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Breaking the cycle of ignorance: information technology and the professional development of teachers

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Abstract

Despite numerous national and local initiatives there are still many schools within the UK which have yet to take Information Technology (IT) on board in any meaningful way. For the majority, IT flourishes only in pockets of good practice within the school. Lack of resources both in terms of hardware and software and in terms of adequate training are often cited as the prime causes of this failure to advance. The research literature on teacher expertise, however, suggests that there is a more fundamental reason for the lack of progress: the inherent resistance to meaningful change within our profession. What is the nature of this resistance and how may it be overcome? Here evidence drawn from the formal evaluation of Integrated Learning Systems in UK schools will be used to illuminate our understanding of the process of professional development of teachers.

Keywords

Professional development, attitudes, classroom practice

1 INTRODUCTION: THE CYCLE OF IGNORANCE

The starting point of this paper is the discussions held by IFIP Professional Groups 3.1 and 3.5 at the World Conference on Computers and Education (WCCE) held in Birmingham in 1995. The groups noted with concern that despite earlier predictions of a bright electronic future for education, as the end of the century draws nearer, the reality in our classrooms does not match the vision. Although there are pockets of excellence, where IT is playing a significant part in supporting both the learner and the teacher, on the whole we are faced with a bleak landscape of poor or non-existent use of IT. Explanations for this state of affairs generally focus on the lack of resources but the WCCE working group argued that of equal significance is the poverty of knowledge within the teaching profession as a whole. Student teachers

characteristically claim that their reluctance to use IT to support their teaching is due to a failure in their formal training which they describe as at best inadequate and at worst non-existent. Sadly, the knowledge base of the majority of practising teachers and of teacher educators is itself fragmentary. It is not surprising therefore that many students are receiving inadequate training. Tutors are not confident in using the technology to support their own instruction and they therefore provide poor role models for the students. As student teachers tend to teach in the way they have been taught - not the way they have been told to teach - they in turn fail to use the technology effectively.

The WCCE working group concluded that there was in effect a *Cycle of Ignorance,* a function largely of the rapidity of the IT innovation cycle, which results in poor classroom practice. They argued that this *Cycle of Ignorance* must be broken and that the most cost effective strategy to achieve this would be to target the IT capabilities of teacher educators. To effect this goal it would be necessary to identify good practice and develop strategies for disseminating that practice across the profession. In brief, the strategy for breaking this *Cycle of Ignorance* consisted of:

- Providing effective role models of good practice for new teachers by raising the IT knowledge of the teacher educators. Although it was acknowledged that providing teacher educators with personal IT skills would not necessarily impact on their pedagogy, it was assumed that it was a necessary prerequisite to pedagogic change.
- However this was seen as only a beginning. The technology is on an exponential growth path and one of the consequences of this is that the tools we now have available are increasingly specialised and subject specific. This subject-specific skills-base needs to be identified.
- For all professions there is a body of skills, knowledge and understandings that are unique to the profession. It was noted that we had yet to specify what the professional practitioner's IT capability would entail, but it was felt that it should include a critical awareness of how specific uses of IT implicitly support or promote specific epistemologies, and the implications of any one approach to IT on the overall process of learning.
- In order to ensure the development of good classroom practice we should identify those factors that will support effective transfer into the classroom.
- This process of self development then needs to be repeated with our students. As teacher educators we need to have both a vision and clearly articulated goals for promoting our students' IT development. The students need to be exposed to many different implementations of IT within the classroom and to have the opportunity to experiment with and evaluate those models. Will this in turn place additional pressure on the teacher educators, or is it enough to provide effective role models for students, and as a profession ensure that a strong, positive signal is transmitted to the student teachers?
- Finally we concluded that there is a critical need for an appropriate and continuing level of professional development for all educators, whether initiate, novice or expert.

The model implicit in these discussions was one of filling the empty vessel through apprenticeship or experiential learning. If we can provide appropriate knowledge and experience first to the teacher educators and then to their students it will be possible to achieve the potential of an electronic classroom. While it was acknowledged that the identification of such appropriate experiences was no trivial matter, and that there

were additional barriers such as resource levels that would impede progress, there was a collective feeling that the job was one of scale rather than the identification of more fundamental problems.

Initially depressing though it may seem, I should like to argue that this is not the case and that there are more fundamental issues to be addressed. In order to do this, I would like to draw upon the extensive literature on teacher expertise gathered across a variety of subject domains. As Desforges (1995) points out, we know a lot about novice and expert teachers, but our knowledge is largely descriptive. For example, it is well established that expert teachers have a wealth of subject knowledge, while novices have a more fragmentary and less rich understanding of, for example, the pedagogy of their specific subject area. Further, expert teachers are more flexible in their response to classroom events while novice teachers tend to be more wedded to their lesson plan. Such descriptions have led to a number of stage models of teaching (for example, Berliner, 1988) but these models have done little to illuminate our understanding of the process of how novice teachers reach a level of expertise as opposed to a level of experience.

2 CHANGING PRACTICE

There is a wealth of evidence that teachers, in general, are not given to questioning their professional practice. Teachers at all levels appear to behave in ways that maximise predictability in classrooms (Doyle, 1986) and when their routine operations do not appear to get predictable pupil behaviour, they put in place those actions that will return classroom interaction to the normal status (Brown and McIntyre, 1992). Desforges and Cockburn (1987) argue that teachers have a way of ignoring or absorbing data without recourse to restructuring their conceptions of teaching. They do not seek explanations of the discrepancy. It is not that teachers are insensitive to the 'unusual' in their classrooms, but that their first and most persistent tactic in dealing with discordant or discrepant behaviour is to enforce 'normality'. This resistance to change within our profession crosses age phase and subject boundaries. As Galton (1987) and others have shown, the practice of teachers is remarkably consistent over lengthy periods of time, maintaining the *status quo* is the norm.

How then does change take place? Are there no circumstances under which we can cause a shift in practice? The evidence from the formal evaluation of Integrated Learning Systems (ILSs) in UK schools suggests that change in practice is possible (Underwood, Cavendish and Lawson, 1996). The key purpose of the trial was to evaluate whether ILSs could be used effectively in UK schools, but a subsidiary goal was to observe the impact of the technology on classroom practice. In particular we were interested in the development of teachers' IT skills as they worked with pupils using the system. As the project developed, however, it became apparent that our initial assumptions about the development of IT capability provided a very impoverished view of what was to happen. We identified five areas of impact on teachers working with the ILS. These were impacts on:

- IT skills development,
- classroom practice,
- learning styles,

- reflective practice, and
- levels of collaboration.

Evidence for these effects was available from each of the schools that made a conscious effort to involve their staff fully in this curriculum development. There was, however, a minority of schools that elected to divorce the classroom practitioner from the active use of the ILS. In these schools there was little impact on teacher development in any of the areas we discuss here.

The effects on professional practice documented in this project are of primary interest largely because change is so difficult. Why should working with an ILS, a massive, ability-sensitive but nevertheless drill and practice program, effect change? The first comment to make is that much of the change appeared to be centred on the use of the diagnostic reports produced for individuals and groups of children by the system. Figure 1 shows a section of a typical course report.

Figure 1 Part of a Student's (Sian) Course Report for MATH CONCEPTS

Course Report Wed Apr 13 1994 08:16 For Student(s) 6-99
MATH CONCEPTS
This line gives information on Sian's current performance
6 SIAN .....Apr 13 1994 IPML:4.71 ATT:29 COR:22 %COR: 76%

These lines give information on Sian's cumulative performance

SES	**TIME**	**TATT**	**.....%COR**	**REVQ .....**	**AVG**
48	**8:15**	**1500**	**.....79**	**2**	**5.54**

AD(addition)	**DC** (decimals)	**ME** (measurement)
5.65	**5.45**	**5.50**
100%	**92%**	**85%**

Key
SES Total number of sessions TIME Total time in hours and mins.
TCOR Total number of questions correct %COR Total percentage correct
IPML Initial placement level REVQ Number of strands of work of concern
AVG Current average level - this *approximates* to grade level

Desforges (1995) argues that just as scientists will adhere tenaciously to a theory, ignoring conflicting data, unless a new and more encompassing theory evolves, teachers adhere to their current practice, ignoring the research evidence, until or unless that evidence provides a clear practical application into the classroom. The diagnostic reports produced by the ILS had ready application into the classroom. One teacher argued that it helped him as a teacher and that it was now second nature to him to use the diagnostics and produce an appropriate response to a child. For example, he noted that the spelling reports identify individual words and groups of words with which a child has been having difficulty. For this relatively inexperienced teacher, who was acknowledged as weak, the diagnostic support from the system had allowed him to operate at a competent level. Moreover, the senior management in his school commented that the insights he was achieving from using the system were now showing benefits in other areas of his teaching.

Chinn and Brewer (1993), working in a constructionist framework, identified four factors that influence the restructuring of current pedagogic knowledge and practice. They are:

- the effect of 'old' knowledge.
- the quality of anomalous data/experience.
- the depth of processing.
- the availability of alternative cognitive structures.

Here I would like to focus on two of those factors - the teachers' responses to anomalous data, and their depth of processing or level of reflection about those data. Interviews with teachers in the ILS project revealed that teachers viewed the data contained within the diagnostic reports as both reliable and revealing. The following quote is typical of those from many experienced teachers *'the detailed diagnostics are very useful, they often confirm my intuitions but do occasionally highlight problems or successes that I have not noted.'* This acceptance of the quality of output from the system (the quality of anomalous data/experience) is an essential prerequisite to any change in practice.

In addition, our observational data and teachers' own perceptions of their practice showed that teachers were operating as reflective practitioners. The restructuring of knowledge is dependent on not only the acceptance of anomalous data by the teacher but also on the depth of processing of that data. For a few teachers the ILS raised profound questions about what it is to be a teacher and what was actually happening in their individual classrooms. The following example shows the level of that reflective thought. The teacher, commenting on her pupils' progress when using the ILS, stated that *'All the children are successful but the most able also benefit the most'* and she went on to ask herself *'Is that happening in my classroom as well?'* She had also noted that after two years on the system the children were still motivated, that they liked competing against themselves and that they were also happy to tackle new things because they were in a non-threatening non-judgmental environment. Although she perceived that the system corrected, even punished, errors it was *'not personally offensive as it often is in the classroom.'* She understood her power as a teacher and knew that one mis-placed word from her was far more meaningful and could be far more damaging than anything the system said to the children. This teacher felt that working alongside the ILS was in a very real sense a refresher course for herself as a teacher. Chinn and Brewer argue that such deep processing or restructuring of knowledge is most likely to occur when there is strong personal involvement with the matter to hand, as is clearly shown by this teacher.

3 CONCLUSIONS

The research evidence shows that teachers are more likely to close down rather than open up to experience, that is their practice becomes more stable and resistant to change over time (Desforges, 1995). If change is to be brought about through experience then that experience must not only be provocative, but it must be meaningful in both a personal and practical way to the teacher. Throughout the ILS study it has become apparent that the reporting system of the ILS was perceived by teachers as providing not only reliable but valid data on their children. These data had

personal meaning for the teachers and were readily applied to the classroom. As one teacher commented *'I would be very reluctant to allow the system to be taken away. BUT it does matter how you use it. It's not a delivery system but a partner with children and teacher in the learning process. You must think of a partnership to get the full benefits out of the system.'* However, interacting with the system has proved to be a stimulus to teachers' professional development. At one level teachers have seen the ILS as a support tool helping them to identify weaknesses in their children's understanding. That is the ILS had provided practical solutions to real classroom problems. In addition, for a few teachers it had led to a rethinking of what it is to teach. The implications of the ILS effect for classroom practice have a significance beyond our understanding of the value of the software *per se*, in that they support current process models of professional development and provide us with some suggestions of how IT can be introduced successfully to a conservative profession.

4 REFERENCES

Berliner, D.C. (1988) Implications on studies of expertise in pedagogy for teacher education and evaluation, in *New Directions for Teacher Assessment.* Educational Testing Service, 39-68, Princeton, N.J..

Brown, S. and McIntyre, D. (1992) *Making Sense of Teaching*. Routledge, London.

Chinn, C.A. and Brewer, W.F. (1993) The role of anomalous data in knowledge acquisition: a theoretical framework for science instruction. *Review of Educational Research*, **63**, 1-49.

Desforges, C. (1995) Experience and knowledge for teaching. *Learning and Instruction*, **5**, 385-400.

Desforges, C. and Cockburn, A. (1987) *Understanding the Maths Teacher.* Falmer Press, Lewis.

Doyle, W. (1986) Classroom organisation and management, in M.C. Wittock (ed.) *Handbook of Research on Teaching.* MacMillan, New York.

Galton, M. (1987) Change and continuity in the primary school: the research evidence. *Oxford Review of Education*, **13**, 81-93.

Underwood, J., Cavendish, S. and Lawson, T. (1996) Technology as a tool for the professional development of teachers, in B. Robin, J.D. Price, J. Willis and D.A. Willis (eds.) *Technology and Teacher Education Annual, 1996.* AACE, Charlottesville.

5 BIOGRAPHY

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