material but they were also linked to text-based commentary which served several purposes. For example: an English transcript of the lesson; prompts and questions to focus attention on 'critical incidents' in the video and to promote discussion and reflection. CD-ROM material included commentary on salient professional issues which users could access after having considered the issues themselves.

The material tended to focus on the most practical aspects of teaching which was broadly appropriate as student teachers typically need to be able to quickly learn managerial routines and teacher behaviours that accelerate their transition into classroom practitioners. The CD-ROM products provided a wealth of exemplifications of teaching practice to provoke and encourage reflective discussion. Not all of the examples in the video sequences were necessarily of high quality practice, but that could serve as a useful aid to discussion with novice teachers, providing that it is carefully mediated by an experienced professional.

The technical-rational approach to development of professional knowledge may focus too heavily on acquisition of a narrow set of skills. The materials developed for the TICEC Project risked an over-emphasis on aspects of general pedagogical knowledge at the expense of other types of professional knowledge. This highlights the tension between the need to offer practical strategies to novice teachers whilst encouraging them to recognise that these strategies have underlying theoretical rationales. This risks losing an opportunity to develop teachers' critical thinking about efficacy and rationale or, in Schön's (1987) terms, reflections *on* action. It would be possible to use the TICEC materials in a very technically focused way, but one strength of the materials was that the theoretical basis of video extracts was acknowledged through the inclusion of bibliographies. Thus the potential was there for users to follow up areas of interest or need in the literature to develop a more theoretically grounded and evidenced-based approach.

4.2   Case Study 2: Developing Ideas and Evidence using 'ICE'

Here, a project to explore science teachers' use of digital video in professional development (PD) activities is described. Extensive use is made of video materials as a part of science teachers' professional development in England but there is a need for published research on its contribution and efficacy.

The project involved a team of science teachers and researchers in critically evaluating examples of digital video produced for PD purposes. The material used was selected from those produced for the IDEAS Project (2002); (Osborne, J., Erduran, S. and Simon, S. 2004) to support the use of argument in developing pupils' understanding of scientific ideas and evidence. The study made use of a novel software tool, the Interactive Classroom Explorer (ICE) to mediate PD activities and to facilitate the evaluative processes. The project set out to harness the professional knowledge of teachers involved in seeking to develop their practice in collaboration with others. Broadly the project goals were to identify the way in which teachers developed their thinking through use of PD videos, and to examine the role of ICE in promoting such developments to improve teaching.

4.2.1 The ICE Instrument

Interactive Classroom Explorer (ICE) aims to present digital video for exploration and discussion (face-to-face, online or offline) in a way that offers much more flexibility than is available with traditional video. ICE offers a much broader suite of tools than traditionally available, enabling the user to:

- play back a video while scrolling through a "timeline" containing a transcript, lesson plan and/or other annotations;
- create 'video quotations' (i.e. short video clips) that can be pasted into emails or a discussion area;
- display as 'pop-ups' resources associated with the video – e.g. still images of whiteboards, student work, copies of worksheets etc., selected either from a menu or from hyperlinks in the timeline;
- work with a collection of tasks, videos, timelines, texts and other resources that form a "module" containing everything needed for a particular professional development or learning activity.

4.2.2 Project Rationale

The project sought to investigate the efficacy of features of the ICE tool in supporting teachers' collective reflections-on-action in a key aspect of contemporary science education in England, namely *Ideas and Evidence*.

The development of this work has been informed by the experience of using ICE in other PD contexts (Harrison et al 2006). In the research discussed here, a series of short video sequences in which teachers and pupils are seen in classroom contexts working on developing skills of argumentation in science lessons was selected. This approach to presentation of argumentation used in the video had an extensive research basis (see for example, Erduran et al, 2004) and the project materials used in the present study was a development of that research project (IDEAS Project, 2002).

When working with ICE, teachers were presented with video and a simultaneous scrolling transcript and timeline. Other windows in the ICE tool present information to users, offer a discussion area into which contributions can be posted and an 'assignments' area which was not used in the present study.

A small group of experienced science teachers was recruited to work with the researchers. Following project briefing and training in using ICE, the volunteer teachers were asked to view IDEAS video sequences and identify professionally interesting aspects of practice exemplified in videos. The teachers were free to comment as they wished on the material. They were asked to post contributions to the on-line discussion in response to the video and to other postings. They were asked to use tools within ICE to identify video clips (known as 'video quotations') which illustrated their postings.

The teachers' postings were subjected to a content analysis and follow up interviews were conducted. Postings were typically data-rich and rooted in personal professional practice. Many of the areas focused on for discussion related to issues of classroom management and organisation prompted by the video. Interestingly, there was an emphasis in the early stages on the hindrances to engagement with the material. Some of these appeared to be linked to the 'overheads' in acquiring proficiency in using the ICE interface but others reflected issues of participation in online communities of practice.

5. IMPLICATIONS FOR IMPLEMENTATION

The case studies outlined above offer novel approaches to managing aspects of teachers' professional knowledge for development purposes. The TICEC project focused primarily on novice teachers in training and the ICE/IDEAS project was directed at more experienced teachers. From this experience a number of inferences about the design approaches of the two projects can be drawn, which have implications for knowledge management using ICT in teacher development contexts.

First, both projects make use of ICT as a tool for disseminating professional development opportunities. In the case of the TICEC project these opportunities were mediated through CD-ROM material which is easily distributed and can be accessed by individuals or small groups in professional development settings. By contrast users interacted directly with

the IDEAS material in ICE either offline or online modes. These features facilitate collaboration between users over distributed or local networks. One key difference between the two approaches was the nature of the community of practice that could be established around the tools. In the case of the TICEC project the design enabled the materials to be used in extant groups. By contrast, ICE was both the means of establishing and of mediating the distributed group. Use of distributed groups has the potential to support PD rolled out on a wide scale, which may support national initiatives' more flexibly. But this is not unproblematic (Lueg 2000). However, the potential advantages for PD of a distributed group operating within ICE have been shown likely to be contingent on developing protocols for establishing a functional virtual group.

Both case studies made use of a blended approach to presentation of material. They shared the inclusion of video sequences supported by other materials. In the case of the TICEC materials, any reflective discussion on the content is contingent on the relationship to other artefacts in the PD 'system' (e.g. a tutor). In the case of the ICE tool, discussions were an intrinsic feature of the software design. The discussion content itself becomes a part of the shared artefacts of the PD episode within ICE. Users have control over the extent and nature of their postings to the shared discussion but it is the software that acts as the vehicle for discussion and the users are in control of the discussion topics independently of a tutor. To that extent, the ICE tool offers the opportunity for users to identify and develop discussion on issues that are of immediate and situated professional relevance, rather than imposed from outside the immediate context of use. However the absence of a mediating tutor may constrain the extent of progression of the discussion.

Despite the design advantages of ICE over more self-contained PD resources, it is clear that the efficacy of the tool is very much dependent upon teachers' investing time and developing their ownership of using the tool. Such investment is not automatic even for motivated ICT users. Much appears to depend on the relationship between the design purposes of the knowledge management tool and their relationships to the broader contexts of use for PD purposes. Thus, although there are exciting future possibilities for ICE, there is scope for further research in the design and practice of such tools for the management and development of professional knowledge.

6.   ACKNOWLEDGEMENTS

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