

In his review of ICT in UK primary schools, Robertson (2002) argues that 20 years of relatively major investment have given rise to quite limited reforms and have not yet resulted in ICT becoming embedded in classroom practice. When we visited the 50 schools in the early '90s ICT use was in its infancy. While many classrooms had a computer, these were often switched off and appeared to be used infrequently. When they were in use, this was predominantly for individual or pairs of pupils to type up work for display or to work on drill and practice programmes. In their review of primary education from 1994-98 Ofsted (1999) states that "in the majority of primary schools, information technology skills, knowledge and understanding are not systematically taught, and almost never systematically assessed" (p.126). Although over the four years they report an increase in the whole-class teaching of IT skills to pupils in rooms with 10 or more microcomputers, they found that "the vast majority of schools are still unaffected by these changes in pedagogy: even where information and communication technology tools are used to promote learning, the teaching of information technology is mostly an adjunct activity rather than a systematic part of lesson planning" (p.127).

This chapter describes developments in primary school ICT provision and examines the role of headteachers, ICT coordinators and support staff in leading and managing its contribution to teaching and learning. The difficulties and possibilities teachers experience in changing their practice to accommodate and exploit the new technologies are documented and their views given on the implications of these for their pupils. In doing so this chapter demonstrates how, over the decade between our fieldwork visits, not only has ICT moved from having a very marginal place in the curriculum to playing a central role but is also contributing to substantial changes in primary classroom practice.

### ICT provision

The New Labour government is promoting a vision of a learning society underpinned by ever more powerful and innovative information communication technologies providing lifelong learning opportunities. Schools are crucial to this vision and, to promote their use of ICT since 1997, the government has launched a number of major initiatives. These include the National Grid for Learning (NGfL), which provided a network of information and learning materials and funding for schools through the Standards Fund and its associated *Virtual Teachers' Centre* (the latter is now closed) (DfEE, 1998a). In implementing these initiatives the DfES has worked closely with LEAs, the TTA (now the Training and Development Agency for Schools [TDA]), the British Educational Communications and Technology Agency (Becta), the National College for School Leadership (NCSL) and commercial ICT companies. Regional Broadband Consortia (RBCs) were established in 1999 to develop the provision of broadband connections to schools to enable speedy access to the internet via school or LEA-managed intranets. Funding for this is allocated each year from central funds. Training in the use of ICT for teachers and school librarians was provided by the National Lottery's New Opportunities Fund (NOF) from April 1999 until December 2003. In 2003 the combined initiatives were relaunched as the *ICT in schools*

programme with continued earmarked funding for schools to purchase ICT hardware.

Interactive whiteboards are the technological invention of the moment, with the government having pledged to put them in every school. The 2004 survey of ICT in schools (DfES/Becta, 2004) found that 63% of primary schools had at least one. In 2004 interactive whiteboards accounted for £50 million of the £252 million invested in ICT in primary and secondary schools. The DfES has also introduced new flexibilities in the use of schools' Devolved Formula Capital funding to allow the viring of more monies for their purchase. In his 2005 budget speech the chancellor Gordon Brown claimed a further £1.67 billion investment in ICT to enable schools to be "no longer blackboard and chalk" (Cross, 2005, p.6).

The 50 schools we visited were at different stages in the development of ICT provision and use. Depending on the stage that they were at, ICT priorities in relation to classroom practice were to:

- install or update computer suites
- purchase mobile trolley systems with laptops
- increase the number of PCs in classrooms
- install data projectors and/or interactive whiteboards
- provide teachers with their own laptops
- network all the computers together linked to a server, to enable all available programmes to be accessible
- provide internet access
- move to wireless-based systems.

In schools with ICT suites the majority of teachers were in agreement that the provision of a computer suite had made an enormous contribution to more effective teaching of ICT skills and use across the curriculum. A unit of work to develop particular ICT skills could take over a term when taught in the classroom with one or a pair of children working at their own pace, on one or two classroom computers, perhaps with the assistance of a parent helper. However, through focused whole-class teaching in a suite, such a unit could be taught and assessed in a couple of weeks. Children's queries and ideas could be shared with the class and responded to immediately by the teacher.

Depending on the number of classes requiring use of the suite (some larger schools had two ICT suites), classes were timetabled for an ICT skills lesson each week, a general lesson when literacy or numeracy programmes might be used or research carried out for other subjects, and classes could sign up for any other available timetable slots. A few ICT coordinators also commented on the increase in teacher motivation and competence derived from using the suite because teachers were able to concentrate solely on teaching ICT. They prepared more thoroughly for such lessons and, as their confidence grew through greater familiarity with the hardware and software, were more likely to experiment. This was thought to be particularly the case in the small minority of schools where a technician or teaching assistant for ICT was available before and during the lesson to deal with any technical problems that arose and to offer advice.

Small schools, and schools with insufficient space to create a computer suite and no possibility of extending the school building, concentrated on building up computer access in classrooms and mobile provision:

*Each classroom has two computers for the children to use. This year we have just got six laptops for the children on a trolley and they have got wireless connections so they don't have any wires whatsoever. You can use the internet without having any use of wires, use the printers without plugging them in and so they are great. They are really portable and the children love them because they are laptops. (Year 3/4 teacher, 144, June 2003)*

The positive view of laptops expressed above by the Year 3/4 teacher was a minority one as generally laptops were regarded as “too temperamental”, “too vulnerable”, “too prone to batteries going flat” and “too prone to being tampered with”. Teachers described how they often found them extremely frustrating: “I have nearly thrown that trolley out of the window several times because I have wasted an entire afternoon doing nothing apart from setting up the laptops and realising that they don't work, trying to sort the problem out, putting them away, and ‘Oh look, that is the end of that!’” Such problems were exacerbated when provision was inadequate:

*My ICT lessons are usually delivered in the ICT room. When I use ICT in other subjects I would use the laptops because I can't get in the computer room ... we have only got 9 laptops and I have got 32 children in my class so that is almost 4 to a laptop which isn't a good idea. I have got a teacher's laptop so I always get mine out and let them use that, and I always think... umm... could be trouble! Then one group might use the computer in the classroom or whatever, but that is quite slow. So I think that it is all very nice in principle, but if you haven't got enough resources sometimes it can get a bit problematic. It is the logistics of it all I think, especially with it being such a big school. (ICT coordinator, 444, June 2004)*

As was found a decade ago, enabling children to develop their ICT skills through productive use of one or two classroom computers was generally viewed as difficult. This was because any group or pair of children working at a classroom computer were likely to be missing aspects of teaching, distracting other children and not getting the support needed to move on their learning:

*I find it very difficult – meaningfully using a computer in many lessons. Because if I'm teaching for example, a maths concept, I want the children to be listening not over in the corner on a computer. And then when I'm working with a group obviously I don't want somebody from that group out working on the computer. Now it may be that, if I've got something appropriate, children from another group can be working on it, but then of course they can be frequently needing help or coming to me asking questions about what's going on with the computer. I do find it quite difficult using it in all lessons in the classroom situation. Having said that, I really enjoy teaching ICT up in the ICT suite. (Deputy head, 212, June 2004)*

Headteachers all expressed concern at the enormity of the costs involved in installing and maintaining an up-to-date system. They referred to the speed with which hardware becomes out of date, the knock-on effect of replacement

when new equipment is often not compatible with existing provision and the continual technical problems with individual PCs, the network and internet access, particularly with older equipment. Headteachers who felt they had insufficient ICT expertise were especially anxious about the financial implications of decisions on ICT and the costly nature of mistakes. For example, one headteacher was overseeing the amalgamation of her school with another and was making decisions about how best to integrate the provision in both schools:

*The financial implications are a nightmare because everything needs updating so regularly. The other thing that I find a nightmare is that everyone is telling you what you need! If you are not technically minded... which I don't pretend to be, you don't know what to believe and what not to believe. You don't always know what the best course is to take.... The ICT suite has 15 computers but they are old and need replacing, the majority of them, so what we have done is, leading up to amalgamation each school has bought a trolley of 16 wireless laptops. So when we move to the new school we will have 32 wireless laptops and we are currently doing an audit to see which of the computers in the suite will transfer to the new school to run the whiteboards. Also because we need to update the server which is another massive financial implication ... we have to have a new server and the computers that we have got won't run on the new server because they are not good enough! So again that financial implication. (Headteacher, 180, Dec 2004)*

One inner city school was in the process of a radical update in order to remain at the forefront of ICT innovation. It had moved to broadband, increased the power and speed of 80 of its 120 computers with gigabyte cards to enable video conferencing in classrooms, replaced Promethium whiteboards with Soft Touch Boards, bought projectors with higher resolution images and installed a video server to stream videos direct to classrooms. The headteacher explained that financing the ICT developments had been made possible by a combination of government ICT funding saved from one year to the next in order to buy equipment in bulk at reduced costs, control over the “full budget share” as a result of being “a self-sustaining school”, and being able to use monies from the Excellence in Cities programme to fund other projects, leaving more of the school budget to spend on ICT and staffing economies:

*We don't have any facility to collect much money from parents. It is about being creative with your budget. It is about being three-form entry and being big. It is about running large class sizes so most of our class sizes are 30. We run vertically grouped classes to make sure that we get up to 30. We have been very economical with staffing which has released other money to put into some of the technologies that we have got. I have to say it has been my vision rather than the staff's vision initially, but I have managed to sell that vision to the staff which is part of the responsibility of leadership. I did that by saying, “Look we can go for more staff but that means we have less resources in school which makes our job harder which means that we need more staff to support us, or we can try and work a little bit smarter by using the technologies” – so we've got a pretty IT-literate staff now who are sharing resources across the network and sharing planning and lessons. (Headteacher, 564, June 2005)*

Most schools had at some time experienced the theft of equipment and realised that whiteboards in particular were attractive to thieves because they could be sold to clubs and bars for showing sports and other events. Consequently, having invested considerable sums on ICT equipment, all schools wanted to make the equipment as secure as possible, particularly in areas where theft was rife. The inner city school mentioned above that had upgraded its ICT provision had also invested heavily in security, dividing the school into seven zones that could be alarmed separately. CCTV consisting of 32 cameras covered the school entrances and perimeter, smoke screens were fitted in the computer suites and a Master Blaster alarm in the corridors. The projectors for the interactive whiteboards were encased in cages bolted to the ceiling. Although one classroom was broken into and the cage was ripped from the ceiling, it proved too big and heavy to get through the window. Projectors in the mobile classrooms were in specially made steel cabinets bolted to the floor. The headteacher thought the expenditure worthwhile, not only because it had prevented the loss of equipment, but also because awareness throughout the wider community that the school was so secure meant attacks on the premises were far fewer than previously.

### Leading and managing ICT

For a few headteachers, such as the head of the inner city school described above, leading and managing ICT was both challenging and immensely interesting and exciting. However, for all headteachers, while ICT was generally central to their school improvement plan (SIP), it was not the only priority area for development. Taking the lead in ICT was a worry to those who felt it was an area in which they lacked up-to-date skills and knowledge, not only because of the expenditure involved but also because of the need to support anxious colleagues who also lacked expertise.

Owing to the increase in administration, site management and personnel management, most headteachers spend very little time teaching and therefore do not have first-hand experience of implementing classroom initiatives such as the NLS and the NNS. The teaching of ICT skills and their application across the curriculum was an additional innovation that made some heads feel further de-skilled:

*I wouldn't ask anybody to do anything that I wasn't prepared to do myself, but I have to say that some of the teachers are more skilled than I am in ICT certainly. We have classes with interactive whiteboards and I am de-skilled, I haven't had to get to grips with that and so that is something that they are better at than me. I can't set them an example in that. (Assistant head, 470, Oct 2003)*

Coordinators worked collaboratively with headteachers in leading and managing ICT, although their influence over decisions, particularly major expenditure on hardware, varied according to their expertise in ICT, confidence and status within the school. Given the monies involved in ICT development, coordinators felt considerable responsibility to ensure that their advice was based on thorough research. A few ICT coordinators were allocated the role because of their qualifications and past experience (eg three coordinators had a first degree

wholly or in part in ICT). However, more usually, where needed the role was given to whoever was willing to take it on. “Because no one else wanted it basically” was the most common reason given for becoming an ICT coordinator.

Despite government investment in ICT training for schools, ICT coordinators, like headteachers, claimed to have developed their expertise predominantly through their own efforts and the assistance of family members, friends and school governors whose work or hobbies gave them up-to-date knowledge of ICT:

*I'm pretty much self-taught really. My daughter has been helping me out because she actually did a degree in computer science when she was at university and I was a complete and utter dinosaur before then. She actually bought the first computer that came into our house and got me started. She doesn't live at home any more, but whilst she was at home she would do this and that and I just picked the rest of it up really on my own because I quite enjoy it. So I can actually get carried away spending hours doing that. (ICT coordinator, 113, Feb 2005)*

The role of ICT coordinator in the 50 schools included all or most of the following responsibilities:

- to write ICT policies, eg on internet use
- to advise on the teaching of schemes of work for ICT such as those provided by QCA and/or to lead development of a school's own scheme
- to provide advice on the use of ICT across the curriculum
- to oversee and make recommendations for updating software and hardware
- to liaise with other subject coordinators about the evaluation, purchase and use of software for their subjects
- to sort out technical problems (with or without the assistance of a technician or teaching assistant (TA) with ICT responsibilities)
- to set up the school website and/or to oversee its updating
- to organise and deliver staff training in ICT
- to monitor the teaching and learning of ICT across the school
- to keep abreast of issues such as child protection and email use.

Generally the role was viewed by those who did it and by other teachers as an “extremely demanding” and “highly pressurised role”. This was because not only did ICT coordinators manage and lead ICT in the same way as those coordinating other curriculum subjects, but they also spent enormous amounts of time tackling seemingly endless technical hitches:

*The technician only comes in on a Monday afternoon, so if you have a problem Tuesday morning it could take ... almost a week for it to get sorted out. I mean I can sort some of the problems out but something like the complex networking problems that you can sometimes come across just go straight over my head. You know, it comes up with jargon on the screen saying this and that is happening or there's a firewall implemented which is stopping the TCP/IP and I'm looking at it thinking "I haven't got a clue what it's talking about". So I go and email the technician so he comes in and he knows what to expect, he knows what to do before he gets here. So I mean it's a rewarding area but it can be really frustrating at times. And there's always things to be done. (ICT coordinator, 196, Nov 2004)*

As ICT was a priority area for school development, the purchase of new hardware and software was generating an escalating need for extra training and continual staff support. A designated ICT TA could help enormously both in providing such support and in maximising children's use of ICT provision (see also Box 4a). As described by a Year 4 teacher, as only half a class could work individually at a computer in their computer suite, lessons in ICT skills were often taught collaboratively by the teacher and the ICT TA:

*Well, what usually happens for the ICT lesson is the teacher takes the whole class up when they're doing the objective for that lesson, and introduces it and then they will leave a group in the ICT room and she [the ICT TA] just takes over and carries on doing the objective with a little group because we can only fit 10 children in as there's only 10 computers. We could fit, like 20 in, which means sharing a computer but that's not always ideal, especially when they're getting older as well. And then the teacher takes the rest of the class back to the classroom and does something related to what the others are doing in the ICT suite. For instance, this afternoon, mine are doing cutting and pasting because we've been doing instructions. We've mixed all these instructions up that we did yesterday when we made some beans on toast so some children are going to the ICT suite this afternoon to use cut and paste to unjumble them and put them in the right order, and the children in the classroom are actually cutting out and pasting onto another sheet of paper, and then we're going to discuss, when they've all had a go, what way we found easiest. (Year 4 teacher, 220, Oct 2004)*

Nearly all headteachers considered that there were one or more teachers in their school who lacked confidence in using ICT and were therefore hesitant in, or resistant to, using it. At the time of the school visits most schools were installing or expanding the provision of interactive whiteboards in classrooms, which required staff to learn how to incorporate their use in teaching:

*Some people are using them very well and have taken them on board and are wanting to use them and are quite intrigued by them and enjoy what they can do with them. Other people want to walk past them and would much rather have a stick of chalk and it's not necessarily the older members of staff who want the stick of chalk, which is quite interesting. Some of the younger members of staff, particularly if they were trained in the '80s, seem to have missed the IT surge. It's coming up now from colleges and universities, but the '80s younger people are quite fearful. (Headteacher, 328, July 2005)*

Staff who were anxious about incorporating ICT into their teaching were usually viewed as requiring gentle persuasion and considerable support. For example, the headteacher and ICT coordinators in the junior school described in Box 4a (later in this chapter) tried to alleviate teachers' unfamiliarity with ICT by providing extra help, such as "crib sheets to follow in lesson plans" which gave individuals step-by-step instructions on how to operate particular programmes. Boosting staff confidence in, and understanding the potential of, interactive whiteboards was crucial for all classes to derive benefits from them. One of the two ICT coordinators explained how they tried to enthuse staff by introducing them to ways in which the new technology could enhance the teaching of subjects in which they had a particular interest:

*The idea when we introduced the interactive whiteboards was not to say "this is what you have got and you have got to use it" and the head didn't want us to do that anyway. One of the teachers in Year 4 is a phenomenal artist and she is art coordinator. So [the other ICT coordinator's] idea was to just show her one thing that she could use with art and the Smart Board and let her run with that and then wait for her to come back and say, "I really like that, can I have something else?" Just a little bit and that is what she has done. It has worked. We don't feel that there is anybody who hasn't got off the ground floor with the Smart Boards. (Part-time ICT coordinator, 580, June 2005)*

However, one headteacher, who had taken over a very low-performing school with inadequate ICT provision, found staff "absolutely terrified of ICT" and required pressure from her to get them to move forward. She described how the first stage in ICT development was to put a new computer and an interactive whiteboard in each class and provide every member of staff with a laptop. Once this was done she would insist that these were used:

*I like to say things straight, I'm a very straight person, and I've said that we'll all get a laptop because we're all going to plan and a member of staff came to me and she said, "Well I don't need a laptop because I'll do my planning by hand" and I said "No you won't. You will be planning on the laptop and sharing because then, when you've done it one year, you've only got to tweak it the next year and get it even better and high quality" and this sort of thing. I think some people are waiting to see whether I put my money where my mouth is and make it, but I shall, I'm determined. (Headteacher, 647, July 2005)*

### Staff training

There was much dissatisfaction with the New Opportunities Fund (NOF)-funded training which only met its expected outcomes in about a third of all schools (Ofsted, 2004) – a failure that Ofsted attributes to its over-ambitious aims, the insufficient differentiation of provision to meet the diversity of teacher needs and teacher disillusionment with the self-study elements of the training. However, irrespective of the success or otherwise of NOF-funded training, schools require considerable follow-up training on courses provided by LEAs, private consultants and/or school-provided professional development opportunities in ICT, to help teachers consolidate and update their skills and enable ICT to become embedded in their practice.

In the 50 schools training staff in the use of new hardware and software in order for them to have full and confident use was an ongoing problem:

*The big issue is we've got whiteboards but we're not using them enough. One of the teachers uses it because she got it first and she's been practising, so we've got to develop the use of the whiteboards in the classroom. And then another issue is getting the children to use more – it's not just computers, we're getting the children now to use the camcorder and do multimedia presentations. We want them to do more work with interviewing people with tape recorders and then putting*

*that onto the computer. You know, developing their skills.... And the hard thing is, we don't have the skills and we've got to get the skills to give it to the children.*  
(Headteacher, 43, June 2004)

As the headteacher of the inner city school that had invested heavily in ICT explained, although teachers were provided with a training session in the ICT suite at least once a month, to keep up with developments staff ideally needed weekly training sessions. However, in addition, the ICT coordinator, who had worked as an LEA ICT advisor, gave weekly informal staff workshops to demonstrate the use of new software, or “clinics” when individuals could seek help with specific queries. These were used regularly by most staff and were thought to be very beneficial. Nevertheless, the coordinator felt that staff were “becoming overwhelmed”, unable to keep pace with developments and needing a period of consolidation to “assimilate what is there”.

A few schools had bought in LEA expertise to provide whole-school training days or found ways of buying in external help from consultants, such as the small school where teachers used their individual learning accounts to fund a computer course that was attended by all support staff as well as teachers. Schools benefited when support staff were trained alongside teachers but this was difficult to organise as training generally needed to take place at times when they were not in school, and so relied upon their voluntary unpaid attendance. Most of the training appeared to be provided by the headteacher and/or the ICT coordinator. For example, at the time of the interviews, giving staff instruction in using whiteboards was the main training issue. As one headteacher of a large school explained, 18 whiteboards had just been fitted into classrooms at “colossal expense” but the potential benefits of this expenditure could not be realised until the teachers were able to use them. Consequently, he intended to undertake training and then train his staff himself.

Trying to find effective ways of training staff in new equipment and resources, particularly before their own skills were fully developed, created considerable difficulties for ICT coordinators. They had tried various approaches including:

- PowerPoint presentations in staff meetings
- supplying staff with trial resources and requesting feedback
- producing handouts on the use of new software
- arranging demonstration lessons by LEA advisors
- working alongside colleagues to plan and prepare lessons using ICT.

As claimed by Ofsted (2004), “working alongside others in the classroom is often the most effective form of in-service training” (p.26). However, this seldom occurred in the 50 schools because buying in external help was expensive and ICT coordinators seldom had non-contact time in which they could work alongside colleagues. However, a small minority of schools had either appointed, or were considering appointing (see Box 4a) a TA specifically for ICT. As illustrated in the quote earlier from the Year 4 teacher, such roles could contribute to staff development.

### Case study of one school's provision and use of ICT

The portrayal of ICT in a large junior school given in Box 4a below brings many of the issues together. It illustrates the school's developing provision and the ways in which this is used by teachers and pupils. It shows how the leadership and management of ICT was shared between the headteacher and other members of staff and how ICT was having an impact on planning, tracking and reporting pupil progress. It also reveals how the school intranet with its "shared areas" brought work in the ICT suite, class-based lessons and pupil independent working into a closer interrelationship.

#### Box 4a: ICT at a junior school (580 pupils)

Over two years from 2003 this large junior school, two thirds of which was housed in mobile classrooms, underwent a major building programme, paid for jointly by the government and the LEA, that included a new hall, 16 classrooms, a music room and a staff room. At the same time the school paid for the old magistrates' court on the school site to be joined to the new buildings and converted it into two ICT suites (court one and court two), with 16 computer stations in each. The suites opened into each other so they could be used together for staff training sessions and computer clubs. Having all the school housed in one block enabled the two computer suites and all the classroom computers to be networked to the server, with points throughout the school where other PCs and laptops could be plugged in.

#### Interactive whiteboards

In 2004 the head attended a *Strategic leadership of ICT* (SLICT) programme of in-service training for senior staff provided by the NCSL, Becta and the DfES. He came back with two key messages. One was that, when introducing interactive whiteboards, they should be installed simultaneously in all classrooms rather than introduced in dribs and drabs, thus enabling staff to be trained together and to support each other by sharing experiences and ideas. By drawing on capital funding for three years, Smart Boards with surround sound were purchased for every classroom together with laptops for each of the 28 teachers. A two-year programme of staff development was implemented, designating one in three staff training sessions for ICT using mainly LEA ICT consultants and through sessions in the weekly staff meetings. For example, at the time of the school visit, the deputy head was introducing the staff to a new assessment and recording package which had been put on the network.

The head regarded the school's approach of "moving everyone forward and no one having the option to say 'I am not going to do it' as having been very successful" because although "there is still a range of expertise ... some of the teachers are amazed themselves about how quickly they can move forward". Also, "there is an element as well where people don't want to get left behind so they have to push themselves". During lesson observations, he was increasingly seeing excellent examples of interactive whiteboard use. However, he pointed out that, as an Ofsted inspector, he had also observed inappropriate use of whiteboards. He emphasised: "We want to make sure that we don't

just put an interactive whiteboard system into every classroom and say, 'Right things will improve because we have done that', because they won't – you have got to make sure we are using them in the right way." Consequently, he was stressing to staff "only use it if it makes the lesson better".

### **The role of ICT TA**

The second message the headteacher brought back from the SLICT course was that a key way of improving teaching and learning through ICT was to have a TA solely responsible for ICT, who could support teachers in using ICT in their teaching and work alongside them in the ICT suites. A post for an ICT TA had been advertised and the TA was to start in September 2005. The TA would also be responsible for ensuring the suite was prepared for lessons and for assisting with maintaining children's records. The ICT coordinators hoped that he or she would also be able to assist staff with technical problems, taking over the recording of technical faults in the "blue book" and liaising with technicians from the local company contracted to tackle these.

At the time of the interview a teacher on a temporary contract had this latter role because the coordinators found dealing with technical problems so time consuming that it was encroaching on their own classroom preparation as well as their ICT responsibilities. No longer having to cope with the many teething problems caused by staff unfamiliarity with the new equipment and software freed them to concentrate on monitoring, staff support and curriculum development. However, while the headteacher agreed that sorting out technical problems was a crucial issue, he did not view this as part of the ICT TA's job description. He was hoping that, if the local secondary school was successful in its bid to be a specialist school in maths and ICT, the feeder primaries to this secondary school might be able to access its technicians.

### **The ICT coordinators**

Initially the school had one ICT coordinator who set up the first computer suite. As ICT provision and use expanded, the senior management team decided it was too much for one person and made him the network coordinator. Two other teachers were brought in as additional ICT coordinators to work alongside him. When he left they took over his role and split their ICT responsibilities into those for upper and lower school. Subsequently the upper school coordinator became part time and, at the time of the school visit, she had just become English coordinator as it was felt that one ICT coordinator could manage the subject now the major development of provision was completed and the ICT TA was being appointed.

In addition to supporting teachers in the use of the new equipment, the other major aspect of their role was buying in software and advising other coordinators on the resources available in their subjects. In the first round of spending, e-credits were used to replace and upgrade software that was an integral part of schemes of work to make it compatible with the new ICT set up. In the second round the e-credits were allocated to subject coordinators to buy in resources for their subjects. At the time of the interviews the ICT coordinators were looking for new and innovative resources to support ICT teaching and cross-curricular work.

Their other priorities were:

- updating subject schemes of work to accommodate ICT developments
- monitoring the teaching and application of ICT across the school
- developing pupil self-assessment statements for ICT skills
- consideration of child safety and internet use.

The network coordinator had set up a school website but this had become outmoded, was difficult to update and so had been phased out. However, having a website was viewed as a necessity – parents and anyone seeking information about the school, such as job applicants, would expect it. Consequently, a new site was being developed by a website designer, who had offered his services on a voluntary basis, which saved the school considerable expense. This was due to go live in September 2005.

### **Use of ICT in teaching**

All classes were timetabled in one of the computer suites for two lessons a week and these lessons were used predominantly for teaching ICT schemes of work. All the classes had a proportion of their numeracy and literacy lessons timetabled in the afternoons to ensure the full use of the suites. The few remaining untimetabled slots were booked on an opportunistic basis.

The school had developed its own schemes of work in all subject areas but to varying degrees drew on those devised by QCA, and the coordinators gave advice on how ICT could further contribute to these. Staff saved all their plans and lessons in a read-only folder so they could be shared, downloaded and adapted by colleagues. Increasingly teachers were incorporating the PowerPoint presentations, video clips, internet links and CD-ROMs that they were going to use in their lessons into their plans. These could then be used not only by the teachers that prepared them but also by supply teachers and TAs covering staff absence and/or providing planning, preparation and assessment (PPA) time. However, over-reliance on ICT could prove problematic. As the head and the ICT coordinators warned: “There is a danger if you are relying completely on your laptop because if it goes down for any reason and that has happened with three of them recently, you know you can’t teach because you haven’t got your laptop there.”

As part of the school improvement plan for 2005-06 recording and tracking of pupil attainment was being moved from a paper-based to an ICT-based system. Pupils’ SAT scores and non-statutory test scores for Years 3, 4 and 5 had been inputted by a clerical assistant working with the deputy who was leading the transfer. It was anticipated that the new system would increase efficiency in tracking pupils and assist with setting and justifying targets. It would also make attainment information readily available for teachers who could use it to identify areas of weakness in their teaching, and those aspects of literacy and numeracy for which individual pupils required additional support. Six years ago the school went over to computerised reports and the practice was being reviewed with a view to updating it. Originally staff wrote the comments for use in relation to the level descriptors for all national curriculum subjects and assigned these a code number. This enabled teachers to type in the codes to produce individual reports electronically and then add an overview of a particular child’s academic, social and personal development.

All the children could log into the school intranet anywhere in the school using their name as a password to access their work in a read-only and “save to” folder. The internet service providers had installed a firewall to deny access to unacceptable sites when children accessed the internet to help with their work. Teachers considered children were motivated to pursue their learning independently by having such access. The next step in using ICT to allow pupils to make more decisions in their learning was to develop the use of other media forms and incorporate these into teaching. Examples included using the video camera to video work on fieldtrips and in English lessons, when drama and discussion were taking place, so these could be shared with pupil and parent audiences. Parents were kept informed of ICT developments and had been invited to presentations “to demonstrate what interactive whiteboards could do” because as the headteacher explained “things have moved on very, very quickly and so we wanted to take parents with us as well”.

### **The impact of ICT on teaching and learning**

As revealed in chapter 2, the introduction of the NLS and the NNS has led to more whole-class teaching than we found a decade ago, not only in literacy and numeracy but across the curriculum (see also chapter 7). Our data also suggest that increasingly whole-class teaching is likely to take the form of teacher explanation and questions interspersed with pupils individually, or in pairs or small groups, engaging in a series of short linked tasks involving oral work, pupil demonstration and written work. Internet access, PowerPoint and the installation of data projectors and interactive whiteboards facilitate and further encourage the development of this approach to teaching. The use of PowerPoint gives explanations and instructions greater presentational clarity and CD-ROMs, internet information and digital photographs can be incorporated into presentations, making them more visually attractive and providing material for pupil discussion and teacher-pupil interaction (see, for example, chapter 7 Box 7a).

### **Exploiting the new possibilities**

Teachers in the 50 schools who were becoming familiar with the use of interactive whiteboards enthused about how they could now produce higher quality teaching materials than before, which made lessons more exciting for pupils. A young teacher explained that since she was completely self-taught with regard to ICT having seldom used computers at school or college, she was initially “terrified” of using the interactive whiteboard. She got over her fear through constant use until “all of a sudden I stopped worrying about tripping over the wires on the floor and I stopped worrying if the pen didn’t work, and I started to realise what it could do”. From the moment after the science lesson she outlines below, when she thought “Wow, I couldn’t have done that if I hadn’t got it”, she tried increasingly to incorporate and experiment with using ICT in her lessons:

*I remember last year it was a really boring lesson because it was, "Do bones grow when we grow?" and most of the children know the answer to that anyway because it is fairly obvious. It is an investigation that you have to do and the idea is that the human skeleton grows. So I thought to myself I am not going to spend a whole lesson doing this and I sent the children home and they all measured somebody's femur and they had to measure people of five different ages. So I set up Microsoft Excel on the whiteboard and I took in their data and I asked them what they wanted me to do with it. So they told me what to do and I put the information in and I highlighted it all and they told me what sort of graph I needed and why. I clicked a button and there was the graph! ... one of the children who finds literacy and numeracy the most challenging put up his hand and he said, "I can see..." and his face was like that [lit up], and he said, "I can see exactly what you mean miss because that line up there means that it is getting bigger so that means they must get bigger". Then, of course, at some point it stops and someone very intelligent put up their hand and said to me "the bit where it levels off..." and he talked about the science. I know that I could never have done that, that quickly, that powerfully, in any other way because on the board you try and draw yourself a graph and you get yourself in a right muddle of a mess, don't you? So once that had gone, up came something that I found on the BBC website – it was a quiz to do with bones and stuff and we had a go at that. It was pacy, it was entertaining, the children loved it and we learnt loads and it was brilliant. (ICT coordinator, 440, June 2004)*

However, rather than viewing technology as a way of enhancing teaching, a few teachers viewed it as a barrier coming between them and the children, which reduced their spontaneity and ability to respond to children's needs and enthusiasms:

*From the point of view of having to put everything on a laptop and then delivering it through a Smart Board, is not, to my way of thinking, teaching. Teaching is a skill that you are delivering information to the children and making them want to learn. It's just a skill that I have at the end of my fingertips. I don't think at the end of a computer; I think in a different way when I teach. (Year 6 teacher, 470, Oct 2003)*

Teaching effectively and creatively using an interactive whiteboard requires more than just confidence in PowerPoint and accessing video clips and material from websites. It also requires getting used to teaching using large screen images and other unfamiliar possibilities. The lesson portrayed below was given by a teacher confident in the use of ICT and shows how the use of new technologies can bring together the teaching of ICT skills and subject knowledge – in this case history. It was also a lesson that demonstrated the power of ICT to motivate children and gain their enthusiasm.

#### **Box 4b: Lesson on ICT skills and history**

This lesson with 28 Year 6 pupils took place in the computer suite in court 1 in the school portrayed in Box 4a. The lesson's two main objectives were to "know some of the important inventions of the Victorian age" and "to learn how to use PowerPoint". The intended outcome was a virtual museum displaying what the class had learned about inventions.

The lesson began with the children sitting on the carpet in front of the teacher, who went over material from a previous lesson questioning the children on what was invented in Victorian times and collecting their opinions on the impact of these inventions on life today. She then introduced them to the idea of making a virtual museum of Victorian inventions. This was followed by a discussion of the purpose of museums and a reminder, using the interactive whiteboard, of the internet sites that they used in previous lessons on the Victorian age. Next she showed them pictures of a penny farthing and a vacuum cleaner and the class discussed the information that would be needed for these to be included in the virtual museum – date of invention, inventor, how it works, what it did and what is used today. She then showed them some search engines, including Yahoo!igans and Google, and demonstrated how to copy and paste a picture into a PowerPoint slide. She also demonstrated how to copy and paste text but stressed that they would need to read the information they found carefully and only select the relevant parts. She told them she would be assessing them on their ability to do this.

The children then went into pairs to a computer, logged on and began finding and downloading images and text for their presentations. The teacher stopped them on three occasions to talk about the effect of background colours in slides, the need to check spelling and alter key words and phrases if the search engine did not locate the material they wanted, and the information that had to be included with the images.

After they had been working for half an hour she asked them to save their work and sit on the floor in front of her while she demonstrated how to incorporate moving images and noises into their presentations. She showed them examples of the previous year's presentations using such images and noises, which they evaluated. They then returned to their computers for 10 minutes to experiment and the suite was filled with strange noises, gun shots and the sound of breaking glass. When they had selected some sounds to accompany their work she reminded them how to save their presentation in "the shared area", and then asked them to log off and return to sit down in front of her.

She then asked for volunteers who would like their presentations shown. As she showed the presentations on the interactive whiteboard, she commented particularly on the use of text and where it had been modified rather than just cut and pasted. When the bell went she promised to finish showing the presentations at the start of the next lesson.

### Resources for teaching

Those teachers who were becoming confident in the use of interactive whiteboards described programmes and materials they felt had contributed to the quality of their lessons. For example, one Year 6 teacher described how she used ICT in an art lesson on distortion:

*Rather than having a picture showing distortion and holding it up and saying "Can you all see that? No, well pass it around or all gather around", I found the same picture on the internet and put it on full screen. On the Smart Board you can spotlight, you can just put a circle around a piece of the picture that you want them*

*to look at and that focuses their attention. I showed them natural distortion first of all from the pictures on the internet – you know, reflections in the water. Then we went onto artists' sketches of distortion and then famous artists who used distortion and then I used the Smart Board to show them the activity we were going to do... which was fantastic. (Part-time Year 6 teacher, 580, June 2005)*

The internet was a massive source of information, illustrative material and teaching ideas. However, the disadvantage of having access to such quantity and diversity of material was the time spent sifting through it all, trying to decide what to use and how to integrate together different information sources. One teacher put it this way: "The internet is making teaching better and learning better, but it's not making teaching any easier really." Consequently, materials provided on government-approved sites were regarded as valuable because they saved time, their content could be regarded as sound and when they were designed to serve a specific purpose were particularly helpful:

*When we were, for instance, studying for the SATs there was a nice website on there where QCA had put together a revision pack. So when it was my turn, if it was my maths group we would be going in there and we would be using computers to revise. The science, we had a good one with science, revision of electricity and it literally teaches and tests all the way through which is a good revision. (Year 6 teacher, 566, June 2003)*

Using commercially prepared materials could also save considerable amounts of teacher time. However, a few headteachers complained that such materials, particularly for whiteboard use, were of very poor quality: "literally putting a worksheet onto the computer". They had anticipated that whiteboard use should enable lessons not only "to be everything our lessons normally are" but to go beyond this in quality and possibilities. Other headteachers disagreed and argued that:

*You can generate your own and you can personalise all sorts of things, but that is not an efficient way to do it. If it is commercially produced they are able to do it better than you would and why should you spend all this time doing that when you are not going to be better off. (Headteacher, 580, June 2005)*

Most ICT coordinators had problems in exercising quality control over the software purchased by colleagues and a few expressed the view that teachers were insufficiently discriminating in their choice of materials, tending to make use of what was available irrespective of whether or not it was appropriate.

Teachers who were enthusiastic and growing in confidence in their use of interactive whiteboards were keen to expand the ways in which it could be used. They cited equipment they had seen demonstrated on courses and in exhibitions that they would like the school to purchase. For example, a teacher who particularly enjoyed art enthused about some equipment that would enable her to demonstrate art techniques to the class so everyone could see: "A camera that would be over your work, connected to the projector, throw it onto the Smart Board and 'Can you see what we are doing here?' Fantastic!"

### Producing and sharing lesson plans

As described in the portrayal of the junior school in Box 4a, schools were increasingly moving towards getting teachers to use computers for drawing up and storing lesson plans, presentations and resources. This process was greatly aided in schools where laptops were provided for each member of staff. The government initiative Laptops for Teachers, whereby it is estimated that two thirds of teachers will have benefited by 2006 (Ofsted, 2004), was assisting the schools in this. However, the distribution of laptops through this initiative was regarded as too slow and therefore a constraint on progress. Generally teachers viewed such developments in lesson planning and preparation as increasing lesson quality and making the production of documentation less arduous and/or rendering print versions of plans as unnecessary:

*I think that it saves me time. I think that the quality of the lesson the children do is far superior.... If I've prepared it on a slide it helps you focus your thoughts as well because I prepare my Smart slides on a night at home. So I am running through the lesson really and then I can go in and deliver a good lesson slide by slide, it is all there on the slides. Yes initially it takes time but then the better you become at using any kind of software the quicker you are at it.... Me personally I love it and it is on my knee on a night time and watching TV and fixing Smart slides. (Part-time ICT coordinator, 580, June 2005)*

### Assessing and reporting

The relative newness of ICT as a subject, the different levels of teacher confidence and expertise, and therefore the variation between classes in the opportunities provided for pupils to utilise ICT and practise skills across the curriculum, meant that continuity and progression were a cause for concern for many headteachers:

*I suppose my biggest concern with development at the minute is the fact that, whilst there's a lot of ICT going on, I couldn't put hand on heart on progression and development across the year groups and I know it was a bit of a shock to Year 6 teachers who had to do end of key stage assessment last year ready to go to secondary. And I'm pretty sure that people haven't a clue what the achievement levels are. So that's where we are. I mean, we're doing the ICT for QCA guidance – I suppose it's a help. (Headteacher, 430, Jan 2004)*

Formative and summative assessment of children's ICT skills was a priority for all those schools where provision and timetabling had been addressed and children were routinely learning and applying ICT skills. One ICT coordinator described how teachers were devising ICT assessments at the same time as they produced the plans and materials for lessons both in ICT and across the curriculum, and these were being saved to form a bank of assessment activities. Another ICT coordinator was developing groups of "I can" statements which were "basically the level descriptors but in child speak" for each unit of ICT work. When the children completed a unit, they coloured in the statement in red, orange or green to indicate their proficiency in the relevant items. Badges were going to be awarded to pupils who could demonstrate that they had achieved various levels of competency.

Headteachers and ICT coordinators also described how, as in the school in Box 4a, they were either introducing computer-based systems to track pupil attainment, identify areas of weakness and set targets or were already using technology to do this. Computer programmes also enabled the production of reports for parents that were consistent in format and adhered to the same criteria. However, at the outset, their introduction caused innumerable frustrations through lack of familiarity and/or support with the selected programmes. For example, one headteacher described her nightmare experience producing the school reports on her home computer as a result of her decision to use a now unsupported programme from her previous LEA:

*I have got a blip on the programme and so I can't transfer it to a school computer. I have downloaded a new version and I can't get the old version to talk to the new version. It is a real nightmare and I am just keeping my fingers crossed so that it will just hold together to get the reports printed out and then I am going to have a look at what we are going to do next year. We are going to have to invent or find something which is better than that. (Headteacher, 144, June 2003)*

### Impact on learning

Teachers perceived that children were much more motivated and challenged in lessons where teachers used ICT. Children were said to enjoy the visually stimulating, faster paced lessons using data projectors and interactive whiteboards. Those with learning difficulties were thought to find such lessons more enjoyable and engrossing, helping them to learn:

*Children are excited by ICT and if they can use it within their learning... Especially some of our children who aren't particularly academic it will help them to succeed whereas if you put a book in front of them: "I can't do that". We have invested in a lot of software that will encourage them, like electronic books so instead of sitting with a book in literacy it is looking at the Smart Board and they are interacting with it. Quite a lot of our children that are lower achievers are so excited by the fact that they have got this technology in the classroom. They are engrossed before the lesson has even started whereas otherwise they may be demotivated. (Headteacher, 190, June 2005)*

Having material on the interactive whiteboard which children could discuss, add to and change was thought to hold children's attention, challenge their thinking and keep them fully participating in the lesson – as indeed we observed in the numeracy lesson (chapter 2, Box 2a) and the history lesson (chapter 7, Box 7a). A few teachers reported that because of their regular use of the interactive whiteboard, children were “definitely absorbing information without it being taught” in relation to ICT skills and competencies. While previously it had taken several lessons for pupils to grasp such skills, now they were readily learned or consolidated in a single lesson. One female teacher who was enthusiastic and confident in her use of ICT also considered that “for girls, I think they find it quite empowering to see a female role model doing that”. ICT coordinators who in our sample were predominantly female also conveyed the implicit message that ICT skills were important for girls and boys.

Teachers agreed that using ICT to do their work promoted greater engagement and better concentration from most children, especially those with behavioural difficulties or who were difficult to motivate such as Year 6 pupils after SATs:

*My kids absolutely love it and to be fair at this time of the year once SATs have gone because they have peaked for SATs they are now really coming down and with Ofsted coming we are having to peak again. It is creating a lot of unrest and behaviour problems that we don't usually have. So to get in there on a more regular basis, even one offs, if I can say to the kids "oh we have the computer suite for an hour this afternoon" and they say, "Oh yes, great!" (Year 6 teacher, 566, June 2003)*

Children particularly enjoyed using the intranet and internet to search for information. For example, in a lesson on homes during Tudor times, with the assistance of a TA the children enjoyed accessing supporting material placed on the intranet. They also searched the internet to find out what Tudor homes looked like and were built from, and to contrast those of the rich and poor.

Accessing inappropriate material occasionally caused minor disruptions; for example, in one of the lessons we observed, a boy was detected by his teacher sharing with friends a sexually explicit cartoon that he had found using Google images. Such incidents increased teachers' concerns about the effects on children of intentionally or accidentally accessing violent and/or pornographic material at home, when unsupervised children might surf the internet unprotected by filtering systems. While children were taught about sending emails as part of the ICT curriculum, this was generally restricted to sending emails to one another within the class on the intranet. Teachers were similarly concerned they were teaching pupils skills that could endanger them if they used email at home. High-profile cases of online bullying, "happy slapping" and possible links between child assault or abduction cases and internet use further served to increase schools' concern about e-safety, and what they should do to make children more aware of potential risks and how to avoid them.

Data projectors and interactive whiteboards were particularly valued for the way in which ideas generated during lessons, both by the teacher and the children individually or collaboratively, could be saved and revisited whenever required:

*You can keep something, so maybe you would write something on the board and then it is gone unless you have written it down. So you can bring it back up and you can save it and you can do stuff with the children. They all work on a floppy disc and then at the end of the lesson you can choose one of those floppy discs, whack it up on the board and say, "Let's see what they have done, what do you think?" You know that is much better than reading out a story or whatever because everyone can see it, so yeah I think that it is great. (ICT coordinator, 440, June 2004)*

While the potential for ICT to motivate children and make learning more stimulating appears undisputed, the likely effect on pupil attainment and school standards is unproven. Comparative data on educational performance in the PISA (Programme for International Student Assessment) programme suggested a positive correlation between computer availability and educational

performance. However, Fuchs and Woessmann (2005), who subjected the data to further analysis, found computers in the classroom have no discernible positive effect on children's educational performance. They suggest this might be because pupil computer use could be at the expense of other teaching approaches or funds were being spent on ICT provision that might have been used for other resources and teacher training.

The Alliance for Childhood, a longstanding critic of ICT in education, also argues that so far international studies have failed to show any correlation between computer use and children's educational achievement. Its publication, *Tech Tonic*, is especially scathing about computer use in primary schools: "We remain convinced that, at the elementary school level and below, there is little evidence of lasting gains and much evidence of harm from hours spent in front of screens" (Cross, 2005, p.6). A few ICT coordinators also raised such concerns. They had discussed with staff issues such as the importance of ensuring pupils sat where they could see the interactive whiteboard, did not look into the projector light when coming to the front of the classroom to use it, and were sat comfortably when working at a PC.

However, Ofsted (2004) claims that the increase in pupils' ICT skills combined with their positive response to the use of ICT "bring clear benefits to their learning which was found to be good or better in 62% of lessons where ICT was used" and "in general, where pupils are encouraged to apply their ICT skills to their learning across the curriculum, they often make more rapid progress in other areas of their work". In the 50 schools, most teachers considered ICT, particularly interactive whiteboards, to be a powerful aid to teaching and for this reason anticipated that it was of benefit to children's learning across the curriculum. However, they felt it was too soon for schools to have any evidence as to whether, and if so how far, ICT and interactive whiteboards contributed to improved learning outcomes and higher standards.

A few teachers described how children with computer access at home had begun to follow up and extend work done in lessons:

*I have found this year more than any other year, and I know from speaking to a couple of other teachers that they have had the same thing, where we have been doing a piece of work and some children have gone home and they have brought disks in which has never really happened before. They might have done a PowerPoint presentation and they have just taken it one step further and done something with it and brought it in to show the rest of the class. (ICT coordinator, 580, June 2005)*

Although teachers thought children who did not have access to a computer at home or who used one solely for playing games were at a disadvantage compared to those whose parents supported them in using ICT for school work, only a few schools had systematically collected data on children's access to computers at home and the ways in which these were used.

Some schools were exploring ways in which ICT could be a vehicle for pupils to learn independently across the curriculum, to take the initiative in aspects of

their learning and to engage in self-assessment. For example, in one primary school the Year 6 pupils made PowerPoint presentations incorporating digital photographs they had taken during a residential visit so they could show Year 5 pupils the kinds of activities they would do when they went on a similar visit the following year. However, generally ICT appeared to be under-exploited for such purposes although teachers thought that developing these areas was the next stage, made possible by both pupils' increasing competency in ICT and the teachers' own developing awareness of its possibilities. Moves in this direction were also regarded as being encouraged by the primary strategy (DfES, 2003a), with its emphasis on personalised learning, freeing up the curriculum and allowing more pupil choice in, and responsibility for, their own learning (see chapter 6).

Most schools offered computer clubs during lunchtime or after school where they could continue their school work by visiting recommended websites, using materials placed on the school website and preparing PowerPoint presentations to share with peers. One inner city school was convinced of the value of virtual learning environments (VLEs), which enabled parents and children to access help with their work and extended the possibilities of the school as a learning community for pupils, parents and teachers. For 18 months they had participated in a VLE project. Ultimately, however, it had floundered due to its complex and cumbersome nature, security issues around children using email and the need for parent and child training in order to use it. Nevertheless, the headteacher had a vision of creating a VLE in the future that could even allow children to log on from Pakistan and Bangladesh during extended leave and so maintain contact with the school.

## Conclusion

The majority of headteachers were in agreement that change in classroom practice brought about by ICT "has been the biggest area of development in the school over the 10 years and has been fantastic". The importance of ICT as a subject in its own right, and as a tool for teaching and learning, has benefited enormously from government funding and initiatives since our original study. In the latter part of the 10-year period, the exponential increase first in the development of ICT suites in primary schools and second in the installation of interactive whiteboards in classrooms appear to be crucial factors in the rapid implementation of ICT in schools and the dramatic observable effects on classroom practice. Both of these developments enable whole-class participation in lessons teaching or using ICT skills and require the teacher to lead (directly or indirectly), manage and monitor children's learning in these lessons. This is in sharp contrast to the predominant situation in the original study where ICT use generally occurred when individual, pairs or small groups of children worked largely unsupported at one or two classroom computers, while the teacher taught and/or monitored the rest of the class engaged in often unrelated work. The increased personal and professional use of ICT by teachers – greatly aided where schools have been able to provide teachers with laptops – also seems to have played a key role in boosting teacher confidence and competence in ICT knowledge and skills, and encouraging them to experiment.

While all the 50 schools were developing in similar directions in relation to ICT, there was considerable diversity in the extent of existing and planned provision. This depended particularly on the availability of funding in addition to that made available for ICT by the government and the knowledge about, and expertise in, ICT of headteachers. Schools also had very different approaches to training teachers and support staff in using new hardware/software. This impacted on teachers' attitudes to ICT, their ability to keep pace with developments and the extent to which it was changing their classroom practice. Ongoing technical problems were a very frustrating aspect of ICT in the majority of schools. Generally teachers regarded technical support as inadequate and/or insufficiently responsive to school needs, creating considerable pressure and extra work, particularly for ICT coordinators. The other major issue raised was e-safety, with increasing teacher awareness of how to teach children about the risks and to alert parents to possible dangers.

Coutts *et al.* (2001) are critical of the fact that enormous expenditure and effort is going into ICT in schools with "no consensus within many school staff groups and in the profession as a whole as to the extent to which practice is to be transformed, and on the particular form that any transformation will take" (p.226). They found from their classroom research three rather different views and developmental agendas:

- an instrumental vision which sees ICT use as an additional subject or complementary activity
- a transformative vision held by teachers who have experienced the capacity of ICT to transform teaching and learning
- a revolutionary view which argues that constraints imposed by the system need addressing before a revolution in teaching and learning can be delivered.

Whilst believing that technology could greatly improve the quality of lessons, the general view amongst headteachers in our sample was that "it just enhances what is already there and used by a good practitioner there are some absolutely amazing lessons", and "it is just another tool in people's repertoire". It would not revolutionise teaching in schools as "you are never ever really going to find that it is going to take the place of the teacher". The 50 schools appeared to have moved well beyond Coutts *et al.*'s (2001) "instrumental" agenda and were engaging with the second "transformative" agenda. To varying degrees they all exhibited characteristics of what Coutts *et al.* term "extended schools" – one of two evolutionary positions between traditional schools and advanced cyberschools. Teachers used ICT to enhance the existing curriculum and to provide additional learning opportunities for children. They envisaged ICT as augmenting rather than challenging existing educational values and structures.

In a few schools pupils had the opportunity to exercise choice and decision making in their learning, such as through the use of digital cameras and PowerPoint presentations. Pupils could also use the intranet and internet for independent learning within the school day, as well as pursuing school-initiated interests at home and in after school clubs, sharing these with peers in the class the next day. However, only very few schools and some individual teachers were exploring ICT development as a central feature in teaching and learning in ways that began to challenge existing school timetables, organisation and processes. This is not surprising. Teachers need much more time and training to be able to maximise the possibilities that ICT offers for diversity in pupil learning. A fundamental constraint is the knowledge and skills to be covered in the national curriculum, especially the NLS and NNS, and the pressure exerted by target setting, tests and performance tables. In combination, these factors limit the time available for, and discourage teachers from, creating situations where pupils can exercise more choice and exert more control over what and how they learn. Nevertheless, as revealed by our data, ICT has caused major changes in teachers' classroom practice and seems set to have an even more fundamental impact in the immediate future.