

ImpaCT2

Learning at Home and School: Case Studies

A report to the DfES by Chris Comber, Rob Watling, Tony Lawson, Sue Cavendish, Rhona McEune and Fred Paterson

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This publication, as well as a summary sheet, is available on the Becta Research web site at:

www.becta.org.uk/research/impact2

A full report of the ImpaCT2 findings (including a more detailed description of the research methods employed), reports from the other strands of the study, the earlier Interim Findings and the Preliminary Reports, are also published on the Becta Research web site.

Other reports in the ICT in Schools Research and Evaluation series are also available on the Becta Research web site.

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Executive summary

1.1 Introduction

ImpaCT2 is one of a number of projects commissioned by the Department for Education and Skills (DfES) and managed by Becta with the aim of evaluating the progress of the ICT in Schools Programme. It is a major study (carried out between 1999 and 2002) involving 60 schools in England and is one of the most comprehensive investigations into the impact of Information and Communications Technology (ICT) on educational attainment so far conducted in the UK.

ImpaCT2 was designed to:

- Identify the impact of networked technologies on the school and out of school environment
- Find out the degree to which these networked technologies affect the educational attainments of pupils at Key Stages 2, 3 and 4.

The study involved three related strands:

- Strand 1: to develop and apply appropriate methods for evaluating the use of ICT in school and out of school, and to analyse the statistical relationship between the effective implementation of ICT and standards of performance in National Tests and GCSEs.
- Strand 2: to develop and apply a variety of methods to establish how pupils use ICT, in particular out of school, and what is gained from such use.
- Strand 3: to explore the nature of teaching and learning involving ICT in various settings, with a focus on the views of pupils, teachers, and parents.

This publication reports primarily on the outcomes of Strand 3.

1.2 Background to this strand

Strand 3 is an independent evaluation of the impact of networked technologies on learning and teaching carried out by staff at the School of Education, University of Leicester. Working in 15 of the 60 schools selected for Strands 1 and 2, this project focused on: learning and teaching environments; learning and teaching styles; and the impact of networked technologies on the perceptions of teachers, managers, pupils and parents. The study team worked with teachers, pupils and others associated with Years 6, 9 and 11.

The overarching aim of this strand was to establish qualitative evidence which could augment that uncovered in Strands 1 and 2. In a series of linked case studies, a range of research methods were employed (including observations, interviews, video diaries and group activities) to explore the *perceptions* and *understandings* of the users of networked technologies in relation to issues of teaching and learning. The study team thus attempted to give a voice to those involved in teaching and learning with, and through, networked technologies and to present a 'view from the inside'.

1.3 Summary of key findings from this strand

Research in this strand was conducted under five key areas:

- ICT in schools: practice and perceptions
- The management and organisation of ICT
- Technology and infrastructure
- Training and professional development
- Home and school use of ICT.

A number of key findings were identified in each area, a summary of which follow:

- Networked technologies are fast becoming a feature of pupils' education, and whilst valued by teachers as an educational tool, strategies for their effective use are still developing.
- Sustainability and improvement of ICT provision are key issues. As many pupils have access to superior hardware and software at home, there are concerns that demand for ICT provision is outstripping what schools can afford to supply. Additionally, shortages of space, funding and technical expertise are key factors restricting schools' ability to maintain and develop suitable systems.
- ICT suites and intranets are now almost standard, and are frequently augmented by clusters and stand-alone machines in various parts of the school. There are educational advantages and limitations with all such strategies, but a particular need for staff to have access to machines for preparation and professional development is recognised.
- Home use of technologies is developing, but issues such as equality of home access, lack of clear guidance from schools, and pupils' ability to evaluate

resources all have an impact in this area. As home computers are frequently more advanced than those available in the school environment, pupils are engaging in innovative use of the technology, which will need to be acknowledged by schools as they develop their own practice.

More detailed findings under each of the five key areas are given in the main body of the report.

1.4 Summary of key recommendations from this strand

A total of 18 recommendations have been made as a result of this study, in key areas of training, guidance and support; ICT provision and support; and development and dissemination of good practice. These are detailed in full in the main body of the report, but in summary are:

Training, guidance and support

- Whilst training to date has undoubtedly benefited teachers, there is a continuing need for training which can move beyond technical competence and concentrate on the appropriate application of networked ICT into the curriculum, along with development of transferable skills such as search and evaluation strategies for both teachers and pupils. Additionally, there is a need for specific guidance regarding the potential of ICT in the areas of Numeracy, Literacy and special educational needs (SEN), and more regard needs to be taken of the impact that ICT use in primary schools is having on secondary schools. There are clear opportunities for developing greater links between ways in which ICT is used in schools and the home environment.

ICT provision and support

- Dedicated staff machines and time should be made available to allow staff the opportunity for professional development and teaching preparation, and hardware and software need to be reliable, well-maintained and up-to-date in order to keep both staff and pupils motivated and effective.

Development and dissemination of good practice

- There is recognition among teachers that a more flexible approach is required if ICT is to be effective. Changes in lesson style to allow a less formal classroom atmosphere, greater pupil autonomy, differing modes of teacher/pupil interaction, and flexible study space are all recognised as key success

factors for effective use of ICT. Further good practice should also be developed in facilitating greater links between home and school use of ICT.

Part 1 – Introduction

Section 2 – The ImpaCT2 study

2.1 Introduction – The ICT in Schools Programme

The ICT in Schools Programme is the Government's key initiative to stimulate and support the use of information and communications technology (ICT) to improve standards and to encourage new ways of teaching and learning.

Since 1998, when the Government published its proposals to develop a National Grid for Learning (NGfL)¹, schools and other institutions have made considerable progress in their use of ICT to support teaching and learning and to improve the efficiency of school management. This reflects tremendous vision, initiative and commitment at all levels of the education sector and has been achieved within the context of the programme.

Meanwhile, the educational potential and the accessibility of new technologies in schools and at home continue to grow. The period since the launch of the NGfL has witnessed significant advances in the range of technologies and applications available to the education and home markets and in the growth of access to ICT outside of school. There is every sign that these trends are set to continue.

Hence while the progress has been significant and can rightly be celebrated, it is only the beginning of an ongoing transformation that over time will deliver exciting new opportunities for individuals to personalise their learning and realise their potential in school, at home and in the community. These opportunities will become a reality as ICT becomes firmly embedded in all aspects of school life rather than as an 'optional extra'.

A vision for the future of ICT in schools is provided in the paper *Transforming the Way We Learn*², available at:

www.dfes.gov.uk/ictfutures.

¹ *Open for Learning, Open for Business – the NGfL Challenge* (DfEE, 1998).

² *Transforming the Way We Learn* (DfES, 2002: www.dfes.gov.uk/ictfutures).

³ Becta (2001), *ImpaCT2 – Emerging Findings from the Evaluation of the Impact of Information and Communications Technologies on Pupil Attainment* (Becta, Coventry: www.becta.org.uk/research/reports/impact2).

⁴ McFarlane et al. (2000), *ImpaCT2 Project Preliminary Study 1 – Establishing the Relationship between Networked Technology and Attainment* (Becta, Coventry: www.becta.org.uk/research/reports/impact2); Lewin et al. (2000), *ImpaCT2 Project Preliminary Study 2 – Promoting Achievement: Pupils, Teachers and Contexts* (Becta, Coventry: www.becta.org.uk/research/reports/impact2).

2.2 ImpaCT2

ImpaCT2 is one of a number of projects commissioned by the Department for Education and Skills (DfES) and managed by Becta, with the aim of evaluating the progress of this programme. It is a major study (carried out between 1999 and 2002) involving 60 schools in England and is one of the most comprehensive investigations into the impact of Information and Communications Technology (ICT) on educational attainment so far conducted in the UK.

The observations made as part of the study took place during the early-mid period of the ICT in Schools Programme, during which the nature of ICT in schools, in terms of both provision and practice, have been developing. This publication is intended to present the key findings from the third strand of the ImpaCT2 study for a broad audience, including teachers and parents and all others interested in school-age education.

This publication, as well as a summary sheet of the ImpaCT2 study, the earlier Interim Findings³ and the Preliminary Reports⁴, is available on the Becta Research web site at:

www.becta.org.uk/research/impact2

Further publications in this series will set out the findings from other strands of the study. A full report of the ImpaCT2 findings (including a more detailed description of the research methods employed), is forthcoming, and will also be published on the Becta Research web site.

Other reports in the ICT in Schools Research and Evaluation series are also available on the Becta Research web site.

2.3 Objectives of the study

ImpaCT2 was designed to:

- Identify the impact of networked technologies on the school and out of school environment

- Find out the degree to which these networked technologies affect the educational attainments of pupils at Key Stages 2, 3 and 4.

The study has taken place against a background of the developing nature of technology. Most obviously, it was important that the study took full account of the difference between networked ICT and computer-based learning as it existed prior to the recent expansion of the Internet and its penetration into schools and homes. It was also anticipated that the impact of ICT on curriculum learning would depend not merely on what went on in the classroom, but would be a result of many other factors. These include the use of ICT outside of school, and especially in the home, as well as its use in school outside of lesson time.

Consequently the study was extended to cover all of these areas, and sought to address the following questions:

1. What is the involvement of pupils with computers and the Internet at home and in school?
2. Does curriculum use of ICT have an effect on pupil performance and attitude?
3. Are these effects confined to use in school?
4. Are all kinds of computer use equally helpful to learning?
5. If ICT-based learning involves interactions between home and school, what are the problems that arise and how can these be resolved?

2.4 Organisation of the study

The study involved three related strands:

- Strand 1: to develop and apply appropriate methods for evaluating the use of ICT in school and out of school, and to analyse the statistical relationship between the effective implementation of ICT and standards of performance in National Tests and GCSEs.
- Strand 2: to develop and apply a variety of methods to establish *how* pupils use ICT, in particular out of school, and what is gained from such use.
- Strand 3: to explore the nature of teaching and learning involving ICT in various settings, with a focus on the views of pupils, teachers, parents and managers.

Strands 1 and 2 were combined within a single project to be run by a team of researchers from three universities

under the general direction of Professor Colin Harrison at the University of Nottingham. Strand 3 was a separate project carried out from the University of Leicester under the direction of Dr. Chris Comber, and involved 15 of the 60 schools that had been selected for Strands 1 and 2. This publication reports primarily on the outcomes of Strand 3, but draws on some material from the other strands of the study.

Section 3 – The approach taken in Strand 3

3.1 Background

In recent years there has been a growing emphasis on the use of technology in educational contexts. The National Grid for Learning (NGfL) programme has increased dramatically the provision of ICT resources in school and training for teachers. Meanwhile the rapid development of communications technologies such as e-mail and the World Wide Web is reflected by the fact that the 'C' in 'ICT' is now used throughout the recently revised Curriculum documentation, signalling the continuing shift away from the notion of 'computing' as a completely discrete domain of study, towards seeing ICT as a range of powerful resources which will play an increasingly central role in all areas and phases of study.

The extent to which these changes have affected the way that teachers teach and learners learn is at the heart of this case study evaluation. By seeking the views of school managers, curriculum co-ordinators, classroom teachers, pupils and parents, and by observing the use of ICT in practice, the study have sought to answer a number of key questions about the current and possible future place in our schools of ICT in general, and networked technologies⁵ in particular. In doing so, it is hoped to build upon and add to the work carried out in Strands 1 and 2 of ImpaCT2.

3.2 The study

ImpaCT2 Strand 3 is an independent study of the impact of networked technologies on learning and teaching carried out by staff at the School of Education, University of Leicester, related to, but separate from Strands 1 and

⁵ A glossary of terms can be found in the appendix to this report.

2 of the ImpaCT2 investigation. The Strand 3 remit was a complex one. The study team were required to explore learning and teaching in both formal educational structures and home-based access to networked technologies, which are themselves expanding as more and more pupils have access to the Internet from home. The central focus of this study is therefore on learning and teaching environments and styles, and the impact of networked technologies on the perceptions of pupils, parents, managers and teachers, in regard to these.

The aim in researching the case study schools was to explore the perceptions and understandings of the users of networked technologies in relation to issues of teaching and learning. The study team was thus required, by the project remit, to give a voice to those involved in managing, delivering and employing networked technologies. By collecting detailed and rich descriptive data, through a variety of methodologies, this report presents the 'view from the inside'. In so doing, this report aims to deepen the understanding of the issues identified in Strands 1 and 2 of ImpaCT2 and provides pointers to the challenges faced by those dealing with networked technologies in educational contexts.

3.3 The case studies

The case studies therefore explore:

- Teachers' attitudes towards and definitions of the effectiveness of ICT training programmes
- Teachers' perceptions of the impact of networked technologies on their teaching style
- The range of actual teaching styles deployed when using ICT
- Pupils' perceptions of the impact of networked technologies on their learning
- Pupils' and teachers' perceptions of the impact of networked technologies on pupil attainment
- Pupils' and teachers' understanding of the value of using networked technologies in terms of wider benefits than attainment
- The impact of collaboration between pupils and between teachers and pupils on styles of learning in the ICT environment
- Pupils' and teachers' accounts of the relationship between home and school use of networked technologies

- The impact of out-of-school and in-school use and experience of networked technologies on attainment.

In analysing the results of the various measures employed, certain themes emerged from the concerns expressed by teachers, pupils, managers and parents that formed a natural framework for detailing the findings. These main themes constitute the substantial sections of the evaluation:

- Teaching and learning
- Professional development and training
- Management and organisation
- Home-school links
- Technology and infrastructure.

However, a number of sub-themes also emerged that cut across the main sections and provide inter-linking threads:

- Curriculum models and classroom delivery
- Achievement/performance
- Pedagogy
- Key personnel
- Specific issues linked to networked technologies
- School policies.

3.4 Methodology

The principal approach to this strand of the ImpaCT2 project has been that of linked case study. 15 of the 60 schools selected for Strands 1 and 2 had a series of visits from the case study team, organised in three phases over a period of two school terms. The case study schools participated in a range of research activities designed to explore the research issues at three main levels: at the institutional level of specific schools; at the classroom level in terms of teaching and learning; and at the individual level of teachers, managers, pupils and other stakeholders.

Sampling and methods

The study team followed a stratified random selection procedure to identify a total of seven primary schools, seven secondary schools and one special school, representing as far as possible an even distribution of 'Average' and 'High' ICT schools across the country (using criteria developed by the Strand 1 team). As in Strands 1 and 2, the case studies concentrated on three

cohorts of pupils, their teachers and their parents, though the sample for Strand 3 was in the academic year following that of the main study:

- Cohort 1 (pupils entering Year 6 in school year 2001/2)
- Cohort 2 (pupils entering Year 9 in school year 2001/2)
- Cohort 3 (pupils entering Year 11 in school year 2001/2).

The case studies have employed six key research methods:

- Semi-structured interviews with key staff and pupils. These were designed to explore the attitudes and perceptions of those teaching or learning through networked ICT.
- Semi-structured observations of specific lessons using a framework developed from Scrimshaw (1997). Lightweight video cameras were used to record key events.
- Stimulated recall of these key events with classroom teachers using the video recordings.
- Video and e-mail diaries by selected pupils and staff describing their use of ICT in school and at home.
- Facilitated group discussion with pupils to explore home-school use of ICT and their perceptions of its strengths and weaknesses.
- A telephone/e-mail questionnaire to selected parents to investigate factors of home ICT facilities and parental involvement in their children's use of ICT.

Identification of sources

Participants were assured that every effort would be taken to ensure that no individual school or informant would be identified in the reporting of this project. Consequently, pseudonyms have been used for all schools cited in this report and some minor changes to direct quotations have been made.

Part 2 – Case study evaluations

Section 4 – ICT in schools: practice and perceptions

The key findings from this section are:

- The introduction of networked ICT into schools in recent years through the NGfL, and the provision of training, support and resources, have all been recognised by teachers as inevitable and valuable, but problematic. Relatively few teachers in the sample offered direct evidence of ICT's impact on attainment, preferring instead to concentrate on its positive effects on behaviour, motivation, communication and process skills, and that it enables pupils to learn more autonomously.
- Networked technologies (particularly the World Wide Web) are fast-becoming a regular feature of pupils' education (at home and school) and are valued for the range of resources to which they can provide access. But strategies for their effective use are still developing. Teachers and pupils are clear about the potential of ICT, but not always able to articulate what is being learnt as a result of its use.
- Some of the best examples of the use of ICT were observed where the lesson moved through different modes of teacher/pupil interaction, which involved both in a variety of roles, and where intended and actual use came together.
- Access to a computer at home is thought to be more important than factors such as age or gender, and (relative to other core skills), even very young pupils now arrive at school with a fairly high level of computer competence.
- Teachers singled out children with special educational needs (SEN) as among those who were especially likely to benefit from access to ICT. There was however a general lack of awareness or knowledge among special educational needs co-ordinators (Sencos) concerning the potential of ICT for these pupils, either in terms of its general use, or regarding more specific programmes or equipment which might assist in meeting individual needs.

4.1 Introduction

This section is concerned with ways in which the integration of ICT and networked technologies into the curriculum tends to produce changes in the patterns of teaching and learning. The principal focus is, therefore, on what happens in classrooms as teachers teach and children learn with ICT. As in other sections, findings are categorised according to a number of themes and sub-themes which represent issues which the study originally set out to explore, and those which emerged from the data during analysis. The major themes which frame this discussion are:

- Impact on learning
- The use of networked technologies
- Approaches to teaching and learning
- Individual and group differences.

4.2 Impact on learning

4.2.1 Attainment and attitudes

Relatively few teachers were confident that they had evidence of gains as a direct result of ICT in standardised tests of attainment such as Key Stage tests, or exams. Nevertheless, the impact of ICT on attitudes and behaviour, its potential to aid understanding of processes and to enable more autonomous modes of learning, as well as its capacity for information gathering, data manipulation and communication with others, were among a broad range of factors which teachers perceived as likely to have an impact on pupil achievement.

The well documented motivating effect of ICT (Cox 1997) was a common factor in these descriptions, and while some saw this as an end in itself (as it captivated pupils who were previously hard to engage) it was often linked to shifts in pupils' attitude to and involvement in learning activities:

"The children ... are completely committed to doing that work, finishing that task ... you can certainly see the motivation. They will all want to go on the computer and the work they produce is far superior, and not just in terms of presentation ... they have more time to consider the consequences of what they are learning."

Year 6 teacher & literacy co-ordinator, Westbrook Primary School

Not only was ICT generally perceived to encourage pupils to become more focussed on the task, but it was also seen by some teachers to enhance both the performance and cognitive functioning of those who had hitherto been on the margins of classroom activity, or traditionally had performed poorly.

“From a motivational point of view, which consequently leads on to better attainment ... that [lesson] was a huge success. Those students got [good] marks in that lesson when I had struggled with them all year to get anything out of them at all. They were coming up with their own ideas and generating, planning and evaluating what they were doing in a way they had never done before.”

Chemistry teacher, Arkwright Secondary School

4.2.2 Understanding of process

The contribution of ICT to the production and presentation of work was often cited as among its most immediate benefits, although some teachers tended to describe this in somewhat functional terms. The fact that ICT can aid presentation, for example, was mentioned by several teachers, and while this was sometimes linked, as we have already seen, to motivation and self-esteem, several cited this as a positive end in itself, or at least the wider benefits were not articulated.

However, many of the teachers reported on the capacity of ICT to enhance not only the product of a given learning activity, but also the process of learning itself, suggesting that ICT can liberate learners from mundane tasks, and allow them to concentrate on higher order skills. A secondary teacher describing her pupils' use of presentational software, for example, told us that they had been far more prepared to edit and structure material than they had done with traditional approaches. Further discussing the use of a spreadsheet to investigate data, the same teacher argued that ICT had the potential to liberate her pupils from the mundane, allowing them to concentrate on higher order skills:

“They are spending a large proportion of their time drawing diagrams and things like that ... they don't need to understand how to do that anymore, they can do that... They need to understand how they are used.”

Economics & business studies teacher, Dalton Secondary School

A primary school numeracy co-ordinator, also discussing the use of a spreadsheet package, illustrated that this potential was not confined to the secondary phase:

“Some of my children came up with some fascinating graphs ... they could spend the time thinking about the questions they were asking and the information they were collecting, rather than ‘have I coloured this square in properly’.”

Year 2 teacher & numeracy co-ordinator, Broadway Primary School

A design and technology teacher in Dalton Secondary School described the contribution of ICT to the various stages of a GCSE project, in which the pupils were required to plan for and build a three dimensional model. The use of the Internet was said to ‘bring a new dimension’ to the research phase of the process, extending the relatively limited and dated reference materials available in the school. By using software which allowed the testing out of aspects of their design, the pupils were also able to reduce the time typically given to this aspect of the process, and have considerably greater flexibility in testing out ideas in a way which would either be beyond them because of limitations in skills or the materials used, or would be impractical in a crowded GCSE timetable.

“they are not limited by their own manipulative skills ... they can play around with different things, like finish, texture ... that they couldn't do [in a real situation]. So not only does this reduce workload, but it enhances their ability to come up with an answer to that particular problem.”

Design technology teacher, Dalton Secondary School

This sense of ICT developing and extending the ability of learners to manipulate and process information was a theme to which many teachers returned when asked to consider the impact of ICT on achievement. In essence the claim was that ICT can enable learners to interrogate information in a variety of ways, and speedily produce accurate representations of their data. This allowed the teacher to focus on developing the pupils' understanding of the outcome of their investigations,

rather than (for example) have them spending most of the lesson laboriously – and often imprecisely – drawing charts by hand.

“Networked technologies give students a breadth of resources and access to information potentially so much greater than a project box or a book. It puts students more in control of what they are accessing and they can speed ahead if they are more able, and as long as information is accessible for all abilities, it can be a very positive experience.”

Geography teacher, Arkwright Secondary School

4.3 The use of networked technologies

4.3.1 The Internet and World Wide Web

While the Internet cannot yet be said to be a regular feature of school life, its usefulness for finding information about a given subject or topic was one of the most commonly cited strengths of networked technologies, not only by teachers, but also by pupils and parents. The attractiveness and currency of World Wide Web resources and the ability to go beyond the school's repertoire of resources were all commonly cited reasons for using the Internet. Teachers also acknowledged, however, that material which children found on the Internet could be inappropriate or at a level which was beyond their understanding:

“...just because [the information was] printed out off the Internet does not make it important...just because it says ‘Mount Everest’ on it doesn’t necessarily mean it is relevant to what they want. If I gave them a school atlas to look at then it’s aimed at their ability level, whereas the Internet isn’t always.”

Year 6 teacher, Hanover Primary School

Moreover, while almost all of the teachers interviewed were convinced of the potential of the Internet, not all were clear about how to develop its effective use or to integrate it fully into learning activities. In particular, many failed to fully differentiate between information retrieval and research. Pupils' frequently described using the World Wide Web for 'doing research' (often at home as well as at school). However it was clear that the term 'research' was used fairly loosely, often describing

somewhat unstructured searching with their favourite search engine. A number of observed lessons where the Internet was being used confirmed this rather random approach to investigation, resulting in a great deal of time being spent on producing long lists of 'hits', with few signs that the pupils had been taught how to search effectively for information, or to assess the relevance of what was found.

Where more structured approaches to Internet research were observed, a fairly common strategy was for teachers to direct pupils to specific sites which they (the teachers) had independently explored and evaluated (often in their spare time). In some cases, teachers had identified 'live' sites such as information gateways or educational sites, which allowed pupils to explore, but within a clearly defined area. Revision sites were especially popular, and were also referred to on a number of occasions by pupils when discussing home or out-of-school-hours use.

In some cases, such resources were located on the school intranet rather than accessed via a 'live' connection, avoiding the temptation for pupils to 'go beyond' that which the teacher had validated. The justification given for this approach was threefold; firstly that that pupils were provided with appropriate and useful material without wasting time in fruitless 'surfing', secondly that the materials were in a form which could be captured, redrafted, cut and pasted into other programme documents, and thirdly, that World Wide Web resources offered an alternative (or complement) to printed textbooks or worksheets.

Some teachers actively sought to develop in pupils a much more structured model of Internet research which involved various processes such as the considered approach to the use of keywords, the identification of likely information sources, the evaluation of found resources, the adaptation and synthesis of information from various sources (including text, graphics and charts), cutting and pasting from the World Wide Web or CD-ROMs into a word processing or desk-top publishing document, and so on. Where introduced effectively, these kinds of approaches had the potential to develop both search and research skills which were transferable across the curriculum:

“We use networked technologies because there are a vast range of sources out there, we are not just limited to books. This gives us the ability to

use the sources for maximum information, first to answer straightforward questions, then to develop thinking skills about applying the knowledge, think about what they have learned and then they do the 'empathy' piece...It worked very well, particularly with boys, who might not have responded so well to just looking through books."

History teacher, Arkwright Secondary School

"We built an Internet site with a student from Nottingham University as part of a Recess residents programme and used it with Year 8s. Basically we put a lot of data on the site and [the students] were directed to it and they had to plough through it, extract the relevant information and it led them to a development plan for an investigation. The whole enterprise was very successful. We had lots of ideas about recording interviews with supposed screen campaigners and company directors and putting video footage on."

Chemistry teacher, Arkwright Secondary School

4.3.2 E-mail

Compared to the extensive use of the Internet in schools, the use of e-mail as part of a learning activity was less common, although it was used regularly by pupils to communicate with friends and family from home-based machines. In a number of cases such e-mail use included the transmission of a variety of attachments. Where e-mail was used in a classroom context, it was generally for exchanges with 'e-pals', often in a school in another country. In many cases these were within the context of an ICT lesson, although some were curriculum focussed, including modern foreign languages, history, geography and (particularly in primary schools) literacy.

A critical motivating feature of using e-mail for many teachers was its immediacy. In Castlefields Secondary School, for example, pupils were reported to be thrilled to receive an almost instant response in an exchange with pupils in Japan. E-mail also provided access to organisations and individuals who might previously have been more difficult or even impossible to contact. One secondary pupil, for instance, reported sending and receiving e-mail from the chief executive of a global software corporation, while a primary pupil had been involved in e-mail exchanges with a children's television

programme. A few teachers built this kind of approach into lessons. An example of this was the Y6 teacher at Westbrook Primary School who described how she used publisher's web sites which facilitated exchanges between children and popular authors to support literacy activities.

In addition to these motivating aspects of e-mail, some teachers also claimed that the pupils often paid greater attention to detail and presentation, spelling and grammar, than they did in their writing in school. A teacher in Wolsey Court Primary School suggested that sending and receiving e-mails was 'more realistic' for her pupils than letter writing, since it was far more closely related to their world of text-messaging and chat-rooms. A secondary languages teacher in Sedgewick Secondary School made a related point, referring to the 'authentic' nature of contact with pupils in other parts of the world, especially as this involved communicating directly with native speakers of the language being learned.

Using e-mail was not without its difficulties however, and teachers in both secondary and primary schools described projects had faltered after a promising beginning, or had failed to get off the ground at all. Some of these problems were of a technical nature, and in this respect, the issues were common to many other features of using computers in general and networked technologies in particular, that is to say problems with the network, the slowness of the system and so on. While the number of projects which completely failed was few, these collaborative projects succeeded and developed most effectively where a clear curriculum context had been established on both sides, with the exchange of information for a geography project. The 'authentic' communication between English and (say) German or French speakers of the kind referred to by the teacher above, being good examples of this approach.

4.3.3 Video conferencing

The majority of teachers reported having little or no direct experience of video conferencing and no examples of video conferencing in use were identified or observed. Of those that had encountered it, or who had at least given some thought to its educational potential, very few considered the acquisition of video conferencing facilities to be a priority. The major reasons for this were threefold: firstly the associated costs; secondly, the difficulty of arranging with other schools a suitable time for synchronous communications; thirdly, the lack of a clear

curriculum need. Two or three teachers were aware of potential benefits, for example for communications between speakers of native languages. One, a languages teacher at Sedgewick Secondary School, saw video conferencing as possibly having greater potential than e-mail:

"[E-mail] is not all it is cracked up to be... [it] is subject to delay, so video conferencing would be ideal as the language would be immediate. We have a problem in German, which is that students are not put under pressure to deliver the language orally, then and there. Suddenly in the GCSE they get an oral and they find it very difficult to do. Video-conferencing would confront them with speaking immediately."

Modern foreign languages teacher, Sedgewick Secondary School

4.4 Approaches to teaching and learning

4.4.1 The role of the teacher

A recurrent claim for the impact of ICT in educational contexts is its potential to alter the teacher-learner relationship, in particular to shift the balance from the dominant provider/recipient or 'direct transmission' model, to a more facilitative approach, thereby promoting greater independence of learning. The extent to which this was evident in the 15 case study schools was therefore of some interest.

There was certainly clear evidence, from classroom observations as well as from both teacher and pupil interviews, of learners of all ages working autonomously with ICT. In some cases this was enforced as a result of the teacher's lack of confidence in using ICT in their subject area, or was occurring 'by default' because of the independent nature of working at a computer (or some combination of the two factors), suggesting that independent working with ICT is not necessarily associated with a fundamental shift in teaching practice. Nevertheless, a number of primary and secondary teachers were clearly aware that ICT had the potential to change the way they interacted with their pupils. This showed itself in practice by a deliberate policy of encouraging pupils to use software in an explorative fashion but set within a clear structure of teacher support and intervention.

While a minority of teachers were relatively comfortable with this degree of pupil autonomy, most were still

coming to terms with change, not only with the fact that pupils were engaged in activities which were not always under the gaze of the teacher, but also that working with computers often engendered a less formal classroom atmosphere. In a number of instances, however, this rather painful process of 'letting go' was accompanied by a recognition of the potential benefits of doing so:

"When we started [using ICT] there was much resistance from teachers [to the more independent approach] – I always want to stand in front of class and see what they are doing ... but once we started seeing how much kids learned by using ICT, they were more happy to let them come into the computer rooms. It took some time for teachers here to accept that kids would be chatting and walking round the computer room, which would not be acceptable in a normal classroom. But that is how kids learn in IT and teachers now manage that situation well. They know when it is focused chat and when just socialising."

ICT co-ordinator, Sedgewick Secondary School

The prospect of pupils working away from the direct supervision of the teacher is not without its problems. A number of teachers alluded to the fact that it was not always possible to determine the extent to which the pupils were actually learning, or indeed whether they were engaged in the task in hand at all, even in relatively 'structured' situations. Reflecting in a video diary on a lesson in which a pre-selected Internet site was used to complete a worksheet, a teacher in Blackheath Secondary School remarked that it "wasn't difficult to keep them on task, it was just very difficult to make sure they were on the right task".

Observations of ICT-focussed sessions confirmed that even with the best-appointed ICT rooms and the most carefully planned lessons, monitoring the activities of 20 or more users proved problematic for many teachers. However, this also proved difficult to resolve for teachers with a limited number of machines back in the classroom. While there were fewer computer-users to 'keep an eye on', the teacher was at the same time required to organise activities for the remainder of the class who were not using ICT:

"I value ICT and I think its very important, but its almost like a fringe activity sometimes ... when

you've got the other 20 or so others doing something else ... it's not always easy to home in. As soon as the others are up and running, I can go back to the ICT, but it's hit and miss, and there's no telling whether I get to see all the children that are working."

Year 6 teacher & numeracy co-ordinator, Yew Tree Primary School

4.4.2 The role of the learner

Increasing access to computers in the home and in other out-of-school venues means that many pupils now come to school with a range of ICT skills. The fact that such pupils 'know their way around' computers means that in some cases pupils tend to be technically more proficient than staff. This is potentially threatening to some teachers, especially those who are relatively lacking in confidence about their own ICT capability.

Most of those teachers interviewed, however, recognised that pupils were much less likely to have the pedagogic or curriculum expertise to plan its educational use. A few teachers actively took advantage of this situation, for example by working alongside more expert pupils to develop their own skills, or by employing the more technically minded pupils to 'fix' problems. Where teachers were open to this approach, ICT sometimes proved to be the catalyst for a new relationship between teacher and pupil.

4.4.3 The role of other learners

The potential of collaborative work around computers is well documented, as is the spontaneous support that pupils give to one another during computer-based work. The latter was a frequently observed feature of the use of ICT whether this took place in a 'suite' environment or around a single stand-alone computer. Even where every pupil in a class was able to work individually on a computer, pupils sought and received help from their near – and often not so near – neighbours: an informal kind of peer tutoring.

Much of this kind of interaction was unplanned and unstructured – pupils briefly offering advice before returning to their own work – but appeared to facilitate a sharing of knowledge which not only had the merit of being conducted 'in their own language', but also served to relieve the teacher of much of this basic skills instruction. While a small number of teachers expressed

caution about pupils working together on a computer-based task, referring to the relative ease with which pupils could 'hide' their lack of engagement in a pair or group, most of what was observed of this kind of voluntary interaction was of supportive intent, and a good number of teachers recognised and accepted, even welcomed, this voluntary kind of co-operation.

However, despite the fact that most teachers appeared to recognise the potential benefits of collaborative working with ICT, far fewer actually took steps to capitalise on this. For example, while we are aware of evidence from other studies (for example, Galton et al. 1997) of the intentional coaching of pupil 'computer tutors' in basic pedagogical skills, no examples of this were evident in the present study. Neither did we come across many examples of learning activities which required collaboration for their completion, and many of the tasks which teachers called collaborative merely involved pupils working alongside one another, rather than jointly addressing a problem.

4.4.4 The role of the technology

When describing how they used ICT in the classroom, a number of teachers referred to ICT as 'a tool', suggesting that it was an additional element of their teaching toolbox. ICT was seen as something to be used when it is appropriate to do so, rather than 'because it is there':

"Where they are the most appropriate tool to use, they are extremely useful. I think we have to make a professional decision about when to use ICT and that will vary from group to group...And you might have to use a different teaching strategy to deliver the same point. [You need to keep] that flexibility in mind...that something does not have to be done by ICT, but it is a tool, an addition to what we used to have."

Chemistry teacher, Arkwright Secondary School

At its most functional, this view of ICT use might be described as being 'bolted on' to existing practice. A number of instances where ICT was being used in this fashion were observed, generally serving as a substitute for a more traditional method without adding greatly to the process. Examples of this approach included the use of a word processor for the copying out of hand-written text, or the kind of random searching of the Internet referred to earlier, where a textbook or CD-ROM might have been a perfectly adequate source of information.

Teachers sometimes justified this kind of use in terms of developing ICT skills, but even where this did occur, it was often incidental rather than planned, and did not necessarily extend pupils' understanding or capabilities.

There were, however, many examples of a much more carefully structured approach to the teaching of ICT where it was used within a curriculum context, or as some have put it, 'built in' rather than 'bolt on'. This involves a rather different interpretation of the concept of 'tool', that is as something that has the capability to transform existing practice rather than substitute for it:

"I think like a lot of teachers, I used to be a 'control freak'. I liked to stand at the front and make sure I'd explained very carefully to all the students exactly what they needed to know by the end of the lesson, then they commenced to write it down. Quite a didactic approach. ICT has certainly encouraged me to produce learning activities where the students have to go and find out things rather than 'listen to what I am going to tell you' sort of lesson. I think I am now getting a balance between the two sorts of lesson."

Chemistry teacher, Arkwright Secondary School

4.5 Models of practice

A very broad range of classroom activities using ICT were observed which included a good number of lessons which focussed on the delivery of the ICT curriculum, many of which – especially in primary schools – were based on QCA Schemes of Work. There were also many examples of lessons in which ICT featured as integral to a subject-based session, that is that ICT served in one way or another to enhance the learning process. Introducing pupils to a new piece of software, or to as yet unused functions of a more familiar package, was a feature of several observed lessons. In most cases of this kind the curriculum focus was ICT itself.

A number of lessons were observed which were purportedly curriculum-focussed, but where most of the ICT use could be described as skill-oriented. That is, while pupils' ICT skill base may have been extended (although this was not always the case – in some cases pupils were simply rehearsing already well practised abilities) it did not further those pupils' subject knowledge or understanding. While there were various instances of the acquisition of curriculum knowledge or potentially transferable abilities (problem solving skills,

the recognition of the appropriate use of ICT in a given situation and so on) occurring within such sessions, these were again incidental rather than being formally built into the lesson plan.

There were several examples of this somewhat unfocussed use of ICT. As already alluded to earlier in this section, lessons which centred on the use of the Internet for research (almost invariably intended to be an integral part of a subject-focused investigation) often involved the rather unstructured approach already discussed, with little sense that pupils were learning a great deal about the subject in question. Locating, evaluating and synthesising appropriate and relevant resources in such lessons was often subsumed to rather less productive procedures such as 'bookmarking' or printing out unedited material.

Other examples of this kind of approach included the use of presentation software in a history lesson, where pupils' understanding of a 'presentation' clearly referred to the presentation software document itself, rather than to the process of researching for and developing curriculum material which would form the basis of an exposition to the rest of the class – the stated purpose of the lesson. In this example (and typical of many lessons of this kind) the dominant mode of classroom interaction was pupil to pupil, with relatively little teacher intervention save to solve a technical problem.

Some of the best examples of the use of ICT were observed where the lesson moved through different modes of teacher/pupil interaction and involved both in a variety of roles, and crucially where intended and actual use came together. A good example of this approach involved a whole-class introduction to (and often modelling of) an activity, followed by clearly structured ICT (or ICT-mediated) work designed such that pupils could work autonomously, which might involve individual and/or collaborative work. At points where pupils needed assistance in solving a particular problem, the teacher would intervene to move them forward individually or collectively depending on how widespread the difficulty was.

Presented here are summaries of two observed lessons that were felt to be particularly good exemplars of this. The following example describes a lesson in which, though part of the GNVQ ICT curriculum, the pupils were provided with an authentic task that involved the solving of 'real' problems:

In the session, pupils were engaged in the creation of a database that would carry out stock control functions. The lesson began with an interactive white-board segment, in which the pupils were brought into the centre, away from the machine, so that they could all see and contribute interactively as requested with the whiteboard. The teacher modelled a problem that they had to solve. However, the teacher used a non-returnable example of stock (in this case, wine) as an exemplar of tracking stock and the use of re-order levels. While the modelling was taking place, the pupils were involved in answering questions and demonstrating possible solutions on the whiteboard.

When the modelling segment was complete, the pupils were told to return to their computers and to access some support material that had been placed on the shared area of the network, and which they could use to continue to develop their own databases. However, this material was also about the non-returnable goods, while the assignment was to create a database for stock control of returnable items, such as library books, videos, car hire etc.

The teacher was thus providing supporting material for the pupils that was not simply to be copied and pasted into their own databases. Rather, the teacher provided a 'scaffold' of material that moved pupils on but which did not give them answers. The activity was explicitly contextualised within the key skill of problem-solving and the pupils were given a long-term time target for solving the formulae for this type of stock control.

In order to solve the problem, pupils had to think through what was needed and find a software solution to it. As this itself would take some time and would involve the pupils in trial-and-error work as they debugged any problems with their proposed solutions, pupils were encouraged to use e-mail to post their database to home. They were to work on it there in their own time 'for homework', returning it to school via e-mail for the next lesson in a weeks time.

ICT teacher, Sedgewick Secondary School

This was a good example of a well structured and fluid lesson in which the teacher moved through various roles, from director, to stage manager, to scaffolder and so on (Scrimshaw 1997), while the pupils similarly took on different roles as they accomplished various elements of the task. Throughout, ICT was used effectively and appropriately by both teacher and learners. What is especially noteworthy about this example is that the 'scaffolding' here was provided to some extent through the design of the support materials. Thus while pupils were able to progress to a certain point, they were required to find a solution which was not given to them before moving on to the next phase of the task. This is a good example of Kennewell et al's (2000) definition of ICT capability, that is developing in a pupil the ability to apply ICT to a range of learning situations in a variety of curricular contexts, and to display this 'transferability' both in and out of school.

Another very effective lesson, this time in a primary school computer suite, was a session with a Year 3 group using a computer-aided design (CAD) package to design a bedroom. This was part of a series of lessons based on a Qualifications and Curriculum Authority (QCA) work unit that incorporated elements of design and technology, numeracy and literacy. The observed session was the second of the series, which introduced the pupils to the main features of the package:

The lesson began with a brief whole class introductory demonstration of the task using a fixed interactive whiteboard. The pupils were reminded, through demonstration, of the work of the previous lesson in this series in which they had begun to explore the capabilities of the software, and the broad objectives of the current session were explained. Pupils were given opportunities to ask questions and seek clarification before commencing the task.

Following this introduction the pupils worked individually. Although there were sufficient PCs for pupils to work on their own design, a considerable amount of spontaneous collaboration took place. Where this was deemed to be moving pupils forward, the teacher encouraged this to take place. The teacher moved around from pupil to pupil, in some cases solving technical problems, but for the most part

using open questioning and prompting to encourage pupils to solve their own problems.

At several points during the session when it became evident that several pupils were encountering a similar problem, the teacher returned to the whiteboard to explore the problem with the class. This was achieved using the same 'open question' approach used with individual pupils, encouraging the children to offer potential solutions, which were then 'tried out' on the whiteboard, rather than the teacher providing the 'right answer'. On some occasions pupils were called out to the front to demonstrate their solution on the whiteboard.

At the conclusion of the lesson, the teacher explained to the class that he wanted them to learn a new way of saving their files (saving to the server rather than to disk). This was demonstrated, step-by-step, again via the whiteboard.

Year 3 teacher & Senco (Special Educational Needs co-ordinator), Branley Wood Primary School

Again, this lesson, though a relatively straightforward one, involved the teacher and pupils moving smoothly and appropriately between the various roles described above. While this pattern might be thought typical of good pedagogy with or without ICT, it represented a good example of appropriate and effective use of ICT resources for the development of key skills. In brief interviews conducted with the children during the session, it was also clear that most had a good understanding of the task, demonstrated progression (from the previous lesson) and were capable of attempting solutions independently, or with the help of a partner.

4.6 Individual and group differences: age, gender and Special Educational Needs

4.6.1 Age

The age of a pupil will clearly have implications for the type of ICT experience that she or he will encounter. In general, however, little evidence was found to suggest that the issue of age was substantially different from the kind of considerations that teachers make concerning other aspects of the curriculum. If anything, what was

distinctive about ICT use in this regard was, according to teachers, the high degree of skill and knowledge of ICT that children now demonstrate.

In Key Stage 1, where the emphasis tended towards the introduction of basic skills rather than curriculum integration, teachers described a level of expertise which suggested that, relative to other core skills, even very young pupils now arrive at school with a fairly high degree of computer competence. While the focus of the observations in primary schools was on Year 6, a number of lessons with younger Key Stage 2 children were observed which confirmed this general perception. Pupils were seen to be confident and competent users of technology, with a sophisticated awareness of the place of technology in their lives. As already noted, the difference between those who had home access and those who did not was a clear differentiating factor in this regard, and in that sense, was often related to socio-economic background.

4.6.2 Gender

A considerable body of research over 20 years has found computing, both in school and at home, to be a male-dominated domain. Boys typically report greater experience with and access to computers, and report greater confidence in their use.⁵ As a result, various schemes and policies have been introduced in schools to redress the balance, for example by setting up girls-only computer clubs, strategies designed to raise girls' computer confidence and so on. More recently, interest in ICT has been suggested as one route to re-engaging underachieving boys. The extent to which teachers perceived a difference, and/or took steps to address it, was therefore of interest.

ICT was widely perceived to help engage boys in learning activities, to maintain their attention for longer, and as an aid to presentation. Most teachers were clear that the intended use of the computer in these circumstances was as a motivator, not a reward:

"[ICT] motivates the sort of boy that has the sort of 'football culture' ... they don't have many outside interests otherwise, and don't get taken places or talked to [by their parents/carers]."

Year 6 teacher, literacy co-ordinator and Key Stage 2 co-ordinator, Branley Wood Primary School

⁵ See for example Schumacher and Morahan-Martin (2001).

One teacher indicated that boys responded better to the use of ICT tools such as presentational technology to deliver the curriculum, while another suggested that spreadsheets and databases encouraged boys to be 'more analytical'. The Internet in particular was regarded by teachers as an effective way of involving less enthusiastic pupils, and again boys were mentioned regularly in this regard:

"[The Internet is] just part of their lives now ... it's a wonderful world out there and it's a good way of accessing it quickly ... especially for boys who are not turned on by books ... there were boys who wouldn't have looked something up in a book [who are doing so on the World Wide Web] ... they're even bringing in their own CDs now to show me."

Year 6 teacher, numeracy co-ordinator and Senco, Westbrook Primary School

In terms of ability and confidence with ICT, however, most teachers who expressed a view were clear that boys and girls were equally capable.

"I feel the children we have got here ... [are] either confident because they have had access to it at home and therefore they approach it with confidence anyway, or they have had very little talk about anything ICT-ish whether they are boys or girls. There are no gender differences in that sense."

Chemistry teacher, Arkwright Secondary School

Teachers' views were reinforced in general terms in classroom observations. No clear differences emerged in terms of boys' and girls' access to or apparent confidence with computers. Neither was there any evidence that boys 'dominated' ICT facilities in general terms, although some isolated examples were observed. This apparent closing of the 'gender gap' was confirmed in brief interviews with pupils during the observed session about what they were using ICT for, their general attitudes towards it, how they believed it helped them to learn and so on.

4.6.3 Special Educational Needs (SEN)

ICT was perceived to have contributed to supporting pupils with special educational needs (SEN) in a number of ways. It was reported to be especially motivating for many children with SEN, promoting understanding and enabling them to accomplish tasks that could be difficult for them without technology. A number of teachers, for

example, reported that ICT enabled pupils with poor handwriting and/or presentation skills to produce work that looked professional, enhancing self-esteem through achieving success and boosting confidence. In other words, a finished article which showed off their efforts to best advantage, rather than highlighting their shortcomings. This was confirmed in pupil interviews, where a number of children, especially (although not exclusively) those in primary schools, identified these features of ICT as particularly helpful.

ICT was also described as aiding differentiation, for example by allowing academically more able pupils to get on with the task, freeing time for the teacher to spend more individual time with less able pupils. In particular, ICT was said to facilitate tailored programs of work to suit the needs of individuals, and allow pupils to work at their own pace, enabling teachers to differentiate tasks for whole class work easily:

"It helps the less able students to engage more readily. They don't find instructions on a screen as intimidating as in a book – they don't see it as reading. In terms of differentiation and individual aids, it is probably one of the most flexible tools we have got."

Year 6 teacher, numeracy co-ordinator and Senco, Westbrook Primary School

One of the clearest demonstrations of the potential of ICT for an individual child emerged in an interview with a learning assistant in a primary school, discussing a pupil with severe behavioural difficulties. The pupil's general interest in computers and use of them outside of school was capitalised upon in order to stimulate interest in learning activities, improve attitude and reward good behaviour, as well as facilitate a more 'one-to-one' approach between pupil and adult:

"He loves it in here [the computer suite]. He is very knowledgeable, uses his computer a lot at home whether it is for games... I think he is on the Internet at home as well, but yes, I think he probably prefers to be in here... He [uses] a software programme, which is all about solving puzzles and riddles – he likes doing that, and there is another one about reading maps which he

is always playing, word processing and using the Internet as well...[Using the computer] is sometimes used as [a reward] if he has a good day, then we will give him half an hour or so of free choice at the end of the week and he nearly always asks if he can come to the ICT room to do work or whatever he wants to do... He seems to be interested in technology and how things work... He pays more attention in here, I think, because you probably get more attention because if you've got a class of 30 then you mainly have to listen and the same thing is said to everybody, whereas in here ... he does get more attention ... he works better when he has got all one and one attention, so that probably helps."

Teaching assistant, Hanover Primary School

Section 5 – The management and organisation of ICT

The key findings from this section are:

- It is important to recognise how far the case study schools have come down the road of using networked technologies efficiently. However teachers and managers are concerned with the sustainability and improvement of ICT provision along a number of dimensions, including the 'ICT deficit' compared to many of their pupils' access to superior hardware and software at home. Despite innovative ways of meeting pupil and teacher needs in ICT, demand was felt to be outstripping what schools could afford to supply.
- The problem of recruiting, training and retaining ICT competent staff was seen as an impediment to sustaining and maintaining facilities in a robust and curriculum effective state.
- Managers and teachers perceived ICT provision as inadequate to meet the demands for ICT-discrete sessions and the use of networked technologies for specific curriculum purposes, with subject work using ICT mainly losing out.

- Most of the case study schools had developed policies on filtering and acceptable use, which attempted to strike a balance between freedom and restriction. While there were still some schools with genuine differences of opinion between key stakeholders, it was usual to address these issues on educational, rather than technical or moral terms.

5.1 Introduction

The level of demand for ICT facilities in schools, following the high profile given to them by Government initiatives such as the National Grid for Learning and the New Opportunities Funding (NOF), has created a new set of challenges for the management of primary and secondary schools. It should be emphasised at this point that what is recorded here are the challenges associated with the successful introduction of ICT into schools, rather than the problems of failure.

The issues faced by the management of schools are associated with high pupil demand for ICT and a continually shifting potential for ICT application in education. In the case study schools, a qualitative shift has been seen in the use of networked technologies for curriculum purposes, away from concerns about teachers' ICT skills and problems of system reliability towards grappling with the curriculum effectiveness of ICT applications and the need to develop new uses for ICT in meeting the needs of pupils.

While the managerial problems facing primary and secondary schools are slightly different, given their various levels of existing provision, they are similar enough to be categorised around five main themes relating to:

- Sustainability
- Integration
- Key personnel
- Filtering systems
- Managing pupil ICT skills.

5.2 Sustainability

While previous studies of the use of ICT in schools have tended to focus on the use and non-use of ICT in the classroom, either as stand-alone or networked

technologies, they have also been characterised by the 'novelty factor'. By this we mean that the teachers and pupils who have used ICT in the past have been seen as pioneers, introducing something new into the repertoire of tools available in schools. As such, the focus has been on the use of present provision rather than 'looking ahead' to future developments in the area of ICT. What is important about the case study material collected by the Strand 3 team is that networked technologies are largely 'taken for granted' and expected by both pupils and teachers alike, as part of the normal education experience in these schools. Indeed, it could be argued that networked technologies are not only seen as something that pupils and teachers might expect to use in the course of a school week, but also that they are now so embedded into the day-to-day work of schools that the denial of access for whatever reason is a major issue for management.

Unlike previous research into ICT that the study team have been involved in, this study found that there was a greater focus on future developments in schools, and this was exemplified by increased and improved ICT facilities in many of the case study schools over the year of the evaluation. Branley Wood Primary School, for example, transformed its ICT provision during this period. This included the building of a state of the art suite of networked computers and the introduction of a bank of wireless laptops. There were also plans to extend this latter facility and to introduce interactive whiteboards into classrooms. The issue for most schools now, therefore, is less about developing new resources, but about how this kind of investment in networked technologies could be maintained. This is a reflection, in part, of the sheer pace of technological change itself, so that hardware becomes quickly out-of-date and 'old-fashioned', while new applications are continually being introduced. Networks quickly became out-dated and a source of some embarrassment and frustration to both teachers and pupils alike.

There was also the issue that pupils were increasingly provided with computers and applications at home, at least as good as and often better than those they experienced at school. Several pupils described how their own computers are of a higher specification than those at school – faster, with better Internet access, with colour printers and scanners. Some described the school's computers as 'too old, too slow and too scruffy'.

The problem of sustaining investment in hardware, in a time of technological change and budget limits, was the main concern of the members of management interviewed. Or, as one teacher put it:

"The bottleneck is the kids' demands for ICT. We no longer have the infrastructure [or bandwidth] that can cope with this demand. We cannot see this as being alleviated."

ICT co-ordinator, Sedgewick Secondary School

There was thus a general awareness that provision of computers did not match up to pupil or teacher demand, despite some ingenious ways in which they had tried to meet it. This was seen then as the 'genie out of the bottle challenge', where once there was a critical mass of ICT provision so that it became a 'norm' of a school, demand far outstrips the ability of schools to meet it. In one school for example, the art department's desire for scanning in images 'had the system whimpering', according to the ICT co-ordinator.

Arkwright Secondary school had two ways of trying to deal with the problem of maintaining an ageing system in the light of increased demands for use. The first was by running a thin client on their 'old' machines. Though it was recognised that this had limitations, it worked fine for applications such as word processing, so that increased performance could be extracted from less powerful machines. The second tactic was to buy second hand machines only, when they were between one quarter and one fifth of the price. The school would purchase them for £50 and then throw them away when they were just too old to serve. They would also buy one or two new machines for specialist use (for example, the art department needed high resolution). The management did not see a future where they would be buying many new machines, because budget for all their hardware, even as a Technology College was just under £30k. They were just not able to replace a class set of old machines at £1000 per machine.

The expense of software licences was also raised as an unavoidable cost to the schools. Although several of the case study secondary schools had shopped

around for an alternatives software products to the global market leader, there was a realisation that that there was little practical alternative if pupils were to gain experience of the most commonly used packages. Moreover, where alternatives existed (such as shareware), there had been problems of compatibility with the network. While alternatives to the market leader might be attractive to the more limited budgets of the primary schools, the secondary schools tended to stick with it and bear the costs.

A further management problem for future provision was that of bandwidth. Where schools had broadband connections, the advantages of speed and reliability were readily recognised, despite the extra costs of installation and running broadband connections. Where there was no broadband connection, either because of cost or availability, the schools were keen to introduce it, as it was seen as a minimum prerequisite for running a sufficiently fast service to the pupils. Indeed, several of the diarists were most critical of the slow speed of the Internet connections:

"We are looking at ways of funding a 2mbps [2 megabits] solution for broadband. We are looking at cable, ISDN and a TC Trust [Technology Colleges Trust] solution. However, we need to bring in some funding for this, whatever we decide to go for."

ICT co-ordinator, Sedgewick Secondary School

The issue of broadband was vital to many of the case study schools because of the recognition that they had just begun to explore the potential of networks and that fast connection was a necessary precondition for exploiting their multimedia capabilities. The development of new ways of using networked technologies was being held back by the lack of broadband connections, and the staff time and resources to invest in new uses:

"There are other potential uses that we have to look at, for example, DVD [Digital Versatile Disc], CD-writers, video conferencing. If we want to keep up with what our students have, we need to be looking at providing these somehow. Some can be catered for by single machine. We don't need network CD for example and we take them out of our machines because of the danger of viruses."

We make very limited use only of web cams. We use the Intranet and messaging as a way of communicating rather than web cam."

Deputy Head in charge of ICT, Arkwright Secondary School

There are other issues concerned with sustainability, notably whether curriculum staff interest can be maintained and issues surrounding key personnel, and these are discussed in more detail later in this section.

5.3 Integration

As described in section 6, one of the major decisions for managers is over the location and organisation of networks. The ideal would be where networked technology is spread throughout all curriculum areas, either in a saturated form (enough computers in every class) or in a dispersed hub network. In both cases, the outlay on machines is very heavy and there is no guarantee of what constitutes 'enough' machines. Indeed, it could be argued that there will never be enough to meet the likely demand, though not having access to machines when they wanted was one of the main complaints of the pupil diarists. The alternative approach is where networks are concentrated in a number of 'bookable' ICT suites, with some stand-alone or networked machines in particular specialist areas where high specification performance is needed. Here, issues of access and equity become paramount.

Management decisions to opt for one or another of these formations are affected by many factors, some from the principles underlying the learning and teaching issues of using networked technologies, but others from external sources over which the schools have little control. However, the organisation of networked facilities also impacts upon the enthusiasm and commitment of ordinary classroom teachers to using ICT, subsequent to their funded training. The thinking behind NOF training was to offer all teachers an opportunity to upgrade their ICT skills and deploy them in the classroom for the benefit of their pupils. However, if access to ICT is limited or difficult because of the organisation of the networks, then the initial enthusiasm and 'willingness to have a go' is easily lost.

Among many of the case study schools, there was a general recognition that difficulty in obtaining sufficient

and regular access to networked technology had the effect of discouraging curriculum use of ICT. A model of use in which ICT facilities are available only at certain unpredictable times implies a high degree of forward planning if the equipment is to be used effectively and efficiently. Teachers have to try and match the topic and the stage in the topic to the booked ICT slot. It may also lead to situations where two different groups following the same programme of study might have very different ICT experiences in relation to it, or as a teacher in Castlefields Secondary School put it:

“Even in a school with plenty of facilities, these were booked out so quickly that I cannot use ICT consistently, so there are problems of access to machines through prioritising some activities over others. The main problem is booking rooms and the difficulty of doing this in any consistent way.”

Key Stage 3 geography teacher, Castlefields Secondary School

The situation regarding dispersal or concentration in the case study schools was complicated, with examples of both types of provision in secondary and primary schools, but with a lower density of hardware in the primary sector. In part, the decision to concentrate or disperse was driven by the general educational principles of the school's management team, and in particular by the ICT co-ordinator, where he or she held strong views. Where ICT was primarily seen as a subject in its own right, then networks were concentrated in ICT suites and priority on the timetable given to discrete ICT lessons. Where the integration of ICT work into curriculum areas was identified as a priority, then more dispersed provision appeared, so that subject access was made easier. Providing both was not an option for most institutions, already struggling to keep up with demand:

“I think we need both cross curricular and IT separate provision, but that is tricky because of limited IT resources. Keeping up to date is a major problem – we are aware of how out-dated some of our machines are. We still have some embarrassing ones from 1994.”

Headteacher, Arkwright Secondary School

In Arkwright Secondary School there was considerable resentment expressed by teachers from non-ICT curriculum areas at the move from cross-curricular to separate provision. They had invested time and training

in developing schemes of work that incorporated regular ICT use into their subjects. This had effectively been taken away from them by the introduction of ICT lessons, with priority being given to separate ICT access. The non-ICT teachers felt that they had been encouraged to develop their ICT skills, had gained some expertise in integrating ICT into their lessons and were currently prevented from utilising these skills because they could not get full access to the networks when it was appropriate to do so. The school responded to this concern with a strategic decision to increase investment in ICT provision. A further issue that emerged from the change to ICT lessons was the idea of equity of provision. While there was a guaranteed minimum amount of ICT time for each pupil in schools with discrete ICT lessons, this was often perceived by the ICT teachers as not enough to deliver the National Curriculum for the relevant Key Stage, such was the demand on access.

In the rest of the curriculum, pupil exposure relied more on chance and opportunity than on careful planning to deliver ICT in subject lessons. As one teacher put it:

“As a language teacher I do not have much access to computers. I just have to see where there is spare on the timetable and for some groups this does not happen very often, so they are at a disadvantage.”

Language teacher, Arkwright Secondary School

This meant that there were problems of equality of access to networked technologies, not only for pupils in their different subjects, with some having ICT-rich and others ICT-poor experiences but also for different groups with the same subject teacher, depending on the availability of ICT rooms. In these circumstances the skills of the subject teachers (or non-ICT specialists in primary schools) were not being utilised to best advantage for the pupils. It is to the issue of personnel that we now turn to explore further the idea of sustainability of provision from management's perspective.

5.4 Key personnel

The 'key personnel syndrome' affects different levels of a school's ICT provision, from headteacher to technical staff. The problem can be summarised fairly succinctly in the difficulties schools have in recruiting and retaining ICT enthusiasts and technical experts in a labour market that has a high premium on the ability to deliver ICT

services. The labour market is not just confined to schools, but there is a perceived tendency for ICT 'experts' to leach away into non-school employment, as well as move rapidly into better paid or more interesting ICT school jobs. The recruitment problem was illustrated by an example from a well-provided and enthusiastic school, where the ICT co-ordinator said:

"We have difficulty in attracting IT teachers even here. We only got a good one because she had been here on teaching practice."

ICT co-ordinator, Arkwright Secondary School

However, appointing newly qualified teachers (NQTs), who have been thoroughly trained in ICT during their training was not seen as the whole answer. As one ICT co-ordinator said forcibly:

"They [NQTs] may have a set of competencies or basic skills, but not the pedagogic ability or experience and thus notions of ICT integration to perform well."

ICT co-ordinator, Yew Tree Primary School

Another school had similar difficulties in recruitment but with technical rather than teaching staff. In order to deal with this they devised an innovative but effective strategy:

"Technical staff have been a nightmare to recruit. We tried to get a field but it was very poor, so we came up with idea of using industrial placement students. One has since been recruited as a network manager. However, we still need to recruit a low level hardware maintenance person."

Headteacher, Sedgewick Secondary School

More successful schools in ICT provision did recognise that they had to keep 'good people' on board and they employed a number of stratagems to achieve this. For example, Sedgewick Secondary School had re-negotiated job descriptions (and given a limited upgrading of pay) to keep their IT technicians at the school. However, they also recognised that the school would have to continue to support their technicians' further training and that eventually they were likely to move on. In that event, they would re-examine the situation in the labour market and choose whether to appoint more expensive expert staff or train up inexperienced technicians.

Similarly, changes in key teaching personnel can have knock-on effects right down the school, as non-ICT

experts have to take up the challenge of providing for ICT lessons:

"The Head of IT moved to new job at Christmas, so I've been put into position of being in charge. I've had to give up some classes to others further down the school, but these teachers were chosen purely on basis of who had free time on the timetable. Only one class was folded. But I have to manage non-specialist staff, which is very time-consuming, when I should be focused on wider development issues."

ICT co-ordinator, Sedgewick Secondary School

However, management also has some difficult decisions to make in determining policy regarding pupil use of networked technologies and it is to those that we now turn.

5.5 Filtering systems

Because a major feature of networked technologies is the ability to use the Internet for a variety of purposes (see section 4 on Learning and Teaching), one of the important policy decisions confronting managers of schools is whether to deploy filtering systems or not. The arguments for and against are well rehearsed and whatever the decision, some of the stakeholders in schools are likely to be disgruntled. Most of the case study schools had quite sophisticated understandings of the dilemma between protecting children from accessing unsuitable sites and giving them the freedom and responsibility of researching information from the Internet, unfettered by restrictions.

All of the primary schools had filtering systems of one sort or another in place and the secondary schools were conscious of age as an important factor in deciding to filter or not to filter. While some of the case study schools imposed a blanket decision to filter on all ages, with some provision for freeing harmless sites barred by the rather crude criteria used to filter, not all of the secondary schools decided to take this route. There were also technical decisions to do with speed and the ability (or lack of it) to cache large numbers of sites involved in these decisions:

"Our Internet provider insisted at first that we go through their filtering system and this slowed the system up. But we now have our own filtering

system and have resolved this speed problem. However, the kids are resourceful in finding sites we do not want them to find. If I find a kid on an unsavoury site, the deal is that they tell me how they got there and I do not lock them off for a first offence. Then we put the site on the filter. We have an acceptable use policy, which comes up every time they log in. We do block out those who offend, forcibly because 'access to the system is a privilege not a right.' I am looking for a second level filter to lock offenders off the Internet but let them on the rest of the network."

ICT co-ordinator, Arkwright Secondary School

All of the secondary schools also had acceptable use policies (AUPs) for all ages and policed the use of the Internet as far as time and practicality allowed. Abuse of the system was followed up and penalties imposed for improper access. The decision by management in Sedgewick Secondary School to filter all access, even to the sixth form was prompted by a concern that parents would object to unfettered access, even with older pupils. However, the ICT co-ordinator was opposed to this decision, both on grounds of cost and on the basis that older pupils should be trusted to act responsibly. There were case study schools where genuine differences of opinion existed amongst significant players:

"We have a filter system, a block on certain things which we manage ourselves through a proxy server. The network manager wanted to block everything, with only pre-vetted information on, whilst the teachers wanted to do the reverse, with only banned material being out of bounds. What we do have, which was introduced in the last couple of years, is a computer resources policy, which is essentially a written promise by the student that if they come across any unsuitable material to let us know, rather than us going to them."

ICT co-ordinator, Dalton Secondary School

The case study data allowed us to explore pupil reactions to filtering. Even very young pupils in the primary sector showed an awareness of what was appropriate use of the

Internet. One group of Year 6 diarists explained that they did not go on 'rude or unpleasant' sites because it was 'silly and childish'. While many of the diarists and those in group interviews accepted that the school had the right to restrict the networks to school work, for example, banning chat lines and games playing, they expressed their disappointment that access to Internet sites was frequently blocked. Very few of the diarists or the pupils in the group interviews suggested that their use of the Internet at home was controlled either by others in the family or by filtering systems and this created another differential between home and school use (see section 8.3 Use of the Internet).

The existence of home computers, with access to the Internet, for most of the pupils in the case study schools also created another issue for management; that is how to build upon the fairly sophisticated ICT skills that pupils now brought to school from their prior experience. These skills sometimes outstripped some of the teachers and meant that some programmes of study were not appropriate for all the pupils in a class.

5.6 Managing pupil ICT skills

While on the surface this seems a small problem for management compared to the weighty questions of funding and organisation, the effects of increased pupil ICT skills, albeit not uniformly across all pupils, were potentially considerable. It was noted in classroom observations that there were big differences in ICT skills even amongst pupils ostensibly at the same level, and which might vary according to their prior experience with the particular application being used. One specific issue that was raised by the secondary schools was the effect of successful training in the primary sector, such that some pupils were now entering Key Stage 3 with already well developed ICT skills. However, this was not uniform in all primary feeder schools, with the result that Year 7 ICT programmes were inappropriate for some but not all of the pupils involved.

Moreover, in those schools that persisted with cross-curricular provision, there were only limited measures in place in most of the case study schools to track and record individual pupil ICT experience. This meant that the package of ICT development in such situations was uncertain and likely to be different for individual pupils with different teachers. Where recording did take place, it was often at the departmental level in schemes of work

and/or informal rather than formal. As a geography teacher in Castlefields Secondary School reported:

“The geography department does not keep formal records of ICT use, because the school does not require it. However, though there is no mapping through of what they do in the formal sense, they do talk informally about what they are doing amongst the members of the department.”

Key Stage 3 geography teacher, Castlefields Secondary School

5.7 Improvement, maintenance or stagnation

The teachers and managers in the case study schools have made great strides, but are concerned by the lack of access to ICT. They want to use the networks to deliver the curriculum across a wide range of subjects and recognise the future potential of broadband access. They were not agonising over whether it is ‘just another tool’, or whether they should be using the networks at all. It was more a case of frustration that, having been given the opportunity to try out and develop networked capability, they could not easily deploy it when and where they wanted. A teacher at Yew Tree Primary School perhaps best sums up this mood when asked to describe how she felt about the current situation regarding ICT provision in schools:

“I’d say it’s fantastic that [the government] have finally realised the huge impact that ICT is having on the world – and that we teachers are bringing that world down into schools, incorporating it into our teaching and learning for children...and how great that we can start using ICT with them at 4 [years], and that they’ve pumped all this money and launched all the initiatives. That’s great because it’s fired everybody up, but the aftermath is that now it’s all calmed down, people are struggling. They did get excited, they did get inspired, but machines are getting older. E-mail’s taken off in schools, the Internet has taken off, and we want to keep the level of commitment. So [the government] need to make a promise of a 5 or 10 year rolling programme ... of [funding] that so that we don’t have to beg for or bid for or promise that we’ve bought this or that or the other with it.”

ICT co-ordinator, Yew Tree Primary School

The key message here is that ‘you can’t take it away’. It is a case of improving provision rather than merely maintaining it. Without this, schools will find themselves stagnating and eventually going backwards.

Section 6 – Technology and infrastructure

The key findings from this section are:

- ICT suites and intranets are now almost standard, and are frequently augmented by clusters and stand-alone machines in various parts of the school. There are educational advantages and limitations of all such strategies, but a particular need for staff to have access to machines for preparation and professional development.
- System reliability and technical support are still key issues, especially for primary schools. Technical failure is both frustrating and de-motivating for staff and pupils.
- Shortages of space, funding, and technical expertise are restricting schools’ ability to maintain and develop suitable systems.

6.1 Introduction

Early IT in schools initiatives in the UK tended to focus on the provision of hardware, with little consideration about how IT might enhance learning (McKinsey Report 1997). Many schools had equipment that was obsolete, unable to run modern software or provide access to the Internet (DfEE 1996; McKinsey and Stevenson 1997). In the relatively short time since the publication of these reports, the rapid expansion of ICT facilities in schools as a result of the NGfL and other initiatives, the development of digital content and resources, coupled with technological developments, has dramatically changed the modern classroom. The development of laptops (followed by palm-held machines) and wireless technology has meant that computers are not only powerful, but (potentially at least) truly portable tools, for teachers as well as pupils (Stradling et al. 1994; DfEE/Becta 1998). The question remains, however, as to what extent these developments have unleashed the educational potential of ICT.

The major themes explored in this section are:

- Access to ICT resources
- System reliability and technical support
- Evaluating educational software
- Factors restricting ICT provision.

6.2 Access to ICT resources

6.2.1 Location of ICT resources

All of the secondary schools had at least one dedicated computer room with banks of PCs, typically between 20-25 machines in a room. In each case workstations were networked to a central school server, and most schools operated, or were developing, a school intranet.

All but one of the primary schools also had a room dedicated to ICT use, although the average number of PCs was generally lower, so that while some schools had 20 or more machines in a suite, others had as few as 10. No primary school had more than one suite.

The pattern of location for additional computers was very mixed. In secondary schools, provision ranged from a school which had several networked PCs in each department, library access, interactive whiteboards, and specific ICT provision for staff, to those which were rather less well served, with individual departments making their own decisions about ICT provision. In one school an otherwise well-equipped science department had just a handful of stand-alone 486's⁷, while in the same school, the design technology department made regular and very productive use of both stand-alone and networked machines.

Of the seven case-study primary schools, six had a dedicated computer room, although the size of the room and number of machines varied considerably. In one school a room housing 20 brand new networked machines, a server and an interactive whiteboard, barely left space for the teacher to move around. In another, a spacious room had just ten older machines. In every case, however, machines in the suite were linked to a school server, although this was much less often the case with classroom-based PCs. The one school without space for a computer suite had a cluster of two or three linked machines in each classroom, a system inherited from the previous headteacher. What had once seemed

to be 'leading edge' technology was now proving to be both unreliable and inefficient, and discussions were underway about establishing a school-wide network.

6.2.2 Advantages and disadvantages of each approach

(a) ICT suite

According to teachers, the chief advantage of the ICT suite was that it enabled a complete class to have access to ICT at the same time. This was particularly useful for the teaching of ICT skills (especially if an interactive whiteboard was used to demonstrate software). Timetable slots also enabled all pupils to work on a project for sustained period of time. One secondary teacher suggested that a large ICT suite had several benefits, including the effective employment of support personnel in supervising out-of-hours access to ICT:

"[The teachers] could take classes more easily en masse, but also [this was an advantage for] the technicians and support staff, as fewer locations made it easier to monitor the computers, especially when pupils were in before, during and after school."

Headteacher, Arkwright Secondary School

(b) Diffused model

The main advantages cited for the 'diffused' model (a smaller number of PCs in the classrooms and/or elsewhere) were that it let teachers integrate ICT with other, non-computer work and enabled the spontaneous use of the computer by individuals or small groups of pupils. This approach also facilitated specialised use by particular pupils, for example those with special needs or behavioural difficulties. In primary schools, the use of the computer in these circumstances commonly operated on a rota basis, so that each pupil had an allocated (often weekly) slot of 'computer time'.

While ensuring equality of access, this approach sometimes duplicated the 'timetabling' limitation encountered in ICT suites. A pupil would be required to use the computer at a given time, whether or not it fitted in with their current activity. These difficulties were experienced to a lesser degree in secondary schools, which generally had more resources available, and were more likely to offer out-of-school access (especially after-school).

⁷ Commonly used term for a model of computer based on a microprocessor first introduced in 1989.

Less positive aspects of this approach were generally related to the limited number of machines available. Teachers reported feeling frustrated by having to restrict the use of the computer to pairs or small groups, while at the same time attempting to deliver a 'regular' lesson to the rest of the class, particularly in primary schools. This also introduced issues of appropriate supervision and support. Reduced flexibility was also an issue, so that teachers were limited to running software installed on a given machine and pupils were required to save all work to disk if they wished to move to another machine.

(c) The 'mixed economy'

The preference of most teachers was, perhaps not surprisingly, for a 'mixed economy' of ICT provision, involving both a dedicated ICT suite and a diffused model. This gave teachers greater adaptability, for example by allowing for work begun in the ICT suite to be continued or consolidated back in the classroom (or vice versa). Where classroom/departmental machines were also networked, this had the additional merit of allowing pupils' work to be saved to and accessed from any machine. As an additional resource, some schools also had (or were planning to have) portable laptop computers to enable flexibility. In one primary school, for example, a bank of wireless laptops was available on rota basis, enabling extension work to take place back in the classroom.

An intermediate solution in some (mainly primary) schools, was to create a 'mini-suite' (for example in the library) or to place a cluster of machines close to classrooms (often in an adjacent corridor) so that groups of children from different classes could be sent out to use them. While alleviating some of the problems of limited classroom resources, these small suites or clusters of machines were outside of the teacher's immediate control. This had supervision implications, especially with younger children:

"The previous head developed the system of satellite rooms around the school... [there was] one network room that had about 20 computers in, but there was nowhere in the school where a whole class would fit. Although we had these 'dropping in' areas where teachers could send small groups, it meant that teachers had to be in two or three places at once and it was a nightmare."

ICT co-ordinator, Yew Tree Primary School

6.2.3 Staff machines

A few (mainly secondary) schools had provided staff with dedicated machines, either in the staff room or elsewhere. This enabled a variety of activities including the use of e-mail for communicating with colleagues, exploring the Internet for learning and teaching resources, preparing resources and maintaining pupil records. In schools with an intranet, this also allowed for the creation of online resources, the receipt of pupil work and so on. Although the use of e-mail for school management purposes was uncommon this is likely to grow as Internet access in all school classrooms and staff rooms becomes more widespread.

The main alternative for schools which did not have such provision was the use of a machine in the classroom or ICT suite. In the latter case, access was often compromised by a fully timetabled programme for pupils (including out-of-hours clubs of one kind or another) leaving little opportunity for staff self-development or teaching preparation. While the lack of non-contact time restricted the degree to which primary teachers may have been in a position to use such resources, where they were present in primary schools, they were well used. Most primary teachers were thus obliged to conduct such preparations on a home machine. For staff without a home computer, opportunities to research or prepare resources were necessarily limited, as was the development of their ICT capability.

6.3 System reliability and technical support

For schools that had limited access to technical support – predominantly primary schools – system reliability was often problematic. Although teachers invested a great deal of personal time and effort on getting to grips with ICT and integrating it into their teaching, it was clear that technical problems could de-motivate teachers and pupils alike. Some primary schools had pooled resources with other local schools to share the salary of a technician, while others operated in collaboration with a local secondary school. Secondary schools tended to be better served in this area, with a number having a full time technician and/or network manager. As noted earlier however, some schools found it difficult to recruit suitably qualified and experienced technical staff.

There were also suggestions that technicians and other non-teaching staff would benefit from a funded training programme, and while the key issue for most (especially

primary) schools was the maintenance of hardware and infrastructure, there were some who thought that such training could also incorporate basic pedagogical skills. In one primary school, for example, a parent helper with a commercial IT background was recruited to offer technical advice and help. However, she had voluntarily learned about the literacy and numeracy curriculum and gradually developed both a teaching and technical support role.

6.3.1 Impact of system reliability on teaching

It was clear from the comments of many teachers that technical failure was both frustrating and demotivating:

"The teachers are all working and committed, but frustrated by the system ... they'd rather not plan it than risk it not working... Teachers are prepared to train, to surf the web, download packages, find out what the good web sites are for their topics, take CD-ROMs home and explore them. But they get despondent when the system just doesn't work ... they are saying 'I've done all this NOF training, I've really got to grips with [ICT], it's in my planning, the children are all fired up, but I can't come in my class every week and think – is it going to work?"

ICT co-ordinator, Yew Tree Primary School

The need for reliable systems is not restricted to PCs and networks, but also includes computer peripherals. The general lack of adequate facilities, particularly the poor functionality of many printers, did little to develop pupils' use of ICT. In one school a single printer connected to 30 PCs meant the time to print off work was prohibitive, leading some pupils to save and print off their work at home. Printing limitations also reduced the amount of output work for assessment by the teacher.

However expert a teacher, unreliable hardware and infrastructure can limit what can be achieved in the classroom, as an ICT-competent teacher attested having moved from a school with modern ICT facilities to one with a much older and less reliable system.

"When I came to the school to see it [at interview], I looked in here and it looked good, but you come to turn on a computer and it doesn't work. Some of them work but won't print out and won't give you

access to the Internet so it is really bad. I was able to do a lot more complex lessons with the children at my old school. There is no e-mail, no Internet activities, it is off and on when it feels like it. [At] my other school, all the computers worked, they were all Internet, we could e-mail, they were all inter-linked by computer in the classroom. I saved work on that when we came into the computer suite – switched it on, the work was there, opened the files and the children could see it. It had a smart board, it was just much, much better."

Year 6 teacher, Hanover Primary School

6.4 Evaluating ICT resources

Several teachers in the case study schools expressed concern about the proliferation of educational software, and the difficulty of knowing what was useful or appropriate:

"You need such a wide knowledge of software to really be effective... I do the best I can, but time just defeats you ... it's frustrating, because I'm excited by it, and so are the children."

Year 6 teacher, Broadway Primary School

Few teachers were aware of on-line support such as that provided by Becta or TEEM (Teachers Evaluating Educational Multimedia), and there was little evidence of any formal sharing of expertise among staff. Even with the aid of such services, however, judging the usefulness of software before purchase was regarded as difficult and time consuming. Most teachers tended to rely on informal word-of-mouth advice, or software catalogues.

6.5 Factors restricting ICT provision

6.5.1 Limitations of school buildings

Even where schools had made a considered decision to develop an ICT suite, the design of school buildings was not always suitable for such use, which meant that the suite would require a new building or the sacrifice of existing space usage. This was a particular issue for primary schools. One school opted to cut their assembly hall in half in order to build an ICT suite. In others, teaching rooms were reassigned to accommodate ICT networks. Some schools were unable to make such arrangements, and set up small suites suitable for group work. Supervision of pupils in these circumstances can

be difficult, and this can lead to ICT being used for basic skill development rather than for higher-order processes.

Squeezing a large number of PCs into a small space, especially where alternative working space is not an option, could be problematic, imposing a particular approach to teaching which differed from practice back in the 'regular' classroom:

"I would like there to be more work space ... more tables ... [but] because there is no space in here and there are, like three to a computer, there is no real desk space, you couldn't have 10 on the computer and 20 say here doing other work and then swap over, there is no space, you are limited to what they can do, you know they all want to go on the computer at the same time."

Year 6 teacher, Hanover Primary School

Classroom observations revealed a number of health and safety concerns in such circumstances. In one secondary school lesson, for example, pupils using written materials alongside their computer sat back in their chairs, keyboard on their knees and materials in front of the screen. Struggling with keyboard and book, pupils were unable to sit upright with their backs supported. Some suites had adjustable chairs, with computers on proper benches, but others had the plastic 'bucket' chairs with splaying legs, offering poor back support and being hazardous in a crowded suite.

6.5.2 Funding limitations

Sources of funds for maintaining and developing ICT systems included entrepreneurial headteachers, parents and government initiatives. Most schools reported difficulty in coping with the fast technological change and budget limits. While government investment via NGfL and other initiatives was welcomed, schools sought a sustained programme of funding if they are to exploit the potential of technology for raising standards.

Section 7 – Training and professional development

The key findings from this section are:

- All schools in the sample have undertaken and benefited from a range of formal and informal training activities. The quality of much of the formal training, however, has been highly variable.
- Teachers believe that it is too soon to say if New Opportunities Fund (NOF) training is having an impact on attainment. They report that it is improving teachers' technical confidence and competence, but they now wish to develop their ability to integrate ICT into the curriculum.
- There were general concerns about the amount of (frequently unpaid) time it was taking to undertake the training, and requests that funding be provided for such time, as well as for the purchase of training materials.
- In addition the evaluators identified a need for further training in issues such as: developing transferable skills; search and evaluation strategies; accommodating children with different levels of ICT capability; and the uses of ICT in and out of school.

7.1 Introduction

The significance of training in this area can hardly be underestimated. It has long been recognised by all concerned that a robust and developed schedule of training is required if networked technologies are to be introduced into schools effectively. This section considers key data related to training and continuing professional development (CPD) under four main headings:

- Training received to date
- Quality of training
- Impact of training on teaching, learning and attainment
- Remaining training needs.

7.2 Training received to date

All of the schools in the sample had undertaken some New Opportunities Fund (NOF) training, but they had completed different amounts of their courses. Between

them the schools had used a variety of different training packages including those produced by national, local and specialist providers. Some schools had linked their NOF training to formal Inset activities, frequently focused on familiarising staff with the technical operation of networks and the shared planning of schemes of work. Additionally, a number of Newly Qualified Teachers (NQTs) and other relatively new members of staff mentioned the importance of the ICT training they had received during their Postgraduate General Certificate in Education (PGCE) course. This had rendered them some of the most skilled staff in the school and, in one case, had led an NQT to be appointed as ICT co-ordinator.

Whatever the *formal* training experiences, however, there has also been a consistently high dependence on *informal* training within these schools. This is taking two forms. On the one hand, a lot of peer-training and development was found which is being managed by ICT co-ordinators, network managers, subject leaders and other colleagues in the school. It often focuses on the technical aspects of running lessons which use the networks and, to a lesser extent on issues of pedagogy. A significant amount of self-teaching was also identified, whereby teachers are developing their own skills, in their own time, frequently at home, and with little or no formal supervision.

7.3 Quality of current training provision

As part of the interviews teachers and ICT co-ordinators were asked for their impressions of the quality of the training they had received to date. It should be stressed, however, that the teachers gave subjective and largely unsubstantiated evaluations of that training, and this report does not offer a systematic critique of NOF or other formal training. It is clear, however, that these teachers' experiences of NOF training have been highly variable. There are some who have found it to be of high quality, particularly when it is tailored to specific subjects, while others had found their training disappointing. It represented a good start to training, they explained, but had left them feeling there was much more to learn, and that they were unsure where they would find the time to complete it. Others have found it even less valuable, and this was frequently put down to the training package they had chosen, and that they had needed to buy their package 'unseen':

"We went for the wrong [NOF] supplier and it has been disastrous. They insist on web-based training and, despite pleas, they will not give us CD-ROMs

or hard copy. It has not been taken up by staff. Why should they spend their own money and time at home accessing a site which in its first year was unreliable? The [site we have used for additional support] is not reliable either. It puts them off straight away..."

ICT co-ordinator, Arkwright Secondary School

ICT co-ordinators were often particularly critical, possibly because they had clearer expectations of the outcomes they wished for their staff. One co-ordinator spent the entire summer holiday re-writing the NOF materials as he felt that the ones they had bought were too poor. A Senco at a different school pointed out that they had not been able to find any courses which specifically addressed the issues of using ICT with SEN pupils. Several teachers pointed out that the model for NOF training was inadequate compared with that formerly provided by some LEAs.

Teachers with more experience and confidence with ICT said they would welcome a "higher-level" of NOF training which could cater for their needs. They were not always sure if any other NOF training planned in the future would fill this gap for them or be better differentiated. But the biggest criticism was the need for teachers to undertake this training in their own time, usually at home, and with inadequate feedback and support:

"It was a joke ... there were so many glitches ... [and] teachers don't have the time in the evening to do the training ... so we all ran out of time... I was supposed to finish by Christmas [it was now January]. I've picked it up constantly whenever I have had space in my life... I have only been able to do [the NOF training] because I've got a computer at home. Other staff who haven't have found it impossible."

Year 6 teacher, Yew Tree Primary School

7.4 Impact of training

The formal and informal training that staff in these schools have received has undoubtedly had some important impacts, even though many of the interviewees pointed out that it is 'early days' to judge initiatives such as NOF training. It is clear from the interviews, for example, that staff feel more confident and competent about using ICT than they did a few years ago, but are still unsure about its effects on children's learning.

However, what also emerged is that this sense of competence does not necessarily extend to feeling confident about integrating ICT into learning activities. In other words, while various training initiatives (and other factors such as increased investment in infrastructure and general support) mean that teachers are more aware of the place of ICT in school, more self-assured about using it at a personal level and for the teaching of ICT as a subject, many are still much less certain about its effective use in a curriculum context, and are actively seeking guidance in this regard.

In some cases it is equally clear that these benefits are beginning to be seen in the work of pupils. The clearest example of this is the many secondary school teachers who said that pupils are now entering Key Stage 3 with greater familiarity with ICT and greater basic skills. This was attributed, at least in part, to the development of primary teachers' skills and confidence. Primary teachers also report increasing ICT competence of relatively young pupils. This clearly has implications for schools who increasingly need to take account of the growing competence of many children, but also of the variation of skills among their new intakes.

7.5 Training needs

Teachers in these schools recognise that they still have specific training requirements, with several feeling that they are getting on top of the technical issues and now need to develop their curriculum skills. As one young teacher at Broadway Secondary School (who had high levels of ICT from her PGCE course) pointed out, she had received quality training in mail merge and databases, but had not had a chance to apply it at school. It was a common feature of many interviews for teachers and heads to request funding for time for personal development, not just for training materials.

The Senco at Walsham Howe Primary School pointed out the specific need for training that would recognise that primary teachers need to learn and teach across many curriculum areas, and that some skills may only be required infrequently. This led her to call for 'refresher courses' in specific areas that might be picked up after NOF training has finished. The study team believes that there is also a need to make clear links between the different sorts of training required for teachers, pupils and parents, and also for administrative and support staff.

In addition to these points, the study team believes that training is still required in five key areas. Firstly, despite the take up of NOF training, many teachers are still not confident about their ability to integrate ICT appropriately and creatively into their curriculum areas. Linked to this is an observation that teachers are not yet confident about the potential of ICT for developing transferable skills such as problem solving and research. This has implications for the learning tasks they organise and for the teaching styles they employ.

Thirdly the study team were struck, in several schools, by the apparently low level of Internet searching skills being taught to pupils, which resulted in much time being wasted (at home and at school) on inefficient searches. Guidance is needed (for pupils and teachers) on search strategies and techniques and on the management of search results. Fourthly, it is still an issue for some teachers that they have pupils in their classes who are more confident than themselves with ICT and network technologies. It is not always clear to these teachers whether the existence of such skills is a threat or an opportunity – whether they have pupils who can undermine their authority, or whether the presence of experienced and confident pupils is a positive advantage.

Finally the study team believe that there needs to be greater understanding about issues on both sides of the home-school relationship. Schools could play a role in disseminating models of good networked ICT practice to parents. Equally the study team suspects that many schools are not aware of the extent or nature of their pupils' ICT experience in other settings, and how this might relate to, or influence the activities they do at school.

Section 8 – Home and school use of ICT

The key findings from this section are:

- While there are examples of good practice in some areas, the use of e-mail to bridge the home and school environments is still under-exploited.
- Home use of the Internet is supporting and enhancing the schoolwork of many pupils, but teachers also have concerns about the nature and quality of some of the resources pupils find by themselves.

- Teachers tend to encourage, rather than require pupils to use the Internet for homework, largely because not all children will have equal access at home.
- There is frequently a lack of clear guidance from schools for parents who do, by and large, want to support their children in using ICT effectively at home.
- Home computers, however, are frequently more advanced than those at school, and pupils are engaging in more innovative uses of new technologies in their own time – uses which schools may need to acknowledge as they develop their own practice.

8.1 Introduction

Many pupils use ICT for a variety of uses at home, perhaps more so than at school. There are some practical reasons for this difference, such as the speed of connectivity, and the relatively open access at home compared to school. The attractiveness of home access to ICT, especially the Internet, was clearly evident in discussions with pupils, and thus of some importance in terms of its potential to enhance learning out of school as well as within it. The major themes explored in this section are:

- The use of e-mail
- The use of the Internet
- Equity issues
- ICT capability
- Emerging forms of communication
- Teachers' home use of ICT.

8.2 Use of e-mail

While the use of e-mail between school and home was not extensive, there were examples that indicated its potential to bridge the two domains. In its simplest form, home e-mail use was characterised by recreational activity such as communicating with friends and family.

A number of schools had developed inter-school projects (see section 4), most of which involved pupils in the UK communicating with same-age peers in other countries. Communications in the majority of these initiatives were informal, reflecting the type of exchanges between friends

or relations using e-mail on pupils' home machines. Information discovered through these contacts was, however, often built into various curriculum activities.

Some teachers actively encouraged the use of e-mail and e-mail attachments to move work between home and school, while a few schools developed systems to enable pupils to access or store remotely materials on the school intranet. An example of this, described in section 4, is a secondary school ICT project where part of the task was to e-mail work home so that it could be completed and then e-mailed back to school. A secondary school music teacher in another school cited a project which involved pupils e-mailing self-created web pages home to be worked on further as a homework task. In the main, however, transfer of work between home and school involved pupils with a personal interest in e-mail rather than as part of a formalised task.

The increase in personal computer ownership in recent years has resulted in a growth in computer-generated homework (in particular word processed documents), where schools have allowed it, increasing the likelihood that pupils will send work back and forth between home and school. Here too, the recreational equivalent of a school-directed task (for example sending one another 'downloadable' games) was echoed in this kind of spontaneous use of e-mail.

The use of floppy disks for transporting work between home and school has, of course, been available for some time. This has not been without its problems however, partly because of issues of compatibility, but principally because of the possibility of virus transmission via diskettes. One school banned the practice altogether, perceiving e-mail to be the solution:

"The main problem is transport of work between home and school. We cannot allow kids to transport their stuff on disk because of the danger of viruses. We did use a remote server as a store for kid's work for a while but [the Internet provider] quickly cottoned on and started charging, and so students would have to pay for it as we cannot... E-mail has also been a problem, in getting it stable and working for all kids, but our newly acquired broadband connection should resolve this. Our first priority now is getting e-mail as a link between home and school."

Deputy Head in charge of ICT, Arkwright Secondary School

It is clear, therefore, that schools have some way to go before an 'e-mail culture' becomes as established as it already is in many commercial companies and academic institutions. This was evident not only from the interviews and observations, but also in the e-mail communications between the study team and schools. Teachers often apologised that they 'hadn't looked at' their e-mail box for several days.

8.3 Use of the Internet

Most pupils had home access to games consoles and this was the most commonly cited use of computer technology (especially among younger pupils). With personal computers, however, the Internet (and by association, e-mail) was cited by many pupils as the most popular activity:

"I use the Internet at home for research mainly but I use it for computer games as well" [Researcher: What's the balance?] "I use the Internet [for research] more I think, cos it doesn't have that many good games on it."

Year 6 pupil, male, Yew Tree Primary School

"You can find out interesting things [on the Internet] ... it helps with homework and spelling. E-mail is great, you can speak to your friends when they're a long way away."

Year 6 pupil, male, Westbrook Primary School

The reasons given for the attraction of the Internet were also applicable to other forms of ICT – it was fun, exciting, a challenge and so on. Many pupils told us how they used the Internet for 'finding things out'. Pupils talked of being able to access 'more information than you get in a library' by using a home computer:

"For our topic we made a book, lots of people went on the Internet at home and at school ... we took pictures of Greek gods [off the net] and put it into our books."

Year 6 pupil, female, Yew Tree Primary School

Pupils' motivation for the Internet was clearly shown by the way they talked animatedly about their 'Internet work' and while some of it was at the request of the teacher, much of it was voluntary, yet complemented school work. Some parents confirmed this general view of the usefulness of home access to the World Wide Web:

"He can practise his keyboard skills, continue his

work from school, and surf the web for information to help with homework projects, and develop confidence to use a computer on his own."

Parent, Sedgewick Secondary School

The interest generated by using the Internet at home appeared to be involving some pupils who would not formerly have been expected to work beyond the school day. One Year 6 teacher noted, however, that while these children were now more likely to bring in information located on Internet, it was frequently inappropriate:

"The Internet certainly attracts more children, those that wouldn't want to go to a book will go to the Internet, but I'm not convinced that they read it."

Year 6 teacher, Westbrook Primary School

As discussed in section 4, while some schools had introduced pupils to effective search/research strategies, there were few examples of pupils being taught to evaluate materials for authenticity or task or age appropriateness. Thus while teachers generally welcomed the fact that pupils were motivated to continue their studies at home, there were issues concerning the nature or quality of the resources:

"A lot use it for homework ... for research ... they seem to put more effort into it [than with traditional media] ... but there are problems where some children download a lot of material without editing or reviewing it, but, on their last topic [ecological report] the ones with ICT at home were better on presentation of their materials, and produced more [relevant] information."

Year 6 teacher and literacy co-ordinator, Westbrook Primary School

Pupils using ICT resources at home do not have the direct input of the teacher. There may be considerable benefit, therefore, in developing parents' ability to help pupils evaluate web-based material. As explained in section 4, the problem of ineffective Internet research was not exclusive to home use, but was replicated in the classroom, either because teachers did not monitor such activities closely, or because they themselves were uncertain about effective approaches to Internet research.

Many teachers did, however, identify educationally sound web resources for pupils to use in school as information sources for subject work, often placing these on the school intranet. There was evidence from pupils and

parents that the use of well-designed and effective educational sites at school helped pupils to identify suitable sites for their voluntary home use of the Internet.

In one primary school, Year 6 children used the revision sites during lessons, and many were observed choosing to continue during lunchtimes. Some pupils reported they often continued visiting these (and other) educational sites when at home. One parent, although not an isolated example, reported that he felt able to provide his daughter with more effective help in her preparations for Key Stage tests by using sites suggested by the teacher.

8.4 Issues of equity

While home access to computers is increasing, a considerable minority of pupils do not have a PC at home. Even where there was a computer at home, however, potential access did not necessarily translate into actual use. In a minority of cases this was due to lack of interest by the pupil, but more generally was a result of competition from other family members, or occasionally due to parental restriction. Teachers were generally sensitive to the issues of equality of access to computers and some (especially secondary) schools provided open access facilities for pupils outside school hours, for example for homework:

"It's for kids who don't have computers at home, it is experience for them to get used to using a computer because when they move on – well this class moves on next year, most secondary schools have got a lot of computer based teaching, so they will need that, so I think that the earlier they get it the better really."

Teaching assistant, Broadway Primary School

A number of teachers actively encouraged pupils to use ICT for homework tasks, although this was generally set in a voluntary context. That is, pupils were told that they 'could' (look for information on the Internet, send an e-mail, use a word processor and so on) rather than they 'should', to ensure that pupils without access did not feel disadvantaged:

"I do set homework but cannot insist on use of Internet because not all children have a computer at home. Those who do bring in examples then give the sites to children to look up at school."

Key Stage 3 history teacher, Arkwright Secondary School

In addition to issues of equality of access were those relating to equality of resources. A number of pupils reported that their home PC had more up to date software than the school, and Internet access was faster. Generally, pupils reported spending longer periods working on the home PC and sometimes had a less restricted Internet access, confirming recent research findings in this area (DfES 2001).

8.5 Parental involvement

Most parents were committed to providing ICT resources for their children, and many cited educational reasons for purchasing a PC. Having made this decision, however, some parents relied on filtering software to protect their children from inappropriate material, or perceived that the role of developing responsible use of ICT was that of the school. Sometimes, children had relatively little supervision at home, particularly where filtering systems were in place to restrict inappropriate access. Some parents put trust in their children and allowed freedom of the Internet, but with sanctions if this trust was abused:

"As with most parents there is concern about the nature of some material the children will see. As yet I have not restricted their Internet access as I want to trust them. The issue will remain under review."

Parent, Sedgewick Secondary School

Where parents did consider their involvement to be important in terms of their child's education, few had models on which to draw for supporting ICT-based activities, and some turned to the school for advice. It was also clear that many teachers had few strategies for advising parents, in some cases because the teachers themselves felt uncertain about effective ICT use. If home-school links are to become a component of the 'future school', strategies for managing this aspect of out-of-school use will clearly need to be developed:

"I still feel I am too early on in that process to be sitting down with parents having an in-depth conversation about the ICT I am doing with them, I feel that I can work with the QCA suggestions at the moment and I need to get comfortable with those before I sort of start stretching it much wider."

Year 2 teacher and numeracy co-ordinator, Broadway Primary School

Interestingly, the same kind of motivating factor which encourages 'reluctant learners' to engage in

extra-curricular Internet work may be operating with some parents. According to the Senco in one school, parents were more eager to offer support which involved the Internet than they were with 'book work'. There was evidence that some parents see their involvement in their child's ICT use for schoolwork as a kind of partnership, in much the same way that they might listen to a child read or help them with a mathematics problem:

"My five year old and I play the CD-ROM which accompanies a new comic called 'Learning Land'. It has helped my son become more familiar with letters and numbers and is much more interesting than playing Batman with small figures."

Parent, Hanover Primary School

8.6 ICT capability

It has been noted elsewhere in this report that many pupils, including the very young, have a high level of technical skill with computers. Most teachers agreed that much of this skill, and associated confidence with computers, is derived from home:

"You can see which children are familiar with ICT, even at Year 1 ... the skills of the keyboard are already there."

Year 1 teacher & ICT co-ordinator, Yew Tree Primary School

"It's so obvious that they have a computer at home, they have the techniques ... head and shoulders above the rest ... so much more confident. The others [without a computer at home] are so much more tentative ... and those that are not so confident just sit back and let [those that are] do it for them."

Year 6 teacher, Yew Tree Primary School

However, not all of the skills learned at home were useful. An early years teacher, for example, suggested that children sometimes arrive with inefficient or inappropriate keyboard skills (the example was given of using the 'caps lock' key for capitalising) which then needed to be 'unlearned' and the appropriate strategy taught. Some teachers did, however, recognise the value of skill development through parental help:

"I think it is clear which students use their computers for games and which are more at home with the packages. One of my little Year 7's

produced a slide presentation that anyone would have been proud of, and I know she'd done quite a lot at home. I think it's not just having the technology at home though, but the support at home, which determines whether the student is computer savvy."

ICT co-ordinator, Dalton Secondary School

The sense of sharing between parent and child when engaged in Internet research was powerfully evident in the comments of one parent, here talking about the impact on her daughter of a school project which she had continued at home using the Internet, which eventually involved the whole family, and had a profound impact on the girls' self-esteem:

"She was asked to find out the names and meanings of ten types of Phobia and having used the dictionary for those she already knew she searched the Net and came up with 173! She highlighted her favourites to the headmaster – she was delighted that there is a name for being afraid of peanut butter sticking to the roof of one's mouth! The work on phobias was the talk of the household for about three days as we made up new ones and giggled at the 'rude' ones. Interested parents will be interested anyway, but the computer shifts the emphasis from 'Mummy can't help me with my homework', to 'Mummy look what I've found out.' I am able to be involved if they want a more sophisticated search on the Net and I used to be able to help with the everyday software programmes but they are now both more competent than me!"

Parent, Yew Tree Primary School

8.7 Emerging modes of communication

Pupils are increasingly regular users of Internet-based and other communications, such as instant and text messaging, web chat rooms and on-line conferencing. While much of this use is recreational, there is anecdotal evidence of these technologies being used for schoolwork. An example of this was pupils 'texting' schoolwork queries to one another, the electronic equivalent perhaps of 'going round to a friend's' to do homework. Generally speaking, such uses of technology – though common out of school – are often forbidden

activities during formal school hours. The comment of one teacher clearly reveals this sense of disjunction:

"I have two kids of my own, and they seem to use the computer as a replacement for the phone, which is fine. However, at school the situation with e-mail is a bit different, and we've stopped e-mailing at lunchtime, and there are no chat-rooms and obviously no game use. I'm not sure what the students' home use is, but I expect a lot of it is games and e-mail."

ICT co-ordinator, Dalton Secondary School

One or two schools did allow supervised recreational use of chat rooms out of school. One school set up an internal chat room and actively encouraged exchanges between pupils, but incorporating emerging communication media into educational contexts was rare.

Ironically then, at a time when the division between the traditionally separate domains of home and school is being blurred through the use of technology, the reaction of some schools to these newer forms of communication, and to the playing of games, appears to be an explicit redrawing of the boundary line. If schools are to develop the kind of positive beginnings reported in this section, then they may find themselves having to take account of these technologies in the near future, much as they have done with the Internet in recent years.

8.8 Teachers' home use of ICT

It is not only pupils who benefit from home access to computers, however, as previous studies (for example, DfEE/Becta 1998) have indicated. Although this was not a major focus of our discussions with teachers, some did spontaneously refer to this as being an important component in their development of ICT capability, an advantage which extended in some cases to the development of teaching materials and (for those with internet access) the identification of WWW resources. At least one school, Dalton Secondary, actively encouraged home access for staff by providing portable machines for domestic use.

As with children's home use, however, the 'self-taught' approach can bring with it the possibility of learning inappropriate techniques, with the added risk, as a Year 6 teacher at Broadway Primary School pointed out, of 'passing on those bad habits to the children'. For both pupils and teachers, then, the advantages of home use

needs to be linked to appropriate guidance and instruction from those with greater expertise. A humanities teacher at Arkwright Secondary School, for example, explained that having a home PC had helped him to gain initial confidence with ICT which he had developed further through NOF and school-based training.

Part 3 – Conclusions and appendices

Section 9 – Recommendations

Recommendations from this study are divided into three main sections. Firstly, a number of points related to the provision of adequate training, guidance and support are identified. Secondly a number of points about the provision and deployment of ICT to its best effect are highlighted. Finally, the study team have identified a number of factors of good practice from their work in these schools which could usefully be disseminated and recognized more widely.

9.1 Training, guidance and support

- The study team would endorse current calls for a comprehensive review of the NOF training model and its replacement/augmentation. Such a review should focus on providing differentiated training programmes for staff with varied levels of competence and confidence, and should consider the best way of providing nationwide consistency.
- There is continuing need (despite NOF) for training which can move beyond technical competence and concentrate on the appropriate application of networked ICT into the curriculum. Teachers still need advice on how to develop the effective use of networked technologies in their teaching, and how to integrate it fully into learning activities.
- More regard needs to be taken of the impact that NGfL and other ICT initiatives in primary schools are having for secondary schools now that some (but not all) Year 6 pupils are transferring with higher levels of ability in some (but not all) areas of ICT activity. Secondary schools may also need to examine procedures for catering with pupils with widely differentiated needs.
- Specific guidance may need to be developed on the potential of ICT in the Numeracy and Literacy Hours.
- Specific guidance may also need to be developed for teachers using ICT to support pupils with SEN.
- There is a need for teachers to be trained in the development of transferable skills with their pupils, and in the improved use of search and evaluation strategies.

- The study team believe that schools and homes have more to learn from each other about the ways in which ICT is being used in each context. For example, teachers could be encouraged to share knowledge of educational software and modes of learning with parents in order to increase pupils' skill, knowledge and understanding. On the other hand schools could usefully examine the ways in which ICT is being used in other contexts and whether these have any potential in the school environment.

9.2 ICT provision and support

- Dedicated staff machines and time should be made available to allow staff the opportunity for professional development and teaching preparation. Central funding may be required to ensure that this occurs equitably across all schools.
- Hardware and software need to be reliable, well maintained and up-to-date in order to keep staff and pupils motivated and effective.
- Adequate technical support needs to be funded and provided in schools. In some cases this may involve schools in sharing personnel and expertise.
- It is essential that bandwidth is improved to allow for more efficient use of the ICT time that classes have available to them. This is particularly important where access to ICT facilities is limited because of timetabling arrangements.
- Schools need to ensure that procedures are in place to detect and deal with viruses so that home-school links can be exploited to the benefit of pupils' achievement.

9.3 Dissemination and development of good practice

More generally this study has identified a need for wider recognition that:

- In the best examples of ICT use, lessons move through different modes of teacher/pupil interaction and involve both in a variety of roles.
- Working with computers often engenders a less formal classroom atmosphere and facilitates more pupil autonomy. This remains a challenge for some teachers.
- Even in well-structured lessons, it is not always possible for the teacher to determine the extent to which the pupils are actually learning or engaged in the task in hand.

- There are advantages to the development of safe and reliable e-mail systems which allow pupils to send work between home and school. Staff can also make good use of this facility.
- In order to exploit the potential of ICT, schools should be seeking to support learners in interrogating information in a variety of ways. The fact that ICT can aid presentation, for example, was mentioned by several teachers and while this was sometimes linked to motivation, self-esteem or higher-order thinking, many cited this as a positive end itself, or at least the wider benefits were not articulated.
- Classrooms containing ICT (including dedicated ICT suites) benefit from layouts that are flexible, which allow for non-computer work, free movement of pupils and teachers, plenary sessions, and clear supervision of work.

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Appendix – Glossary

E-mail (electronic mail) – text messages and computer files exchanged through computer communication, via Internet or intranet networks.

ISDN – Integrated Services Digital Network, a standard method of transmitting digital data over a telephone network at high speeds, faster than a normal modem.

Information and Communications Technologies (ICT) – computing and communications facilities and features that support teaching, learning and a range of activities in education (such as administration). The focus is on the subject being taught or studied, or the organisation being administered, rather than developing pupils' skills with and knowledge of the technologies themselves. (Information Technology – IT – comprises the knowledge, skills and understanding needed to use ICT appropriately and effectively).

Internet – the connection of a very large number of computer networks, using a wide range of telecommunications (such as telephone lines) to provide a means of the exchange of information across the globe. For an individual user to access the Internet (or be 'online'), their computer must be connected to a local network which in turn has a connection to the Internet. The Internet is not the same as the World Wide Web (though the terms are frequently and erroneously used interchangeably). The World Wide Web (WWW, or just 'the Web') is one of the main types of service available via the Internet (other well-known services include e-mail, bulletin boards and file transfer). It refers to the collection of information held in multimedia form on the Internet. Most Internet resources are accessed using the Web, by providers making their information available as a Web site.

Intranet – a communications network, based on the same technologies used for the Internet (for example, the pages look like Web sites), but only available to authorised users within an organisation or company. It is used to share information, resources and services within the organisation.

Modem – a communications device that allows data to be sent over standard telephone lines by converting binary signals from a computer into analog sound signals.

Networked technologies – the hardware and systems necessary for computer users to access networked and online applications as found on the Internet and intranets.

More specifically:

- a) the use of computers for communicating with others (for example using e-mail, video-conferencing, Internet based discussion 'rooms' etc.) *and/or*
- b) the exploration and/or creation of Internet/World Wide Web resources (for example via the Internet 'proper' or via the school Intranet or other 'walled garden' environment etc.) *and/or*
- c) The use of a school-based or other local network for the retrieval, storage or exchange of information (for example storing and retrieving work files on/from the school server, using a shared data area for collaborative project etc).

New Opportunities Fund (NOF) training – The New Opportunities Fund provides National Lottery funding for education, health and environment projects. The aims of the Fund's ICT training programme are to raise the standards of pupils' achievements by increasing the expertise of serving teachers in the use of ICT in subject teaching to the level of Newly Qualified Teachers (NQT's), and to improve the competence and confidence of school librarians in their use of ICT.

Acknowledgements

The members of the Strand 3 study team would like to express their gratitude for the help and support of everyone involved in the project. Particular thanks go to the staff and pupils from all of the participating schools for their enthusiasm, patience and good humour during the many visits. The study team would also like to thank colleagues at the School of Education, University of Leicester for their support and guidance, and members of Becta and the Steering Group for their comments and advice during the evaluation.

ImpaCT2

The ICT in Schools programme (formerly the NGfL programme) is the Government's key initiative for improving ICT provision in schools, developing a wide range of digital resources for teaching and learning and equipping teachers to be effective users of ICT. The programme underpins the Government's vision for transforming education. Evaluation is being undertaken using a variety of techniques, both qualitative and quantitative, and at both national and local level.

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ISBN 1 84185 825 0
DfES/0741/2002

Produced by Becta for the Department for Education and Skills

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