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Enhancing learning with ICT at primary level

Terry Goodison

Terry Goodison is Senior Research Fellow at The National Research Centre for ICT in Education Training and Employment at University of Wolverhampton. Address for correspondence: Telford Campus, Priorslee, Telford TF2 9NT, UK. Tel: +44 (0) 1902 322834; fax: +44 (0) 1902 323952; email: t.goodison@delta.wlv.ac.uk

Abstract
This study looks at three primary schools which have been successful in integrating ICT into the teaching and learning process. It confirms that a range of organisational features are correlated with successful implementation (eg, a sound learning environment, headteacher commitment, good forward planning etc) and goes on to argue that staff commitment plays a pivotal role in the process. This commitment can, however, be compromised by technological change (in this case from CD-ROM and LAN-based learning to WAN and Web-based learning) if the process is not properly managed.

Introduction

How can we judge whether ICT enhances learning within any given school? The statistical evidence produced by BECTa (BECTa, 2001), which was based on a large sample of schools, suggests that good ICT resources, well used, enhance performance at Key Stage 2. Unfortunately, the report in question tends to conflate causation and correlation in its discussion of the nature of the link between ICT and enhanced learning, but the distinction is one that needs to be properly made. To substantiate the claim that a causal link exists, we would have to be able to specify the necessary and sufficient conditions which produce enhancement (however defined) and, in the process, give values to a range of variables within the school context. For example, we would need to be able to specify the amount and type of hardware required and the manner of its deployment together with the quantity and quality of software and the conditions of its use. Let's assume, for the sake of argument, that this is a feasible undertaking and that we had a list of the necessary and sufficient conditions for ICT-based enhancement of learning. We would then be in a position to examine the relevant material and human factors in the ICT profile of any given school and predict, with complete confidence, that learning was being improved because of the use of ICT. It is fairly obvious that such a scenario is somewhat fanciful, but that is what the appeal to causality entails.

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If we reject causality in favour of a simple correlation between the two phenomena, we must accept that an analysis of any given school can only establish the likelihood that the effective use of good ICT resources is having a beneficial effect on learning. And the only evidence that we will be able to adduce, in addition to improved test results, are the accounts given to us by the partners in the teaching context itself: the staff and their pupils and, perhaps, the parents. Further, the conditions that produce positive evaluations by staff and pupils are likely to be specific to the school, grounded in its history and context and subject to variation in time (for example the loss of a highly valued ICT coordinator). This is not to say that generalisation is impossible, however. The literature shows (Lawson and Comber, 1999) and Ofsted inspections confirm, that the roles of the headteacher and the ICT coordinator are especially important, as are the quality and extensiveness of the staff development programme. But it would be unwise to assume that any one of these is a necessary condition of successful ICT integration.

In order to investigate further the nature of the correlation highlighted by BECTa, we conducted a preliminary study of three primary schools which had all received very good Ofsted reports, commending the level of ICT provision and the excellent use made of it. The study was conducted over a period of six months and was based on data derived from the following sources:

- external and internal documentation
- recorded interviews with head teacher and ICT coordinator in each school
- 21 observations of lessons in core subjects incorporating ICT
- 9 recorded interviews with teachers
- questionnaire for staff
- 90 pupil interviews (in groups of three with class teacher).

Comments on how the data were gathered are dealt with in the body of the text, as appropriate. The pupil interviews are discussed in depth in a forthcoming article, since the emphasis here is on teachers' perceptions of learning enhancement. Each school has different amounts of ICT equipment with systems linked and grouped in different configurations, and one of the objectives of the study was to ascertain what impact differences of this type have upon the teaching context. We consider each school in turn.

ICT resources and the teaching context

School A

The school is particularly well resourced thanks to the success of the head in acquiring additional funding over a period of several years. It operates a local area network (LAN) connecting 64 systems across the whole school and has access to the Internet in all classrooms via a connection supplied by a local secondary school. In addition it has:

- interactive whiteboards in three classrooms and data projectors in the others
- either three or four computers in each classroom

- an ICT suite with an interactive whiteboard and 18 PCs and laptops
- a software base of over 150 titles spanning all curriculum areas.

These arrangements give teachers a great deal of flexibility. The LAN enables pupils' work to be saved and subsequently re-used and when this is harnessed to the power of interactive whiteboard technology for whole class teaching, staff feel that it has very beneficial effects. The availability of the ICT suite means that, within time-table limitations, staff have a choice between group work or whole class work. For example, a year five class in science began with group work aimed to complete a previous project before moving over en masse to the ICT suite where the remainder of the session was spent revising work on light and sound. It is worth noting that school policy is that ICT should figure in every lesson plan.

School B

This school's resources are more limited than those in school A, consisting of an ICT suite with 15 new systems linked to the Telford and Wrekin broadband Intranet (with access to the Internet) and one free standing, older system in each classroom. A decision was taken by the staff in 1998 not to deploy computers in the class bases because it was felt that "children learn far more efficiently in whole class experiences than in individual or paired experiences". There are no interactive whiteboards in the school, although one will be purchased shortly for use in the ICT suite, and no data projector.

The implications for teaching are that if a teacher wishes to use ICT to support his or her teaching, the ICT suite has to be booked. Two members of staff, the ICT coordinator and his immediate predecessor as ICT coordinator, are the heaviest users of the suite and the only teachers to use ICT across the whole curriculum. The normal procedure in a lesson where ICT is to be used is for the activity to be prepared in the classroom and then completed within one hour in the ICT suite. Serious problems have emerged in school B as a result of the school's having connected to the Telford and Wrekin Intranet and these are dealt with later.

School C

This school stands in complete contrast to school B with regard to the way in which its ICT resources have been deployed. Each class base has three or four PCs and an interactive whiteboard. All the systems are connected to a LAN and have Internet access provided by a local secondary school. Unlike school A, there is no ICT suite and staff focus instead on the collective experience of interactive whiteboard use, articulated as follows in the school's ICT Development Plan:

"The electronic whiteboard connected to a network means that the children have a world of resources at their fingertips ready for discussion, to test hypotheses and research. The children do this as a large cooperative group. It ensures that learning becomes a much more collaborative and social process therefore a much more powerful way of learning across the curriculum."

Like staff in school A, teachers in this school feel that regular use of the interactive whiteboard with the whole class promotes rapid gains in ICT competence. This is potentially a very important development that deserves further analysis, but, for the time being, the views of the ICT coordinator on her experience with the interactive whiteboard are worth consideration:

"... because with this [the Smartboard], their immersion in computer skills is so quick and so unobvious because they just pick it up by just watching what people do and if somebody presses on this button to close it down they've seen it because it's so big and visual they pick it up straight away. If I'd had the same children this time last year coming new into the class where we'd just got three computers they still wouldn't be able to turn the computer on and load up Publisher, but they could all do that straight away now. So, the actual speed that children learn how to use the computer from using the Smartboard is phenomenal really."

These different arrangements impacted directly upon the data gathering process since, during a visit to schools A and C, the observer could cover a number of lessons, as all of them incorporated an ICT element. In school B, however, since staff only book the ICT suite when they have a specific need for it, and since usage has dropped significantly during the first four months of this year, one visit to the school would typically provide only one opportunity to observe ICT in use. Only 4 of the 21 lessons observed were in school B. Furthermore, one of the teachers in school B confided to the researcher that in all probability the lesson that had just been observed would not normally have taken place in the ICT suite and so would not have incorporated ICT at all. One possible conclusion to draw is that the ICT arrangements in schools A and C, by their novelty and ubiquity, challenge staff to develop the appropriate technological and pedagogical skills, whereas in school B there is less pressure of this type. In other words, the policy on what systems to purchase and how to deploy them can have important consequences on the degree of integration of ICT into the curriculum.

Commitment to ICT

To set the context for what we have to say about staff commitment to ICT, it will be useful to consider the three schools more generally. The three primary schools we chose are located within Telford and Wrekin Education Authority in the West Midlands. The reasons for the choice were largely practical: all three schools are on the National Research Centre's doorstep and operate within a context which actively promotes government policy with regard to ICT implementation. Within the NGfL framework, the authority has established a broadband network linking together all its schools and has also made available ICT training for all its teachers. An analysis of the schools' most recent Ofsted reports reveals the following common features:

- The schools are considered to be very well resourced in terms of ICT.
- The head is convinced of the importance of ICT and so are the teaching staff.
- The ICT coordinator(s) are appropriately skilled and run peer-to-peer networks and trouble-shoot most problems.
- All staff have achieved a good level of competence (ECDL or better) and transmit their enthusiasm to the children.

- ICT is well integrated across the curriculum.
- There is a detailed ICT development plan.

In addition, the schools also shared the following more general characteristics:

- Leadership and management is of a high standard and the head teacher is singled out for especial praise.
- Standards of teaching are high.
- Staff development is thorough, and ICT has been a priority.
- The schools successfully promote a sense of community and personal worth in the children.
- The schools have high expectations of all members of the school community.
- Standards of behaviour and levels of social skills are high.
- Curriculum is rich, balanced and varied with a strong extra-curricular element.
- Relations with parents are very positive and there is a high level of parental satisfaction.

Looking through this list of favourable judgements it is clear that the conditions that BECTa identifies as being necessary for the successful implementation of ICT (BECTa, 2001) have mostly been met in our target schools:

- level and type of pupil and teacher ICT training and skills
- pedagogical awareness among staff
- staff attitude towards ICT
- the integration into classroom practice and existing teacher interventions
- pre-use and planning
- school ethos
- technical support, resources management and infrastructure
- establishing clear learning and curriculum objectives.

All of these items have one important element in common: they are critically dependent upon teachers' commitment, so the key question we need to ask is: what is the dynamic which sustains the process of ICT integration and what can undermine it?

There is a difference between commitment and compliance. Staff can be required to attend training courses and carry out agreed programmes of work, but if they are to become committed to an initiative they will have to become emotionally involved in what they are doing. That Ofsted inspectors were sensitive to this emotional factor is evidenced by their observations on the enthusiasm for ICT shared by teachers and pupils. Researchers, in contrast, are somewhat chary of invoking emotional factors in their analyses, perhaps because emotions and feelings are seen as hard to identify, subjective and unquantifiable. They happen, however, to be an integral part of the rational decision-making process in each one of us, as the work of the neurologist Antonio Damasio (Damasio, 1994 and 2001) and several others has shown over the last decade. This is not the place to attempt to summarise any of the main themes of Damasio's work, but the nub of his argument, as far as it concerns what is at stake here, is as follows:

"I see feelings as a having a truly privileged status. They are represented at many neural levels, including the neocortical, where they are the neuroanatomical and neurophysiological equals

of whatever is appreciated by other sensory channels. But because of their inextricable ties to the body, they come first in development and retain a primacy that subtly pervades our mental life... And since what comes first constitutes a frame of reference for what comes after, feelings have a say on how the rest of the brain and cognition go about their business. Their influence is immense." (Descartes' Error, 159–160)

The approach that we adopted in interviews with staff was designed precisely to encourage them to express their feelings regarding ICT use in the classroom by first observing the lesson and then, as soon as possible afterwards, interviewing the teacher about how (s)he felt the lesson went and, subsequently, about the use of ICT generally. As with the section on resources, we will briefly look at each school in turn before drawing some conclusions.

School A

Ofsted noted, in 1999, that:

"The pupil population is socially and economically deprived, with a significant number (42%) of pupils coming from non-earning households... Fifty-two per cent of pupils take up the free-meal entitlement, which is well above the national average and is an increasing figure... There are 105 pupils (41%) on the school's own special educational needs register, which is much higher than average." (Ofsted, 1999)

The effect of this level of deprivation is that many children "start from a very low knowledge and skill base and do not make sufficient overall progress to meet national targets for their age by the end of Key Stage 2". Needless to say, the school directs all its efforts towards making good this initial deficit and Ofsted found that, when judged against schools with similar problems, children's performance was above average in mathematics and English and well above average in science. In ICT, significantly, standards were in line with the national average.

The headteacher is totally dedicated to creating a rich and challenging school environment to offset the deprivation that afflicts many of the children in the school. The ICT strategy is an essential part of the school's efforts to raise the children's self-esteem, make their learning more stimulating and productive and increase their life chances. The motivation to make ICT work is therefore particularly strong amongst this group of staff. This is how the head articulated the school's approach to ICT during interview:

"IT... is the tool to raise the profile of those curriculum areas and provide a variety of stimuli to inspire children to learn, to excite them, to challenge them, to thrill them. They won't question how it works, they'll just accept that it does and as long as curriculum co-ordinators embrace IT to complement and to flatter their curriculum areas, rather than think of IT in isolation, so the two come together and they reciprocate with one another then I can only see how IT goes beyond an entitlement, it goes... it then becomes providing an essential opportunity."

This vision has been implemented with great success and the head and his staff are justifiably proud of their achievement in securing such a strong ICT resource base and using it to help achieve yearly improvements in attainment. There is a high level of staff solidarity and commitment which feeds a continuing extension of technical competence

and confidence in the classroom. Here is one comment, amongst several, which typifies this attitude:

"We've still got weaknesses in the curriculum where we maybe haven't got as much software as we would like in order to channel specific objectives into specific curriculum areas and we'd like to develop that... a greater use of the Internet, I mean I think my knowledge is still, you know, you're always learning and I think there's a lot I can do personally in terms of learning how to use it to the best advantage for the children."

School policy is that ICT is a part of every lesson and there is a planned progression to develop ICT competence from nursery through to year 6. Some staff report misgivings about the need for an ICT component in every lesson, but on the whole they are solidly committed to its use for a wide range of reasons as shown by their answers to the question "In what ways can ICT enhance pupils' learning?" set out in Table 1.

Table 1: Responses to "in what ways can ICT enhance pupils' learning?" in school A

motivation	Autonomy
learning independence	coordination skills
independent exploration	Confidence
interactive: brings learning to life	increase in interactive responses
can accommodate a whole range of teaching styles	Enthusiasm
rapid feedback	strong visual and aural elements
better preparation of lessons ie, in subject knowledge	provides what the teacher cannot eg, animation

Just as relevant were staff's responses to the question: "In what ways can ICT have a negative impact on pupils' learning?". There were only two replies, suggesting that for the staff who did not answer this question negative impact was not an issue. Both answers indicated a clear awareness of the need to subordinate the medium to the educational objective being pursued:

- Needs focus and targets
- Pupils become immersed in the graphic, animations etc at the expense of intended outcome.

Interviews with staff also showed a firm belief in the role of ICT in enhancing learning. For example, here is the teacher of a nursery class talking about the impact of ICT upon the children and their parents. It is quoted in extenso because it also illustrates the way in which the school is embedded within the community:

"Before we had computers in the nursery I probably would have said it wasn't that important. Having had them now for several years, I'd say they were essential, not only from a teaching point of view but also from the children's own experience within the home because more and more children are having computers and they're perhaps not getting the right sort of messages from computers at home... So they may have had a limited experience of computers at home but we can put that into positive effect at school. And the other side of the sort of parental involvement is that having families coming actually into the nursery, they see what's happening and we have family sessions as well, once a fortnight, where parents come in with their two and a half, two year olds, three year olds and suddenly see a computer there, don't know what to do with it and say the child's there wanting to get at it and the parents saying 'But I don't know about those

things' and that's our channel in to say 'Well it's easy, it's fun let's have a go' and you can actually model with the child very simple basic programs, maybe based on colour or shape or stories and you find the next time that, you know, the child's using it quite well the next time the parent comes back in and the parent takes the child straight there."

The gains in self-esteem and confidence amongst the staff are enhanced by the positive feelings that they have in observing the pupils' commitment and success, so creating a virtuous circle. The teacher of a year 2 class describes the motivational impact of ICT upon his pupils in these terms:

"But when you can incorporate it [ICT] and which is becoming more and more easy because of all the different programs that are available, and as we get more experienced, then the power of that visual side and being able to show a whole class something up on a whiteboard and involve everyone, it is, it's very powerful for the children, I mean they can't get enough of it. They'd work from the computers and the whiteboard all the time, you know, if they could, yes, I mean they really enjoy it."

School B

In many ways this is a similar school to school A. The Ofsted report of October 2000 characterises its socio-economic setting as follows:

"(The school) mainly serves its local community, which is situated in an area of social disadvantage... The number of pupils eligible for free school meals is above the national average... The number of pupils on the school's register of special educational needs is above the national average; the number with a statement is well above the average. When pupils start school their attainment is below average."

When compared with schools nationally, Ofsted notes, "results in English are below average, and in mathematics and science are well below average. When compared with similar schools, results are better in English and on a par in mathematics and science." The head teacher of school B, just like the head of school A, is passionately committed to making good the initial educational disadvantage that many of his pupils face and he sees ICT as a means of increasing their employability and helping them develop a sense of community:

"Equally, if I'm thinking about, you know, my real vision of the school for the sort of educational philosophy is that the reason that I do what I do is to open windows of opportunity on the world to the children in our care and the reason that I want to work on an estate like the estate that I work on is because that's the sense of vocation for me, that feeling of actually giving somebody life chances, or improving their life chances, which, had it not been for the staff in this school, they might not have got."

He then goes on to explain how ICT fits into his vision:

"... you want to be preparing them for the adult world, and the adult world is about a high-tech, computer-literate world. If they're looking to get jobs in the future that are beyond the expectations that they might ordinarily have had, I think they'll need to be computer-literate. I think also they'll need to have the communication skills that now depend so much upon ICT. That if they're going to be well-informed about, for instance, choices that are being made about their community, or their health service, they need to be able to get access to the Net and empower themselves that way and I feel that that's really important and that starts, you know, that starts from the minute they walk into school."

This enthusiasm for, and commitment to, ICT is tempered, however, with an awareness of its relatively high cost and the pressing need to support children in other ways:

"And I think that it's that analogy really that I'd use, that if we're looking at maybe spending a lot of money, several thousand pounds each year on up-grading, upgrading, up-grading, you really have to be absolutely certain that it's what the children need and that the basic, you know, the sort of basal level of computer-literacy that they'll need to help them in the future you've developed, but then maybe that extra money could be producing support groups in Maths or developing emotional literacy, which a lot of our children need, they need to have that, you know, support on emotional literacy which is something else that I hold very dearly and when you're prioritising spending you have to think of the whole child not just the computer skill side."

The school's search for a cost-effective way to further develop the base level computer literacy the head refers to above has meant that it was amongst the first to connect up to the Telford and Wrekin Intranet. Unfortunately, this move has had a significant de-stabilising effect upon the school's ICT strategy. Over a period of two years or more, school B had developed its own LAN running its own preferred software over which it had complete control. When it connected to the broadband network in January 2001, it was obliged to remove all its own software from the local server and hand over control of the network to a central NGfL support team. This meant, unfortunately, that much of the software that it had built into its programmes of work was no longer available and that local IT emergencies had to be dealt with by the trouble-shooting team at the centre, with the delays and frustrations that this inevitably produced, given the size of the team. The effect on staff morale has been serious. Staff who at one stage felt a sense of ownership and a burgeoning self-confidence are now experiencing the very negative emotions of frustration, loss of control and, in some cases, loss of face. The fact that only three staff out of nine filled in the questionnaire on ICT in the school is perhaps another indication of the mood of disenchantment that seems to have settled over the school's ICT programme. Here are the responses to the question "In what ways can ICT enhance pupils' learning?". They are inevitably more limited in scope than the replies generated by school A because of the lower level of response.

Table 2: Responses to "in what ways can ICT enhance pupils' learning?" in school B

Overcomes writing phobia/dislike	Cross-curricular connections
Supports research skills and independence	Cross-curricular, linking to literacy etc
ICT as an independent subject ie, developing skills	ICT as a research tool ie, Internet
Particularly good for those who do not enjoy pen and paper methods	

Below are the replies to the question "In what ways can ICT have a negative impact on pupils' learning?". There are comments here which reveal anxiety about the effects of the switch to the broadband network: the network itself is too difficult for some of the younger children to manage and its reliance on Microsoft Office products does not match children's ability levels.

Table 3: Responses to "In what ways can ICT have a negative impact on pupils' learning?" in school B

Children become reliant on it and motivated by it against other methods	Too complicated eg, NGfL login process—too difficult for younger children
Software [on Intranet] matched above their ability eg, Excel, Word etc	Can become too reliant and not keen to use other methods
Technical difficulties—time-wasting and frustrating	

School C

This school contrasts sharply with the other two in socio-economic terms and its pupils enter the school with average standards of attainment:

"The school is situated in a rapidly growing residential area of detached private homes... The wards from which the children are drawn are of mainly high socio-economic status. The percentage of pupils eligible for free school meals at 1.4 per cent is well below the average for primary schools nationally." (Ofsted, October 1999)

There is no need, against this background, to see access to ICT as one of the mechanisms for compensating pupils for socio-economic disadvantage. Instead, the school regards ICT as a catalyst for a new type of learning community, a new type of relationship between teachers and learners promoting a systemic change within the teaching context:

"With increased use of technology we are already finding that teaching and learning becomes a far more collaborative process with adults and children being engaged in both. With use of (the) Internet for example, the teacher cannot predict what the outcomes may be and must be flexible enough for the learning to take a new direction. They must also be prepared to continually learn themselves as this will become unavoidable, but we believe also desirable. Schools will become much more of a whole learning community. Children will be able to lead and direct the learning with the support of their teachers and other children, they will feel much more in control of the learning and therefore more enthusiastic." (ICT policy document)

Many of the staff at schools A and B would concur with such a perception, but in this school ICT has an especially high priority and this has been recognized by the Ofsted inspectors:

"High expectations for attainment in information technology pervade the school through the high profile it is given and in the way that teachers communicate to pupils the assumption that information technology will be used wherever there are opportunities."

"... the school is an excellent example of the effective use of information technology in the development of teaching and learning."

There is evidence from both observations and interviews, with teachers and with pupils, that the learning community aspiration is becoming a reality. Teachers and pupils have been observed experimenting with the interactive whiteboards and this is regarded as normal practice:

"And there's also a lot of learning together [pupils and teachers] with this: I mean there's things that I still don't know how to do so we just, we load it up and just play with it. And that's a lot of the Smartboard stuff we've learnt, the Smart Notebook, because we've just, we've tried 'well let's see if it will do this' and we've found out it does so we've been able to use it."

Interviews also produced one of the clearest statements of how teachers build positive feelings about using new technology. One of the more senior members of staff recounts, in the following quotation, her feelings of apprehension when coming to terms with new technology but also her sense of excitement upon discovering the opportunities it opened up for her in the classroom. Notice also the remark that staff learn from each other which was a constant refrain in all three schools. External training days are all very well, but often they do not meet teachers' specific needs whereas the collaborative exploration of software in order to meet classroom objectives holds out the possibility of a gratifying outcome if the class that has been prepared is delivered successfully.

"It's a fairly constant learning curve. We learn from each other. I mean the introduction of the Smartboard was a learning curve because when it first came I thought 'I can't do that' but then once you start using it opens a whole range of potential for what you could use it for and you start seeing more and more 'Oh I could do this on the Smartboard'."

Six of the seven full-time staff completed the questionnaires and, as can be seen from their answers to the two key questions, their feelings were predominantly positive. The responses to the second question show a sharp awareness of the need to ensure that the medium does not obscure the learning objective being pursued.

Table 4: Responses to "in what ways can ICT enhance pupils' learning?" in school C

Gives quality finish and presentation.	Spell checks can improve work and highlight errors.
Editing features mean children less concerned about mistakes.	Reading a wide range of challenging texts.
Presentation.	Variety of resources.
Want to learn and exciting.	Pupils' learning is not specifically advanced by ICT but it can help present resources.
Pupils learn ICT skills not specific to a lesson's focus.	Allows children to interact together.
Allows virtual movement where mistakes can easily be undone.	Allows professional presentation both of children's work and of sheets/materials for children.
Motivational and interesting.	Better access for those who struggle with writing.
Programs allow children to develop skills independently.	It helps maintain the children's attention.
Encourages children of a young age to record or write when often reluctant to do so on paper.	

Table 5: Responses to "In what ways can ICT have a negative impact on pupils' learning?" in school C

Handwriting.	Children can get caught up in clip art and borders rather than the writing part.
Some software too fussy, not direct to the point of learning—too many graphics, noises.	Lots to choose from: slows them down.
ICT may become the focus rather than the area which is being studied.	Can be used for the sake of it: no real purpose.
Only a problem if children do not see written print, only computer print.	

Coping with technological change

We all feel threatened to some degree by change, but when change damages our self-esteem and threatens our sense of ownership of a process, the strong negative feelings that are generated can deplete the stock of emotional capital that we invested in the process in the first place. Paradoxically, an attempt to further improve ICT provision in school B has produced precisely this effect, sapping the commitment of just those people who had been successfully driving ICT implementation forward. The early indications are that successful integration can be compromised if the sense of empowerment and ownership which ICT can bring to the school community is threatened.

Because, in the case of school B, the central (Telford and Wrekin) support team is struggling to cope with all the local problems with which it has been inundated since the beginning of the year, the school's ICT coordinator has been obliged to spend far longer attempting to get trivial problems solved than would have been the case when the school had sole charge of the LAN. So not only has staff morale been undermined and pupils' confidence and learning opportunities diminished, but costs have escalated as well, as the head explained:

"So it's not as if I'm some sort of Luddite when it comes to technology, but I am really concerned that the technology that we install in school gives value for money and at the moment, I don't think in terms of the expenditure that we're having, if you look at that on the basis of the last couple of months it's not good value for money, because if I'd spent that money short-term on something else—like non-contact time, release time for staff to do other things in other areas, I'd be getting something out of it, something tangible out of it."

The other two schools, having become aware that the authority's roll-out of the system was not going to be able to deliver the required level of service within an appropriate time-scale, decided to delay their connection to the Telford and Wrekin network and to preserve a smaller local network running alongside the Authority's Intranet. This process will be monitored in a more detailed study which will follow on from this preliminary survey.

It should be emphasized that the problems outlined above are not the result of a lack of commitment on the part of either the Authority and their contractors or the schools and that there is a great deal of goodwill on all sides. The Telford and Wrekin NGfL project team are aware of the problems and doing what they can to solve them whilst the schools, for their part, recognize the importance of the initiative and the efforts being made at the centre to support them. It would appear, however, that the management of the process has been defective in certain respects, especially on the content side. For example, the list of software to be made available on the network was originally drawn up in 1999, well before the appointment of an ex-teacher to be responsible for content. This meant that a degree of inflexibility was already built-in, and that made adapting to Curriculum 2000 somewhat problematic:

"For content, for example, [the content coordinator] didn't come into post until a point in time when we were actually starting the factory acceptance testing of the new core set of software. She didn't have any opportunity to revisit that list and say 'OK there isn't sufficient software on here to cover the National Curriculum'." (NGfL project leader, March 2001)

A mechanism was established to try to close this gap between the supported software and what was needed by the schools: subject-based procurement groups composed of school representatives, subject advisors and the content coordinator. The content coordinator described the initial intention as follows:

"The procurement groups would identify software, I would then go out, get evaluation copies of it, we would then evaluate it... against criteria set up by the procurement groups and they would then report back the following term, and a decision would be made to buy it on an authority-wide basis." (February 2001)

However, such was the volume of software requested by the schools, at a time when there was still only one content coordinator, that this model had to be abandoned. Teachers who attended the procurement groups had rapidly become frustrated that the decisions taken at the group meetings were simply not being implemented. As a result, the NGfL team decided, in early March 2001, to change the role of the procurement groups and use them as a means of directing teachers away from the CD-based software they had hitherto been using and towards materials available on the Web. The project leader described the change as:

"... re-focusing the procurement groups to look at Web-based content and to rechange the focus and say 'OK how can this particular Web-based content be used to meet curriculum needs?' As opposed to 'What did we always use, how can we get it on the network?' or 'What's your favourite sort of maths CD?'. So I think that has been a culture change."

Culture change is exactly the right expression. Members of the procurement groups may be able to alert their colleagues back in school as to the nature of the change of focus, but it is clear that a new phase of professional development will be required if staff are to migrate from their CD and LAN based environments to an authority-wide Intranet and Web browser solution. Doubts have been expressed by teaching staff in a number of schools as to whether the NOF funded training currently on offer will be able to meet this need. Certainly the NGfL project leader is aware of the problem:

"I think there's a massive big gap there (in the training) because all that a teacher is going to do when they log on to this network initially is look for the applications they're familiar with, most of which aren't there, and panic."

It is clear, then, that the project is in a transitional phase and that it will take some months for the current difficulties to be properly addressed, if not finally resolved.

Conclusions

This is a preliminary survey aimed at exploring some of the factors that underpin the successful implementation of ICT in primary schools. The schools in question are in a transitional phase, moving from the CD and LAN based model to a broadband WAN based on Web technologies. This transition, as we have seen, is not without its problems. The Authority has failed to make available in time the software that schools needed for Key Stages 1 and 2, their new target being to resolve this issue for the start of the 2001/2002 school year. The mechanism that is supposed to replace procurement groups needs to involve teachers in a meaningful way or the Authority risks alienating them from the process and compromising the project's vision. Staff development needs to be

re-assessed because the transition to a broadband Web-based solution means that staff will have to become familiar with a new type of technology, as the NGfL project leader recognizes. Finally, the centre has to deliver an effective support service which meets the schools' need for timely responses to technical problems.

Assuming that these issues can be satisfactorily resolved, staff commitment to ICT implementation in the three primaries could be maintained and even enhanced, since the broadband network opens up new opportunities and creates new challenges in terms of teaching and learning, for example the sharing of lessons and lesson materials across the network between schools and the creation of on-line learning communities of different types across the Authority. There is also the issue of the further deployment of interactive whiteboard technology and its impact on ICT skills and collaborative learning.

Our intention is to track the changes which occur in the three schools over the next two to three years as the potential of the broadband network is progressively exploited. In particular, we will focus on the issues of teacher and pupil commitment to ICT based learning and the ways in which teachers and pupils exploit the new opportunities in the classroom.

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