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Evaluation

Evaluation of the ICT Test Bed Project

The Qualitative Report

March 2007

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1.   Introduction

1.1   Purposes of this report on the qualitative strand

This section of the Final Report of the Evaluation of the ICT Test Bed Project draws on data from the qualitative strand, collected mainly during the academic years 2004–06. It builds on the three previous Annual Reports for 2003, 2004 and 2005. The first two reports tracked the complexities of planning, procurement and the development of new practices to embed ICT in the work of the schools and colleges. This report, like the 2005 report, focuses on the impact of the investment on the five key aspects of ICT Test Bed work in the 28 schools and three Further Education (FE) colleges: Teaching and Learning; Leadership and Management; Workforce Development; Cross-institution Relationships; and Home and Community Links.

By its very nature, a Test Bed project is ambitious and exploratory. It asks the question 'How much can be achieved by this intervention?'. The schools' and colleges' action plans, drawn up in the autumn of 2002, focused on specific activities and tentative targets, but the outcomes of the ICT Test Bed project were necessarily unpredictable. Its aim was to see to what extent high levels of ICT resources could enable schools and colleges to change the life chances of children and young people in areas of socio-economic deprivation. The job of the evaluation over four years has been to track the process of planning, procurement, installation and implementation of high levels of ICT during the first two years, and in the final two years to collect evidence of impact and develop explanatory theories about both the drivers and barriers to success. The report contains key learning from the initiative which can inform policy and practice in ICT in education, nationally, within local authorities and at the level of the school and college. It includes recommendations for schools and policy makers locally and nationally.

1.2   The evidence base

This report provides a succinct summary of the findings with indicative evidence and short illustrative examples. It draws on a number of more detailed reports of all aspects of the evaluation work available on the ICT Test Bed Evaluation website [www.evaluation.icttestbed.org.uk].   In addition, interviews with a small number of ICT Test Bed participants, most notably the managers/officers who oversaw the project's work in the three clusters, were carried out during the autumn term 2006 and provided clear messages based on experience with the benefit of hindsight. The detailed reports are:

- Heads' / Principals' Perceptions of the Action Planning Process in Year 1
- Autumn Term, 2003 Bridget Somekh
- Teaching and Learning: the Impact of Whole-class Technologies
- Autumn Term, 2004 Cathy Lewin, Diane Mavers, Diane Saxon and Derek Woodrow
- Evidence from the Workforce
- Spring Term, 2005   Cathy Lewin, Diane Mavers, Diane Saxon and Derek Woodrow
- Leadership and Management in the three Further Education Colleges
- Summer Term, 2005   Bridget Somekh and Diane Saxon

- Learner perceptions of the impact of ICT on their education
- Summer Term, 2005 Janis Jarvis, Diane Mavers, Diane Saxon and Derek Woodrow
- Management Information Systems and Virtual Learning Environments in Schools and Colleges
- Autumn Term 2005 Janis Jarvis, Stephen Steadman, Diane Saxon and Derek Woodrow
- The Role of ICT in Enhancing Learning and Assessment
- Spring Term, 2006 Cathy Lewin, Diane Saxon, Derek Woodrow
- The Organisation of Content and Resources
- Summer Term 2006 Diane Saxon and Derek Woodrow with Cathy Lewin
- A Case Study of the Learning Platform(s) in One Cluster
- Summer Term 2006 Cathy Lewin
- Additional Questionnaire Data
- Autumn Term 2006   Jean Underwood, Gayle Dillon and Derek Woodrow

1.3 Executive summary

This evaluation report presents findings on the impact of investing high levels of ICT in schools and colleges in areas of socio-economic deprivation. The report focuses on key learning from the ICT Test Bed project which can inform educational policy and practice.

1.3.1 Overall key findings of the evaluation

These findings are based on both the qualitative and quantitative strands of the evaluation.

Learning and teaching

- As technology was embedded, schools' national test outcomes improved beyond expectations
- The impact of ICT on attainment levels was greater for primary schools than secondary schools.
- Effective use of presentation technologies led to greater interaction between teachers and learners.
- Effective use of ICT personalised learning by enabling greater learner choice within the curriculum, improved assessment for learning and more learner directed teaching.
- Technology facilitated more effective assessment for learning by making it easier for learners to be more involved in target-setting and for teachers to give individualised feedback.
- The use of electronic registration improved attendance levels in some schools by 3-4% whilst behaviour management systems were perceived to have a positive impact on both behaviour and attendance, prerequisites for effective learning.
- To enable learners to get the maximum learning benefit from using the internet, internet protocols that safeguarded learners' welfare without being overly prohibitive were required.
- Some changes to teaching and learning strategies were inhibited by tensions between the priorities of different government policies and agencies, regarding ICT.

Leadership and management

- Institutions that were more e-mature improved their performance levels significantly more quickly than those that were not. However, there was a dip in performance until the ICT became embedded and staff developed the requisite skills.
- Managing the implementation of large amounts of ICT required a strong vision, an extended planning phase, staged investment and support throughout.
- Schools needed to build sustainability, of both resources and pedagogic change, into their change management strategies from the start.

- Ready access to databases, which enable better analysis of data, made assessment and planning more systematic. However, there was a need to ensure that the amount of analysis required was not over-burdensome.
- Management Information Systems (MIS) enabled leaders to better identify the particular needs of their school community through improved data analysis.

Workforce development

- The involvement of ICT changed the working practices of teachers and extended the roles of administrative staff and technicians.
- Well –co-ordinated and sustained professional development opportunities were important in developing ICT skills and confidence of all staff and embedding the use of ICT. Informal, on-the-job training was very effective when supported by in-school champions.
- Where new technologies were introduced into all of a school's classrooms at the same time, a culture of sharing and mutual support developed as the whole staff faced the task of embedding the technology into their pedagogy. Collective need led to collective solutions being found and shared
- Access to reliable technology and daily use led to rapid improvements in teachers' skills and improved management of workloads.
- Shared server areas and virtual learning environments made it easier for teachers to find, store, share, create and reuse resources and lesson plans. This ensured long-term value from the initial high investment by the workforce.

Cross-institution links

- Effective cross-institution collaboration required a common purpose and leadership from the top. Plenty of time for staff to meet and establish trust needed to be built into the process with roles and responsibilities clearly identified. This was especially important in the cross-sectoral collaboration.

Home and community links

- The majority of students in ICT Test Bed schools, as in other schools, now have access to computers at home. Loaning ICT equipment to learners helps to bridge the digital divide.
- ICT made it much easier to share assessment information with parents via school websites or learning platforms.
- Schools slowly increased their use of email – and in some cases text messages – to communicate with parents, enabling them to respond to parental enquiries more rapidly. However, establishing a two-way dialogue with parents was more challenging.
- Increasing home access to ICT and the internet was operationally difficult for schools. It was very time consuming and required careful planning.

1.3.2   *Main findings from the qualitative evidence*

1.3.2.1 Procurement and initiation of major ICT initiatives needs reflection

- Clearly-defined management structures and stable senior management teams are important conditions for effective leadership of change in major ICT innovations. The active support of a senior manager and supportive interest of the whole senior management team were essential.
- Procurement timetables for large projects are often too short to enable managers to understand fully the consequences of their choices. Managers may not have sufficient knowledge, or awareness of the potential of ICT, to make informed decisions. A delayed second phase of procurement may lead to better choices.
- Change management support is necessary at the start of the project, not only after structures are in place. Schools should write their action plans as a mechanism for the management of change, to take forward the broader vision that the school wishes to develop.
- It was clear that an LA with well-established structures and procedures could take on a strong leadership role and provide very high levels of support. ICT Test Bed showed that at best this role builds on existing practices and that there was no one right approach.

1.3.2.2 Sustainability of major ICT initiatives involves more than just the equipment

- Sustainability is part of an ongoing process of development, not something which comes at the end of an initiative. Sustainability needs to be planned for from the start, not only by managers in schools and colleges, but by the LA and policy-makers at the national level.
- Sustainability of ICT innovations means much more than the replacement of equipment. Real sustainability means the long-term embedding of ICT in pedagogic and organisational change. Installation of ICT equipment in all classrooms at the same time proved to be one of the best ways of getting staff to form a mutual support group and learn together, which led to embedding pedagogic change.
- Revenue funding for change agents and to give staff time to meet regularly for planning and training is essential in changing practices. With good leadership this high level of support can be reduced over time without making the innovative ICT initiative unsustainable.
- Innovative, large-scale ICT 'test bed' initiatives are intentionally exploratory and perfect decisions on all points are not possible. It can be frustrating being a trailblazer, but the learning that comes from frustrating experiences is a valuable source of knowledge next time round.
- ICT equipment will need to be replaced in three or four years' time. Ideally, this should be budgeted for from the start but in practice this may not be possible. It is of interest that in the ICT Test Bed schools and colleges, funding to replace equipment that has become embedded in teaching, learning and administrative practices has not proved difficult to find. It had become essential and therefore a priority for funding.

1.3.2.3 High levels of ICT lead to changes in roles

- It is, of course, not the use of ICT 'tools' which is of interest, but the way in which they have enabled and altered the nature of the task which teachers and learners are engaged in. Ultimately the nature and style of learning is about teacher practice more than equipment.
- Teachers in the classroom cannot afford to take risks, so reliability and assuredness are fundamental requirements of the resources they use. The provision of technician support is invaluable in the early stages of a major investment in ICT and needs to be maintained, albeit at a reduced level, as a support mechanism. High levels of ICT mean that high levels of technical skills are required.
- The role of the classroom/teaching assistants has changed in ICT-rich classrooms. They need training along with teaching staff and can then play a full part in supporting pupils. Experienced classroom assistants are able to support supply teachers and new staff in ICT-rich schools.
- The installation or upgrading of management information systems (MIS) leads to changes in the roles of administrative staff and pastoral support managers and needs to be built into planning for change.
- Email is changing the way that staff communicate, facilitating flexible working and enabling student work to be submitted and marked electronically. Email has speeded up dissemination of information between teachers and administrative and support staff.

1.3.2.4 Training and professional development are crucial

- Professional development was important in developing ICT skills and confidence, developing professional pedagogy, and increasing prestige and professionalism. Training needed to be co-ordinated with the introduction of the ICT equipment. Informal training, working with and watching colleagues and personal practice, has been seen to be more effective than specific training courses.
- Action research has been valued by staff and afforded a means of personal and professional development.
- Technicians need training and professional development, which requires co-ordination by LAs.

1.3.2.5 Many ICT Test Bed teachers now have high levels of ICT skills and are highly motivated to use ICT in their teaching

- There have been exceptional gains in the competence and confidence and understanding of what can be achieved by the use of technology of primary school teachers and some FE tutors who now routinely use ICT in all their teaching. Secondary teachers' use is more varied between departments and individuals but some are also making extensive use of ICT. Initially new technologies are incorporated into existing practices, with the result that those technologies that provide a good 'fit', such as interactive whiteboards and visualisers, are used first and others such as video conferencing and learning platforms are incorporated more

gradually. Training needs to continue over time to enable teachers to integrate innovative pedagogy into their practice.

1.3.2.6 High levels of ICT have enabled planning of teaching to be easily shared

- There is evidence of ICT being used to formalise planning and make it easily available to colleagues and managers, leading to improved teaching and better monitoring. There are clear time savings in medium- and long-term planning which are corporately shared.

1.3.2.7 ICT has had a considerable impact on teaching and learning

- Presentation technologies[1] were very influential in stimulating innovation in the ICT Test Bed schools, as they create a forum for discussion and interaction with pupils. They provided a real incentive for teachers to develop computing skills and effectively changed teachers' preparation and planning for the curriculum and encouraged more detailed lesson planning.
- The provision of presentation technologies for a whole group of teachers at one time has a significant effect in producing cooperative professional development and mutual support amongst the teachers.
- When embedded across the curriculum, ICT can raise attainment in writing. Case studies of two ICT Test Bed primary schools provided evidence of considerable improvement in national test scores for children's writing at KS2, particularly boys' writing.

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[1] In one cluster a customised package of equipment (computer, data projector with large whiteboard, visualiser, and interactive slate) was installed in all classrooms in preference to an interactive whiteboard in all the classrooms of the other two clusters. These two options are henceforth referred to in this document as 'presentation technologies.'

1.3.2.8 Digital cameras help personalise learning

- Digital cameras and videos personalise the curriculum and improve assessment for learning, particularly for self-review and peer-review. In FE, digital evidence is increasingly being used in student portfolios.
- The problems of establishing compatible and reliable technology for video conferencing limited its development and more recent technological innovations in this area mean that further development is needed before this becomes a common school activity.

1.3.2.9 Teachers create and adjust resources to reflect their students' needs

- A significant proportion of resources is designed and created by teachers themselves, often using ideas and elements downloaded from the internet. Resources developed by other teachers are usually used as a stimulus and source of ideas rather than being used in their original form. Software which supports teachers in creating classroom resources, through appropriate images, video clips and short programs, is particularly valued by primary teachers. Once established, the teachers' effort is focused on improving the resources and making them more relevant to their current classes.
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1.3.2.10 The establishment of shared network access is a major instigator for staff sharing resources and ideas

- A good resource bank supports teachers when they change the year groups they teach. It also easier to develop a new portfolio of resources when it is scaffolded by existing resource provision. The resource is also invaluable in providing continuity when working with classroom assistants and employing supply teachers.

1.3.2.11 The internet is an invaluable resource for learners and teachers

- The internet has given teachers unrivalled access to information so they can focus on the presentation and organisation of the information. It has also revolutionised the way in which learners obtain information for projects, since they are no longer limited to the classroom reference library.
- Increased downloading of media, such as video and music, requires increased server capacity, which needs to be planned, managed and sustained.
- Over-restrictive filtering of the internet can hinder exploratory learning. This has been a problem to some extent in all ICT Test Bed schools, but particularly in secondary schools.

1.3.2.12 ICT is embedded across the curriculum in ICT Test Bed schools and the ICT Test Bed curriculum areas in the FE colleges

- Despite some unevenness in the use of ICT in different subjects in the secondary schools, there has been a clear shift in the ICT Test Bed project towards embedding ICT in teaching and learning across the curriculum. This is a very positive move forward from the position

recorded by the ImpaCT2 evaluation in 2002, when the major use of ICT was for teaching ICT skills.

1.3.2.13 Curriculum changes are constrained by general policies

- Curriculum in schools and colleges is largely determined by external authorities, examination boards and central strategy creators. In primary schools, however, although there is a well defined curriculum, there is more scope for managing ICT usage as the model of one teacher and one class enables flexibility in timetabling and planning. In secondary schools the nature of the timetable and room usage militate against flexibility and inhibit the use of ICT.
- Pupils do gain a measure of control over their work programme when they are engaged in project work, which is more common in primary classrooms and some KS4 subjects but is more limited in KS3.
- The National Strategies were not seen by teachers as being in the forefront of ICT development in their respective subjects, due in part to their concern for schools which are not ICT rich.
- The evaluation found evidence of a lack of coherence in the implementation of government policies for ICT in education between government agencies and OfSTED. This is a matter of serious concern because it creates a risk-averse culture in schools and seriously undermines the chances of success from large-scale investment of public money in ICT initiatives.

1.3.2.14 Students' motivation and engagement in learning and education can be greatly increased by access to ICT.

- Students in the ICT Test Bed schools and colleges are very confident in their use of ICT. In primary schools and FE colleges they are consistently enthusiastic about the positive impact it has on their learning. Secondary students are less unanimous in their approval and some expressed frustration in interviews. A key factor is the extent to which students are given autonomy and choice in using ICT.

1.3.2.15 Use of ICT in teaching and learning declines prior to formal tests and examinations

- The current arrangements for national tests, including the recommended teaching strategies for numeracy and literacy, were not designed with ICT-rich schools in mind, with the result that teachers consciously reduce the extent of ICT use in the year leading up to tests to safeguard attainment levels.

1.3.2.16 The secondary school time-table is a barrier to making good use of ICT in lesson time

- Secondary teachers are severely hampered in using ICT for teaching and learning because the timetable fragments the day into short teaching periods with frequent movement of students and staff. There are logistical difficulties in repeatedly issuing and 'logging on' laptops for use by different students in each period, as well as insufficient time for students to engage fully with ICT.

1.3.2.17 Assessment processes have improved because of the use of ICT

- By making assessment and marking activities more public and exemplars more easily shared ICT has improved the quality and consistency of marking and this has improved the reliability and impact of assessment at all levels of schooling. It also supports the involvement of students at all levels in establishing targets and assessing achievement against them.
- ICT makes a considerable difference to the way in which assessment information is readily available to individual teachers and enhances the public sharing of this information with other teachers and parents.
- Teachers are very appreciative of the security and ease of access that electronic record keeping provides. Administrative tasks are aided by the improvement in search and sort ability when data is stored electronically.

1.3.2.18 With effective MIS and educational vision, leaders create a culture of readiness for change and carry initiatives forward

- Educational vision and leadership, together with good management, are crucial for institutional change. The work of the ICT Test Bed schools and colleges demonstrates that enhanced ICT infrastructures, incorporating large server capacity and tools such as management information systems, provide managers with tools that support visionary leadership. A culture of readiness for change has led to good use of change management tools.
- System-wide choices, such as MIS and learning platforms, need to be given considerable thought to ensure that they meet all of an institution's requirements[2]. Some in-house development may be needed. Planning needs to recognise that any new system inevitably causes disruption and leads to changes in operational processes and staff roles.

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[2] See for example the Becta framework for learning platforms[http://matrix.ncsl.org.uk/GMATRIX_679799_80991066/1165941961863/rebrand/matrix/index.cfm?matrix=136&forcenew=yes]

1.3.2.19 Improved attendance and behaviour

- Improved attendance and punctuality are perceived to be a positive consequence of online registration which has enabled student attendance and subject avoidance to be monitored more carefully. This included lesson-by-lesson registration in secondary schools which revealed 'selective attendance'. In some primary schools 'same day calling' of parents/guardians has had a major impact on attendance.
- Better access to behaviour records greatly assists pastoral managers in supporting students and their parents. To use a behaviour management system effectively, teachers require protocols to ensure that all relevant information is recorded.

1.3.2.20 ICT is highly motivating for students with special educational needs

- ICT has enabled gifted and talented pupils and higher ability children to extend their activities and study in more depth. It has also enabled pupils with English as an Additional Language and those with special educational needs to readily access learning.
- Some students with special educational needs such as autism and attention deficit disorder have shown greatly improved attention levels when teachers use ICT for whole-class presentations, or allow them to use digital equipment such as cameras and microscopes.

1.3.2.21 In order to embed use of both ICT infrastructure and resources, institutions need a flexible workforce, who are open to change

- In many of the ICT Test Bed schools and colleges, enhanced ICT has triggered greater flexibility of roles. For example, administrative staff have taken on new responsibilities for managing MIS, and technicians and support staff have taken on new roles to support teaching and learning. There is potential for the roles of all staff to be changed in ICT-rich schools and colleges. Technician roles are vital in supporting staff and equipment and their role changes over time. Technicians need support and training and schools and LAs need to organise an appropriate programme.

1.3.2.22 Cross-institutional links require a purpose

- In order to achieve and sustain cross-sector collaboration there needs to be a clear purpose; it needs to be managed and roles and responsibilities need to be clearly identified. Cross-institution collaboration requires plenty of time for consultation.
- The creation of content development teams has enabled significant expertise to be shared between institutions, but this requires careful planning to determine their role and funding to both establish the team and maintain it.
- The embedding of email as a central communication tool within ICT Test Bed schools and FE colleges has facilitated cross-institution collaboration. Electronic links between schools, LAs and the DfES have enabled essential data to be submitted electronically, which has reduced the burden on administrative staff.

1.3.2.23 In the FE colleges ICT has enabled changes in communications with employers

- In the FE colleges ICT has facilitated work-based assessment supported by PDAs and digital cameras.
- There have been considerable savings of time and money by using email to communicate with employers and set up work placements.

1.3.2.24 Schools do not have the capacity to manage the distribution of computers into students' homes

- The experience of the ICT Test Bed project indicates that schools do not have the capacity to manage the distribution of computers to homes in areas of socio-economic disadvantage. Factors such as the expense of connectivity and software licences, poor local infrastructure and lack of landlines in homes, and the time needed to provide technical support, impose demands that schools cannot meet.
- However, optimism remained high that if logistical problems could be overcome, there would be great benefits for teachers, pupils and parents. This is an area which requires new policy initiatives of the kind currently coming on stream through e-learning foundation initiatives and others. These need to ensure that schools are not left to handle an extensive administrative burden.

1.3.2.25 Communication with parents has improved

- Although communication between home and school will remain paper based for the foreseeable future, ICT Test Bed schools have made significant use of either their websites or their learning platform for providing parents with information to help them support their children's learning.
- Email communication has made responses to parental queries more immediate. However, this also requires that appropriate safeguarding protocols are developed and implemented.

1.3.2.26 A learning platform potentially makes a major contribution to learning management

- Learning platforms are still in the development phase but their potential has been evidenced in ICT Test Bed colleges and secondary schools.
- Those schools that have embraced the use of a learning platform to support teaching, learning and management have made significant progress in many aspects such as day-to-day school management, homework management, communication and parental involvement. Whilst there is evidence that some aspects (email, school diaries, bulletin boards, for example) have become embedded in most schools, the development of the learning platform is still at an early stage, particularly in relation to use in primary schools and use by parents.

2. Procurement, implementation and sustainability of high levels of ICT

2.1 Main findings

2.1.1 Project initiation and procurement

- Major investment in ICT is challenging, complex and time-consuming for the schools and colleges involved. Strong leadership is essential and in the ICT Test Bed project, Local Authority-led models of implementation proved to have considerable advantages over school-led models, not least in greatly reducing the demands on headteachers' time.
- Policy-makers need to understand that innovative ICT initiatives take considerable time to implement. Building works to install new equipment and wiring cause considerable disruption in educational establishments. Staff training and the embedding of ICT in pedagogy take time. We have learned that it takes at least a year before new infrastructures can be put in place and at least two years before any impact on students' achievement standards can be expected.
- Implementing a project of this kind involves school and college leaders in developing a vision and reorganising management structures, allocating new roles and responsibilities, and 'carrying staff with them' as partners in change. To achieve this it is essential that strong leadership is already in place, otherwise any investment can only have a superficial impact.
- Whole organisational change is a powerful strategy for change. Investment in ICT in a small number of curriculum areas in the colleges had far less impact than investment in schools across all departments. The major impact on the ICT Test Bed colleges has come from developments in MIS and learning platforms, which were installed for use across the whole college. The curriculum areas that received ICT Test Bed funding have been able to transform their teaching methods and members of their staff have become models for innovative practice. However, they have necessarily become islands of innovation, which may be difficult to sustain.
- Change management should be regarded as the top priority. This is difficult with major ICT investment, which requires time-consuming procurement decisions to be made. Change management is concerned with changing structures and cultures. It is therefore a much deeper process than staff training, and one that has an impact upon working practices across institutions. It requires both visionary leadership and clear change management tools and procedures.
- Teachers in the classroom cannot afford to take risks with resources, so reliability and assuredness are essential. The provision through ICT Test Bed of enhanced technician support was vital in establishing this security of operation but, as teachers became more competent and confident, they were more able to manage minor problems quickly.
- Large-scale ICT innovations place pressure on technical support staff. The technical services in schools and colleges need to be expanded to

cope with the new workload; re-training is essential for the installation and maintenance of new equipments; and clear lines of management are crucial to ensure that new developments are fully integrated with existing services.

- There have been fewer problems with the wireless networks in primary schools than in secondary schools, probably owing to the increased consistency of having the same pupils and the same laptops in a particular room, reducing the number and frequency of log-ons. Problems began to emerge in the later stages of ICT Test Bed due to the relatively short life of batteries in laptops and the cost of their replacement.
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2.1.2   Sustainability

- Sustainability is part of an ongoing process of development, not something which comes at the end of an initiative. Sustainability needs to be planned for from the start, not only by managers in schools and colleges, but by the LA and also by policy-makers at the national level. New policy initiatives coming on stream in 2006[3] are enabling work in ICT Test Bed schools to be both sustained and further developed. In this sense, ICT Test Bed appears to have filled the role of 'a test bed' in initiating policy development.
- Revenue funding to give people time for new support roles, and regular meetings for planning and training, is an important condition for success in changing practices. Whilst essential initially, with good leadership this level of support can be reduced over time.
- Good technical support is essential in schools and colleges with high levels of ICT. Without this, the ICT is unlikely to become embedded and consequently will not be sustained.
- Innovative, large-scale ICT 'test bed' initiatives are intentionally exploratory and perfect decisions on all points are not possible. There has been considerable learning from elements of the ICT Test bed

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[3] Computers for Pupils initiative and Building Schools for the Future, for example

Project, such as the installation and commissioning of a new MIS or VLE which needed further development to be effective in the school or college context, and were (with hindsight) frustrating at the time.

▪ ICT equipment is never a one-off spend. It is inevitable that equipment will need to be replaced in three or four years' time after purchase. This should be budgeted for from the start but in practice this may not be possible. It is of interest that in the ICT Test Bed schools and colleges, funding to replace equipment that has become embedded in teaching, learning and administrative practices has generally not proved difficult to find. What has proved of real value becomes essential.

▪ Sustainability needs to be understood as something more important than the mere replacement of equipment. Real sustainability means the long-term embedding of ICT in pedagogic change. Installation of ICT equipment in all classrooms at the same time proved to be one of the best ways of getting staff to form a mutual support group and learn together, which in the long term had a profound and positive effect on embedding pedagogic change.

Project initiation

The early plans for the ICT Test Bed Project were developed by the DfES in consultation with the headteacher of a large secondary school in what was to become one of the three participating Local Authorities (LAs). All three LAs were approached by the DfES and invited to join the project. In one case involvement of a particular secondary school and some of its feeder primary schools was assumed; in the other two cases, choice of schools was limited by the criteria specified by the DfES. ICT Test Bed schools in effect received 'an offer they could not refuse', which they greeted with enthusiasm because of the large sums of money involved. However, it was significant that only one cluster of schools had come into the project by their own choice through the kind of bidding procedures that were normal practice in their LA.

The management structures for the clusters were set up by the LAs. The colleges, whose governance as independent organisations was very different, were only loosely linked into the structures. The style and structures of management set up in the three clusters were very different, in each case suiting the LA's established patterns of relationships with its schools. Each pattern had positive outcomes and less effective ones, which were largely a function of context.

▪ One cluster set up a committee structure which separated responsibility for decision-making on large-scale procurement (Executive Board) from cluster strategy and revenue expenditure (Management Board), with the most senior inspector chairing the former committee and the ICT Test Bed Manager (also an inspector) chairing the latter, whose membership consisted of the schools heads and a college manager. This was, nevertheless, a flat management structure which gave heads control over the development of ICT Test Bed in their school, within a strong framework of advice from the ICT Test Bed Manager and the LA's

> specialist ICT service. The Heads' Management Board met once a month in the secondary school.

- Another cluster set up a committee structure which vested decision-making in the management group of headteachers, chaired by one of its members, subject to LA procedures. This LA appointed a Link Officer with a pivotal liaison role between the cluster schools and the LA departments and responsible officers, rather than an ICT Test Bed Manager. Both headteachers and school ICT co-ordinators met weekly at the secondary school to drive the work forward. The college manager was a member of both groups but did not attend all meetings. It was found that in the early days of the project, important decisions were delayed too long, perhaps because the group was trying to make decisions without the necessary expertise. The effect was a lack of strong leadership for the cluster as a whole, which was important given that the group was working with expenditures of up to £500,000 on ICT. Leadership was provided by the head of the secondary school during the first year but other calls on his time meant he was unable to sustain this key leadership role in the long term.

- The third appointed a former team advisor as ICT Test Bed Manager, who held meetings as required either with headteachers or school representatives, depending on the issues involved, and invited them to make decisions collaboratively on the basis of detailed information and advice. The college manager attended meetings and took part in decision-making. This LA did not set up a project committee structure. School ICT co-ordinators had regular meetings with the ICT Test Bed Manager at the LA's ICT Centre.

Different kinds of expertise were available in each LA to support ICT Test Bed planning and procurement. In one case there was a very high level of Council expertise in procurement as well as expert support available from a central IT support service. In another, considerable technical expertise was available and the small size of the LA considerably simplified the lines of communication and decision-making. In all three LAs the ICT Test Bed Manager or Link Officer brought specialist expertise from previous experience of ICT-related projects.

The three Further Education colleges were invited to join the project because of their proximity to the cluster schools. In the colleges, high levels of ICT were to be made available to only three curriculum areas and colleges were required to select areas which were different from each other so as to give as broad a spread as possible. All the colleges appointed an ICT Test Bed manager for the project, in one case it was an existing member of senior management group and in the other two a new appointment. The choice of curriculum areas was guided by Becta. It was a condition of the ICT Test Bed project that investment was to be used to develop teaching across the curriculum, so colleges were not allowed to select IT as one of their focus areas. One college deliberately selected areas where staff had no previous experience of using ICT. Another chose areas where upgrading existing IT equipment was important and timely. However, the selection was made somewhat

arbitrary by the requirement for the three colleges to choose different curriculum areas.

Colleges also received money for infrastructure and MIS improvements. It is important to note that in terms of their total budgets, ICT Test Bed funding was a relatively small sum of money for all three colleges. All three colleges used ICT Test Bed funding to extend their investment in Virtual Learning Environments (VLEs).

Collaboration between the colleges and schools meant establishing new working procedures and communication channels since the colleges are independent corporations reporting to the Learning and Skills Council (LSC) and the schools, while they have their own governing bodies, are under the overall governance of the local authority (LA).

2.3   Procurement and implementation

2.3.1   In primary schools

Initially, many primary schools found the timescale that was imposed on them for completing the ICT Test Bed plan was totally unrealistic. Headteachers felt that there was a lack of understanding of how schools operate in general and of primaries in particular; for example, primaries don't have departments. One headteacher commented "*You just cannot do things instantly. There are other things that take priority in the school. ICT Test Bed is only one strand of the school*". Equally, headteachers needed time to come to an understanding of how ICT might affect their schools and teaching and learning.

The initial action plans were therefore completed too rapidly and did not allow for delays in the procurement and installation of equipment, eventualities that could have been predicted on the basis of the experience of previous large-scale ICT initiatives, such as the National Grid for Learning (Somekh *et al.* 2002, p. 3). These included a large number of trivial but time-consuming logistical problems relating to building works, which disrupted teaching and learning to varying extents. The whole process also caused anxiety because of the large scale of the spending involved, by comparison with the managers' previous experience.

> "The challenge was to get the money spent without spending it haphazardly. The installation of the kit in the five classrooms initially was appalling. The company that came in and put the piping around the school were awful. They had such a tight timescale – aesthetically it is a mess, great big tubes around the classroom that do not look as neat as they could do. When the remaining installations are done we will address that. The remote control for the screen is on the opposite side to the teacher's desk. The projectors are turned on and off from the ceiling where the PowerPoint is. The caretaker switches it off. All they need to do is bring a switch near the teacher's desk area. All those small things need sorting out. There is a frustration in wanting to get on with things and not being able to get on with things." (Project Manager, Junior school)

Almost all primary headteachers underestimated the demands that implementing ICT Test Bed would make on managers and it was clear that those schools which had chosen to appoint a full-time ICT Test Bed manager were able to implement the work of the project much more quickly. Where the major management responsibility was retained by the heads rather than being vested in an ICT Test Bed Manager, the project continued to make considerable demands on their time throughout the whole of the first eighteen months.

In all three LAs procurement of complex networked software systems proved very challenging and time-consuming. Two LAs purchased new management information systems (MIS) and the third took the decision to upgrade the existing system. Two purchased VLEs to provide a shared resource for all ICT Test Bed schools. In all cases the procurement process for VLEs or MIS took many months.

2.3.2   In secondary schools

In secondary schools the problems of implementing ICT resources on this scale were similar to those in primary schools but magnified because of their larger size. There were problems with planning and specifying equipment, with installations and suppliers, and disruption to classes could not always be avoided.

> "Thank goodness we only had 15 rooms done at first. Rooms had to be interrupted lots of times to get the stuff in place – cabling, electrics, computers, desks, projectors. Most classrooms were interrupted more than 10 times. Sometimes we were having to move classes for a small job. They would have come out of school hours but it was dragging on anyway. It wasn't co-ordinated very well. …. This time we have requested storage to hold all deliveries, do a set number of rooms at a time, all boxes are kitted out in the storage area so that when they are brought into the classroom they are all ready and just fitted on the same day as the projector and screens.
>
> A lot of rooms are really old with protruding sockets. The screens could not always be wall mounted, they had to be hung from the ceiling or there was a bit jutting out so they did not fit. The plans did not always reflect that – they were not studied carefully enough from the beginning. So they would arrive with all the bits and pieces to find that the screen did not fit. One room had all cables and electrics fitted in the wrong part of the room.
>
> Blinds were a hidden cost. Maybe we didn't get strong enough projectors. So we've had to spend £9,000 on blinds. We hadn't budgeted for that. Some rooms have lots of large windows. Next time we will have stronger projectors. We will still need blinds as you cannot 'compete with daylight'. " (Secondary Deputy Head)

In one secondary school interactive whiteboards were originally mounted in the wrong place and had to be moved. Managers learnt the hard way that installing ICT equipment on this scale needs extensive planning to cover every detail at every stage. Time spent on initial planning can greatly reduce time-wasting disruptions later.

2.3.3   In all schools

Teachers are now generally so confident and competent with the ICT resources that minor technical difficulties no longer become problems. Partly through the investment in technician support (see Tearle, 2004, who identifies this as important factor), but also because of the enhanced skills of teachers, the equipment is now seen as reliable and stable. Minor problems are now dealt with intuitively and only major system failures create real dilemmas. This confidence in managing the hardware and software is essential if teachers are to utilise ICT in their provision of learning experiences for their students. Not being able to do this was has previously been noted as an inhibiting factor (Malavet, 1998; Greiffenhagen, 2000 as cited in Smith, Higgins, Wall and Miller, 2005; Sutherland *et al*., 2004).

Teachers in the classroom cannot afford to take risks; reliability and assuredness are essential features in resources. Smaller primary school systems tended to be secure fairly quickly but in at least one secondary school it took some time to recover from early problems with wireless networks which were originally purchased without sufficient functionality. Similar early systems problems were also experienced in the FE colleges. Once problems emerge, the perception of staff of the reliability of the system is difficult to re-establish. One secondary school delayed the introduction of classroom sets of laptops for two years until it was sure of the system's reliability, and consequently suffered far fewer problems. Early in ICT Test Bed it was not unusual for system-wide innovation to cause an initial disruption to networked services whilst incompatibilities and interferences were sorted out, but most networks are now stable.

There have been fewer problems with the wireless networks in primary schools than in secondary schools, probably owing to the increased consistency of having the same pupils and the same laptops in a particular room. Problems began to emerge in the later stages of ICT Test Bed due to the relatively short life of batteries in laptops and the cost of their replacement.

2.3.4   In further education colleges

The time-scale for procuring equipment was even shorter for the colleges than for the schools as their funding was not allocated until late spring 2003. Additionally, perhaps because the ICT Test Bed Project was proportionally less funding for the colleges as a portion of the ICT budget than it was for the schools, its likely demands on systems and managers were not appreciated at the start. In fact it placed strain on all existing college systems – finance, learning support, staff professional development and management – and this led to delays in getting the project started. All colleges experienced some delays in procuring hardware and software as ICT Test Bed was additional to existing college operations and placed an additional load on the finance staff and systems. One college had further difficulties because the start of the project coincided with the replacement of the whole senior management team and major restructuring. In this situation, there were clear tensions between spending large amounts on ICT at the same time as staff were being made redundant; between receiving funding that had to be spent on ICT when the college needed other resources just as much; and in creating inequalities between curriculum areas within the college.

Installation of the equipment placed an additional load on the technical staff in all three colleges, which caused further delays. It proved to be essential for senior managers to integrate technical support for the acquisition and installation of the new ICT Test Bed equipment with the existing technical support provision, and in the college which was undergoing major restructuring this was inevitably delayed, causing considerable frustrations for all concerned.

2.4   Sustainability

2.4.1   In all schools

The ICT Test Bed project has provided a considerable body of knowledge about long-term sustainability of large-scale ICT initiatives. Some of the lessons became clear during the course of collecting evidence about the project's work over a four-year period; others emerged in the final year, when planning for the future clarified the thinking of managers and it became possible to look back on what had been learnt.

In the early stages of the project, heads of primary schools saw sustainability as a *real challenge*. They predicted that it would not be possible for schools to renew equipment and maintain the same level of activity without continuing to fund ICT at a higher than normal level.

However, in practice, by the time the project funding came to an end four things had happened which radically changed this perception:
- expectations of the level of funding needed for ICT in primary schools had changed very markedly nationally as a result of initiatives to fund interactive whiteboards and wireless networks in many schools some ICT equipment had become embedded to the extent that practices in teaching and learning and school management had made them indispensable
- the price of equipment had greatly reduced (for example, the cost of data projectors is now 50 per cent less than in 2002 and the cost of visualisers 30 per cent less)

- national policy had moved forward, to some extent building on the experience of ICT Test Bed, and new initiatives such as the Computers for Pupils initiative[4] (directed at placing computers in the homes of disadvantaged pupils) provided new funding to extend and develop what had already been achieved.

The first key lesson is that sustainability needs to be thought of as part of an ongoing process of development, not something which comes at the end of an initiative. Sustainability needs to be planned for from the start, not only by managers in schools and colleges, but by the LA and also by policy-makers at the national level. It also needs to be 'organic' as it will need to respond to changing contexts. The schools and colleges were all placed in the position of 'not looking a gift horse in the mouth'; in effect they had to risk future losses in order to seize current opportunities. Those with strong leadership were better able to plan strategically at the beginning, and more successful in embedding ICT in the curriculum and management structures, and hence better placed to respond to new policy initiatives which came on stream four years later as ICT Test Bed was drawing to an end. Those with poor leadership were among the few who adopted a minimalist approach to sustainability, for example one secondary school felt it would be impossible to find the level of funding that would be required from the school's core budget and by summer 2006 was planning a decrease in provision of ICT equipment over time, adopting a strategy of cannibalising failing PCs and laptops to provide spare parts that would extend the life of other equipment.

A very positive finding of the evaluation has been the extent to which new policy initiatives coming on stream in 2006 are enabling work in ICT Test Bed schools to be both sustained and further developed. This may indicate continuity in long-term planning at the policy level, or alternatively that learning from the first three years of the ICT Test Bed project has fed into plans for future initiatives. The Computers for Pupils initiative already mentioned, which focuses on provision of ICT for pupils in areas of socio-economic deprivation, is one such new policy which is carrying forward the Home–School links work. Two other initiatives which are injecting

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[4] See http://schools.becta.org.uk/index.php?section=oe&catcode=ss_es_opp_02&rid=13420

additional funding into secondary schools for purposes which allow further development of ICT Test Bed work, are the general move towards Specialist School status and the Building Schools of the Future initiative (BSF). LA managers of ICT Test Bed were invited to make presentations at the launch of BSF and the Computers for Pupils initiative, and the evaluators had the opportunity of feeding lessons from ICT Test Bed project into an early BSF planning meeting at the DfES.

> The home–community links have provided a wealth of experience for the new Computers for Pupils initiative. The LA's ICT Test Bed liaison officer has a new post to head that up and she is carrying forward the lessons learnt. Some of the good practice developed in TB [ICT Test Bed] will remain. Through TB and other funding the LA now have Learning Champions in post linked with each school and to the community. This has improved contact with families.

A second key lesson is that revenue funding to give people time is an important condition for success in changing practices. Success was more rapid and more likely to be sustained in those clusters and institutions which appointed full-time managers able to lead and support staff in the early stages, and gave staff time to attend planning meetings and 'timely' training sessions when they were learning to use new equipment. With good leadership, this high level of support can be reduced over time without making the innovative ICT initiative unsustainable. Designated ICT Test Bed managers returned to their classrooms in the final year and other staff took over responsibilities for aspects of ICT Test Bed work that had become embedded.

Good technical support is essential in schools with high levels of ICT. Without this, ICT never becomes embedded and consequently will not be sustained. At the end of the ICT Test Bed project the level of technical support had to be reduced, but almost all schools took the decision to maintain a much higher level of technical support than existed prior to the project. This was done by allocating funding from schools' budgets and one primary head told the evaluators she had taken the decision to replace a teaching assistant with a technician who could provide support for ICT use in classrooms. Most primary schools share a technician since they cannot afford one full time on their own.

A fourth lesson relates to training in change management. Change management is concerned with changing structures and cultures. It is therefore a much deeper process than staff training and one that has an impact on working practices across institutions. As already noted, very tight time frames for planning and procurement placed a strain on all institutions during the first year. This had the effect of focusing early support from Becta on procurement and planning and diverting attention from the need for training in change management. Although included in the original ICT Test Bed project description, support for change management – other than in the form of advice from Becta project staff – was not provided until the spring of 2004, eighteen months into the life of the project.

> "The whole concept of change management is to give ownership and find strategies at the beginning. That was to some extent skipped over in the early stages of ICT Test Bed. It was almost a reaction to the problems we encountered rather than being a starting point." (LA manager)

The change management workshops provided by the National Remodelling Team in the spring and summer of 2004 were universally praised for their practical value and high-quality delivery, but were seen to have come too late to prevent some poor management decisions early in the life of the project. This had the effect of undermining the potential for sustainability. For example, in one secondary school where the introduction of the VLE was not integrated with a change management strategy, the training from the commercial provider was inappropriate and staff failed to make a sustained attempt to integrate the VLE with their practice.

However, another key lesson relating to sustainability is that innovative, large-scale ICT 'test bed' initiatives are intentionally exploratory and perfect decisions on all points are not always possible. Managers, supported by their LAs and Becta, had to take procurement decisions on prototype versions of complex ICT software systems such as Virtual Learning Environments (VLE), early versions of wireless networking, and early models of new hardware such as interactive slates and video-conferencing facilities. There are disadvantages in being a trail blazer. One LA manager advised schools against purchasing a VLE and felt vindicated in that decision at the end of the project, particularly as a new understanding had emerged over time as to the purpose and value of what are now called Learning Platforms:

> "We've been proved exactly right. The others have all changed their products. There are very few institutions that are getting full value from a VLE [purchased three years ago]. We've waited and the systems are now more mature. It's the right time to do it now…learning platforms are now a driving force – you need to get data from an MIS into classrooms and potentially out to homes. Initially the VLE was about content and lesson plans – teachers didn't feel the need for that. … Now teachers are clicking on a link and finding information on individual pupils, using the data to plan their teaching." (LA manager)

In many other cases mistakes were made but, with hindsight, these are best seen as inevitable and valuable for what has been learned through the experience.

> "It was a really useful experience going through the frustration relating to the VLE … From that we have learnt about (a) change management, (b) technical infrastructure, and (c) planning the implementation. Our new VLE (post ICT Test Bed) is taking off in a big way." (LA manager)

There is also a need to recognise that it is inevitable that equipment new in year one will need to be replaced in three or four years' time. ICT equipment is never a one-off spend. The pressure to renew equipment has three causes: the acknowledged three-year life-span for most hardware; constant use that further reduces its life through 'wear and tear'; and 'people's expectations of technology' that always rise

over time. Routine replacement of ICT equipment should, therefore, be planned for where possible. In practice this is relatively easy in large institutions, but likely to cause problems in primary schools with small budgets.

Sustainability needs to be understood as something more important than the mere replacement of equipment. Real sustainability means the long-term embedding of ICT in pedagogic change. Schools that bought hardware in a phased approach were in a better position to replace equipment than those who bought all the hardware at the start of the project. This was particularly true of one secondary school that delayed purchasing laptops and establishing a wireless network until the third year and was thereby able to benefit from both knowledge gained and improvements in the technology itself. However, installation of ICT equipment in all classrooms at the same time proved to be one of the best ways of getting staff to form a mutual support group and learn together, which in the long term had a profound and positive effect on embedding pedagogic change. This was true in all the ICT Test Bed primary schools, in some secondary school departments and in the selected curriculum areas in the three colleges. The key lesson here is that embedding change in pedagogic practice is more likely to occur if there is a combined focus of all staff on using new ICT equipment and software, rather than a gradual introduction over time.

Where schools were committed to maintaining their high levels of ICT, they were determined not to 'go backwards'. Reactions from visitors from other schools made schools realise how much they had changed in the three years of the project and that staff were working in a different way. This meant that priorities for spending had shifted and there was a commitment to finding money from the school core budget to maintain the high level of ICT.

Some equipment proved not to be very robust, and by the end of four years was urgently in need of replacement. Early wireless networks, particularly in one secondary school and the FE colleges, were underspecified and unable to cope with multiple, simultaneous log-ons of laptops. These networks are now much more reliable and laptops have in-built wireless connectivity rather than requiring additional wireless networking cards. Laptop batteries proved to have a limited lifespan and this made banks of laptops less useful in classrooms as time passed. Projector bulbs also began to fail and their luminosity began decreasing, making the image much less distinct. In some cases interactive whiteboards began to suffer surface damage due to intensive use.

However, in all cases where the use of ICT had become embedded and the senior management team realised that it had become a crucial part of the infrastructure, funding for replacement equipment had been found or was planned. The LA managers, when interviewed three months after the end of the project, confirmed that, in most cases, levels of hardware and software were being retained. Two reported that the level of funding for staff training, including meetings and planning sessions, had been greatly reduced and both felt this would be detrimental to future development, although neither felt that it would be reasonable to expect the level of revenue funding in ICT Test Bed to be sustained. The third reported that funding to pay for connectivity from students' homes would not be continued after summer

2007, but it was clear to the evaluators that linking to the learning platform from home had not become fully embedded in students' practice as learners. Observing the rapid growth in the availability of broadband in homes, the picture could well change quite rapidly.

2.4.2   In further education colleges

Many of the key lessons discussed in the previous section on schools are also true of colleges. However, both the nature of colleges and the different scale and focus of their ICT Test Bed funding have strongly influenced the long-term sustainability of the project's work.

Colleges are different from schools in their level of financial independence and responsibility so there was a realisation from the start that the new hardware would bring an ongoing cost in terms of upgrading and replacement. Only a few curriculum areas received enhanced ICT for teaching and learning, which also made it easier to plan for replacing and upgrading ICT as part of the college's spending cycle.

Developments in MIS have had a significant impact on the whole college and its operation, particularly when considered in terms of the proportion of ICT Test Bed funding that was invested in MIS. Although they comprised a relatively small part of the ICT Test Bed funding, they have acted as a major catalyst to changing the culture within the colleges.

MIS developments require such radical change to work practices that they are likely to be sustainable developments, and the rapid improvements seen during the ICT Test Bed project will have a lasting impact in the colleges and provide a solid base for future developments. College environments are increasingly complex and subject to frequent and unpredictable change: staff leave or change roles, departments move rooms, from site to site or to new buildings, so there are many reasons why equipment may not be replaced or updated. In this environment, it may be that change in teaching and learning in the colleges is transient; there is perhaps a tendency to revert to the 'stable state'. ICT Test Bed could be viewed as a project designed to bring about change in teaching and learning, but given the limitations to specific curriculum areas within the colleges, it may be that the developments in MIS discussed in this report represent the real impact of ICT Test Bed for FE.

3. The impact of high levels of ICT on teaching and learning

3.1 Main findings

3.1.1 Using high levels of ICT equipment to support teaching and learning

- There have been impressive gains in attainment at Key Stage 2, including gains in boys' writing, in two primary schools which made sustained use of laptops for pupils' writing across the whole curriculum. This is a model which could be adopted by other schools, but changes in the training of Ofsted inspectors' expectations for 'handwriting' would be necessary to make it a risk-free strategy for schools.
- It is not the use of ICT 'tools' which is of interest, but the way in which they have enabled and altered the nature of the task which teachers and learners are involved in. Ultimately the nature and style of learning is about teacher–student interaction more than equipment
- In secondary schools and colleges, equipment which is permanently installed or which is common to all classrooms has been most effectively embedded. Equipment which is very subject specific is generally well used.
- For younger children the increased independence afforded by technology use and the provisionality it enabled enriched learning, allowing them to undertake activities they might not have been able to engage in previously.

Presentation technologies

- Interactive whiteboards (IWBs), in particular, provide a shared pedagogical space where teachers and students can interact with curriculum content and one another. This enabled teachers to demonstrate, to explain more fully, to respond to perceived need according to student response, and to respond to student questioning.
- There was regular student use of IWBs, not just in whole-class sessions but as a tool for group work and this is true for even the youngest pupils.
- The visualiser provides an additional set of valuable functions, in particular for creating a communal focus for the analysis of students' work and also for reviewing objects and artefacts.

Other equipment

- The use of graphics tablets was disappointing, in part because they require more practice to use than is generally available and in part because they were introduced later in the process and hence were seen by teachers as less essential.
- The use of digital still and video cameras was extensive in the early years, in order to personalise the curriculum by bringing images of the pupils' home into the classroom.

- Digital cameras were valuable when used to record pupils' work to demonstrate their achievements and provide evidence which can be transmitted should a child change school.
- The problems in establishing compatible and reliable technology for video conferencing limited its development and it would appear that further technological development is needed before this becomes a common school activity.

3.1.2 Using high levels of electronic resources for teaching and learning

- The use of electronic resources, whether off the shelf, customised, or created from scratch, has a positive impact on classroom practices in relation to the visual nature, structure, clarity, instant feedback, immediacy, relevance, pupil engagement and involvement, and pace.
- All schools and colleges have developed a storage and retrieval system, with which teachers are now familiar.
- In all schools a significant proportion of resources was designed and created by teachers, often using ideas and elements downloaded from the internet.
- Teachers reported that it was initially very hard work to establish and find useful resources to deliver the planned curriculum, but that this was retrospectively very worthwhile in terms of the resources that they now had available and could readily modify for re-use.
- Sharing of resource on the school's intranet is noticeably saving teachers' time. The time freed up is often used to make resources more relevant to the needs of different groups of students.

The internet

- The internet has given teachers access to information so much more quickly and easily that finding lesson content is no longer a problem; their main focus is now on presentation and organisation of the information.
- The ability of learners to 'free range' the resources they wanted from the internet provided a much wider information source than classroom reference texts. Researching material for projects on the internet is one of the major uses of ICT by students. Some safeguarding restrictions in schools limit this activity.

Resource providers

- Commercial resources which provided clip-art and video clips, as well as short lesson activities for primary teachers to manage, were found particularly useful in preparing lessons.
- Lessons produced by other teachers and content creation teams are usually used as a stimulus, and banks of ideas form lesson preparation rather than being used as they stand.
- After some initial enthusiasm the experience in ICT Test Bed suggests that there was limited continued enthusiasm for integrated packages of Individual Learning Systems, the use of which made it difficult for teachers to maintain access and knowledge of pupils' progress and needs.

- The National Strategies were not seen by teachers as being in the forefront of ICT development in their respective subjects, probably because they are primarily designed with schools without a strong ICT base in mind.

3.1.3 The impact of high levels of ICT on pedagogy

- Presentation technologies can fit easily into existing patterns of classroom interaction, and in some cases their efficiency reinforces presentational approaches and teacher dominance.
- Presentation technologies created an easier forum for discussion and interaction with the pupils since the planning and presentation of a lesson was already accomplished and the teacher could concentrate on the pupils and their reactions.
- In primary schools the impact of computers on the central strand of pupil and group activity has been as important as presentational technologies in many classrooms
- For some secondary teachers, presentation technologies have changed their practice from a didactic approach to a more interactional one, in which they ask more questions and are more able to focus on learners' knowledge. This stops short of passing control to the pupil, but does increase pupil involvement and pupil impact on the lesson.
- In secondary schools choice is mainly made available through project work, in which internet searching and drafting of text are significant elements made available through ICT; whilst this is often limited in KS3 it becomes more common in KS4.
- ICT has enabled gifted and talented pupils and higher ability children to extend their activities and study in more depth. It has also enabled pupils with English as an Additional Language and those with special educational needs to readily access learning.

3.1.4 Using ICT for teaching and learning across the curriculum

- In primary schools, although there is a well defined curriculum, there is more scope for managing this in the flexible timetabling and planning which derives from having one teacher and one class. Integrated project work is a real possibility.
- Co-ordinators felt that as ICT Test Bed schools they are well ahead of the ICT focus in the Primary Strategy materials.
- In secondary schools where much of the core curriculum is centrally and nationally directed, the impact of technology is problematic since central designs have to encompass schools in which the technology is limited. Nevertheless, some innovation naturally occurs with the introduction of ICT. In secondary schools many of these developments have occurred in the KS4 curriculum, where assessment through project work allows more flexibility and freedom to manage the curriculum. In KS3 the curriculum is more constrained and controlled and assessment is less project based.

3.1.5 The impact of high levels of ICT on assessment

- Students at all levels are increasingly involved in establishing targets and in assessing achievement against them.
- Lesson planning increasingly has exemplar student responses to the assessment tasks linked electronically to the planning to aid consistency and provide scaffolding for students' work.
- By making assessment and marking activities more public and exemplars more easily shared ICT has improved the quality and consistency of marking within secondary departments.
- By focusing on the learners' outputs, assessment activity is immediately made personal and relevant. Digital video and still cameras with the facility to record short excerpts of video have been used creatively and effectively to support peer- and self-assessment at all levels of schooling.
- The analysis of assessment information has improved significantly through the use of electronic recording of outcomes.
- The ready access to assessment information is invaluable to those engaged in pastoral support.

3.2   Introduction

Arguably the most important ICT Test Bed theme was 'teaching and learning'. The choice of clusters of schools in areas of relative deprivation was a significant act in piloting enhanced ICT resources in schools with social priorities. Much of the success of teaching and learning depends upon the personal skills of the teachers in the schools and the positive leadership provided by the school and LA managers. The investment in very high levels of ICT was intended to have a positive impact on students' attainment across the whole curriculum. The focus was not on discrete ICT teaching and students' acquisition of ICT skills, but on the skilled use of ICT by teachers and students to improve performance in national tests in literacy and numeracy, and public examinations, as well as enriching the whole experience of teaching and learning.

It is clear that amongst such other issues that concerned these schools, ICT Test Bed has provided a stimulus to improve the teaching and learning, and the confidence and enthusiasm which has followed the acquisition of skills in using ICT have been seen to be an effective force for improvement. A clear finding of the evaluation is that merely having ICT equipment was not sufficient for schools to achieve significant gains in students' learning. The crucial factor was the way in which teachers and students used it, which related directly to both their school's management of the resource – springing from the headteacher's vision and leadership – and their teachers' ability to use ICT to change their pedagogy and transform the students' learning experiences.

3.3   Two illustrative cases

Case studies describing the teaching of writing in two primary schools in one of the clusters serve to illustrate what ICT Test Bed achieved at its best. The quality of their work is typical of a number of the ICT Test Bed primary schools, while at the same time illustrating the unique approaches of these two schools. Each school used the project's ICT resources to build upon existing strengths and give students new opportunities to achieve more than they could have done before.

School A is a community primary school that serves two villages in a rural, former mining area, as well as attracting children from nearby towns. Like all the ICT Test Bed schools, its catchment includes areas of socio-economic deprivation, but its students are less disadvantaged than those at other schools in the cluster. It is highly regarded by parents and between 2002 and 2006 expanded its student numbers by almost 25%, from 135 to 174 students. It has embedded ICT in all aspects of the curriculum and has achieved recognition for outstanding use of ICT and ICT leadership from bodies such as NAACE, Becta, the Specialist Schools Trust, Capita and the National Council for School Leadership. The use of ICT for writing has achieved some outstanding results, particularly through strategies such as writing presentations or display to the class on the interactive whiteboard. Children in all years make frequent use of the laptops (of which the school has 80), linked to a wireless network, as well as PCs located in their classrooms. Children store their work electronically on the school's server.

Examples of writing from Year 1 include from a high achieving pupil:

Do you have nice wall paper ?
Do you have a fridge?
Did you have a bath?
Do you have cub bords ?
Where do you keep your food?
Is your tabl made of wood?
Do you have elechrisate ?

You can tell me things about a past kitchen

and from a student of lower ability, a quiz to be presented to the class and used for discussion:

What is the cluster you need?

	cl		pl
	cl		sm
	fl		pl

Examples of informative writing from year 3 include:

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How to pack a sandwich

❖ Put sandwich in plastic container

❖ Put a sticky top on gently

❖ Put it on a machine until it is don

❖ After that put it onto another machine for sell by date

❖ Make sure sell by date is sealed on the top

❖ Put it on a machine to go to a van

❖ After store in shop

❖ sandwiches are packed in plastic

❖ If they were pack in metal they would not taste very nice

❖ If they were packed in paper your sandwich would be soggy

❖ They put sandwiches in plastic because it dos not moiled

❖ We put them in plastic containers so germs don't get in

Very informative!

Very clear and easy to read!

and an illustrated alphabet (letters A to E) to be used with younger children.

PHOTO REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

Examples of writing in Year 5 include a fairy story, called *The Sleeping Chicken*, based in part on the story of Romeo and Juliet which was word processed by a girl and presented in 'Edwardian script' font, a review of a film called My Worst

Nightmare using presentation software by a lower achieving boy, which includes the following slide:

PHOTO REDACTED DUE TO THIRD PARTY RIGHTS OR OTHER LEGAL ISSUES

There is also a film script for the fight between Romeo and Tybalt by one boy, and a piece of persuasive writing arguing for more play time, word processed by another boy:

> "We should get more play time because running around keeps you fit and healthy. Also, it wakes people up if they had a late night so they can do work better. Furthermore, the teachers will have more time to plan what work the pupils should do next. The teachers also have more time for tea and coffee. The pupil's will also improve their football skills at playtime, which will therefore make the football team better. The teachers could also have more time to make up different punishments for people being bad. "
>
> "Heh, heh – I've thought of some already. You've persuaded me." (Teacher)

As shown in the examples above, teachers read and mark the writing electronically.

This use of ICT for writing has had a positive impact on the standard of students' writing. Boys have been much more highly motivated to take pride in their writing and expend effort on it than when they worked solely in books. As a result boys' achievement levels in writing have greatly improved: in 2006 five boys out of nine exceeded expectations and the Contextual Value Added score for boys was 100.0, compared with 99.1 in 2004 and 99.3 in 2005. Girls' CVA scores over the same period were 100.2 in 2004, 100.4 in 2005 and 100.5 in 2006, so the rate of improvement for boys was greater than for girls – an extremely important gain in

relation to national trends. In 2006, when this use of ICT for writing in all subjects across the curriculum was fully embedded, all students achieved level 4 or above at Key Stage 2 in English (including for writing separately), maths and science.

It seems certain that ICT was a major factor in this achievement because teachers note that it highly motivated two children with special needs, one a boy with autism and the other a girl with dyslexia. Both these children had achieved level 1 at the end of KS1 and raised this to level 4 at the end of KS2, a remarkable achievement. In this small school the numbers of students entered for KS2 national tests between 2003 and 2006 has ranged between 26 and 20, making statistical analysis of variation from year to year indicative rather than significant. CVA data for all children in 2006 was 100.4 and in 2005 only 99.5, however the 2005 data was seriously skewed by the inclusion of a child who had not been entered for the tests at the request of her mother as a result of having been recently diagnosed with epilepsy and not yet stabilised on new medication. When corrected to remove the zero scores for this child the CVA scores for 2005 are 100.1. Results in 2003 were also good with CVA of 100.5 but there was a slight dip in 2004 when CVA was 99.7.

Setting aside the unreliability of statistics based on such a small sample, this apparent drop in standards for one year may have been related to the massive level of innovation experienced by the school during the first eighteen months of the ICT Test Bed project. If so, its 2006 results certainly suggest that the change and temporary disruption has paid off in a relatively short time span.

School B is a voluntary controlled Church of England primary school on the edge of a council estate in a small former mining town subject to socio-economic deprivation. It gained a School Improvement Award in 2002 and the Active Mark Award in 2004, and following its Ofsted inspection in 2005 received the award for Particularly Successful Schools and Colleges 2004–05 from the Chief Inspector of Schools. As part of its work for ICT Test Bed it has attracted the attention of Becta for its electronic method of recording and tracking students' progress. It has embedded ICT in all aspects of the curriculum and, in addition to using a bank of laptops with students in Years 3 and 4, students in Years 5 and 6 are allocated laptops for their own use, with parents signing a contract with the school to ensure the safe transport of laptops between home and school. During Year 5 and until January in Year 6 students do all their writing, for all subjects except maths, on their laptops. Spreadsheet work is also done on laptops, but not number work because, as in most workplaces, calculations and the use of algebraic symbols are still easier to do by hand. In January of Year 6, use of the laptops is considerably reduced to allow students to work at their handwriting in preparation for the handwritten national tests in June.

The quality of student writing has improved markedly and teachers believe this is a direct result of using ICT. In 2006 the percentage of students achieving Level 4 and above in national tests at KS2 rose from 46% to 69%. These children had had access to their own laptops and routinely used ICT for writing and – following their teacher's comments – for improving their work, for two years. In June 2006, the Year 5 students had made extraordinary improvements in writing after using their own laptops for just one year. Whereas, in the optional tests at the end of Year 4, 71.5%

of the students were below the expected level for writing, this had fallen to only 37% in the optional tests at the end of Year 5. It is also of interest that compared with the pattern nationally, less able students in Year 5 at school B achieved at the same level in writing as they did in reading (37% were below the expected level in both), although more students achieved above the expected level in reading (53%) than in writing (37%) which is in line with the pattern nationally. These exceptional gains in standards in writing by the same group of students as they moved from Year 4 to Year 5, were mainly due to gains in the motivation and hard work of boys, and teachers are convinced that this was a result of the support that ICT gives boys (as well as girls) in the writing process and their consequent gains in self-esteem.

School B's method of marking students' work electronically involves regular use of the tracking facility in word processors, to allow teachers to comment on students' writing and students to respond with corrections and their own comments. Word-processing software automatically distinguishes in different coloured fonts between different commentators, producing a clear record of the development of the text from the first draft, through teacher's comments, to the student's revisions. All marking is done on screen and the deputy headteacher who developed the system said in interview that, if anything, it is quicker than writing comments by hand in students' books. Like School A, School B also uses presentation programs for writing to enable students to present their work to the class on the interactive whiteboard, and teachers have devised a similar method of writing comments on the presentations although it is not so easy without the automatic tracking facility.

Electronic marking has now been extended to the collection of examples of students' writing in files stored on the server along with records of students' achievement. This means that direct evidence for teachers' assessments is easily available for discussion between teachers, with parents or with external bodies such as Ofsted.

3.3.1 Differences in inspection reports for the two schools

It is of great concern to the evaluators that these two schools that have worked so closely together, and in both cases provided the evaluators with considerable evidence of the positive impact on writing of embedding the use of ICT in teaching and learning across the curriculum, have not been treated equally by Ofsted in recent inspections. School A was awarded a 'satisfactory' grade (new regulations) whereas School B was awarded a 'very good' grade (old regulations) and, as noted earlier, was specially recognised by Ofsted as 'a particularly successful school'. A factor in the difference was that School B was inspected under the previous regulations and three inspectors spent three days in the school (plus one additional day) making a ten day inspection in all; School A was inspected under the new regulations by two inspectors who were in the school for just a day and a half, making a three day inspection in all.

The accounts of the inspection process given by the two headteachers suggest that the inspectors took a great deal more trouble to discuss the innovative use of ICT and its purposes in School B than in School A. Indeed, in School A the lead inspector said she did not have time to look at any of the students' writing stored on the computer and stated explicitly that she was only interested in seeing handwritten work in books. As a result of seeing only a small part of the students' writing, the

School A inspectors wrongly came to the conclusion that students had not covered all the various kinds of writing required for KS2.

A number of factors suggest that the inspectors of School A did not share the vision of the government-funded ICT Test Bed project, which is in line with policy for investing in ICT to improve standards as set out, for example in *Harnessing Technology* (DfES, 2005 page 41, point 125-6):

We want every child to achieve their full potential by ensuring that every school in England makes full use of ICT for learning and teaching, to improve standards across the board…independent research has shown that children using ICT effectively in lessons get better results…

Instead, they held a very limited view of the nature and purposes of ICT use in education. In their report and an accompanying letter to the children there are seven specific references to 'the ICT project', all but two of which are explicitly negative in their implications, and strongly suggest that the inspectors view ICT as either a discrete subject or an add-on presentational device.

> "The school's involvement with a national information and communication technology (ICT) project has enabled pupils to reach very high standards in ICT, but it has had an adverse effect on their writing."
>
> "Standards in ICT are very high. However, some overuse of computers for writing has had a detrimental impact on the quality of handwriting and the presentation of work."
>
> "While the use of ICT is outstanding and has considerably enhanced the skills of pupils and teachers, it has made many demands on staff and other priorities have received insufficient time."
>
> "The energies of the leadership team have been diverted by the ICT project. Although valuable, it took up more time and energy than expected at a time when the school's leadership was under additional, unexpected pressure."

AND, in a letter sent home with the children;

> "Dear children
>
> Thank you for welcoming us so enthusiastically on our recent visit to your school (…)
>
> Children at your school are very talented. You are very musical, you dance well and are very impressive in your use of ICT. (…)
>
> Some of your handwriting and presentation is not very neat. The children who spoke to us agreed that you do not always try hard enough. We think you need to

> write more in your books and not rely on word processing to make your work look attractive. (…)"

In these comments there is an assumption that ICT is a distraction from the real work of teaching literacy rather than a valuable teaching tool. There is also an emphasis on neatness of handwriting that is at odds with the national tests at KS2 where handwriting only attracts 3 marks, of which neatness probably counts for only 1.

The inspection took place in May 2006 in the week following national tests. Although the inspectors did not take account of the children's writing stored on the school's network (including samples made available to them on a CD) they were shown evidence from the children's books that the standard of writing was in line with the predictions contained in the school's Self-Evaluation Form and appeared to accept this. They were also given a detailed analysis of the school's national test and CVA data which showed that, discounting the zero scores for the child with epilepsy who had not been entered at her mother's request, there was no 'downward trend' of scores but merely a 'dip' in 2004. None of this evidence made the inspectors change their pre-visit judgments on standards. Moreover, they used evidence from the SEF selectively, disregarding the fact that the headteacher had listed the ICT project as 'an aid' to raising performance, and giving great emphasis to the fact that she had also listed it as 'a potential barrier.'

The inspectors who visited School B in April 2005, under the old regulations, were much more thorough in their approach and it is clear from the report that they fully engaged with the aims and purposes of the ICT Test Bed project. This is indicated by these three extracts from the report:

> "The school's ethos is excellent and this is mirrored in the attitudes of pupils with learning difficulties. The use of information and communication technology and the very good relationship throughout school lead to high self-esteem and confidence. Teaching and learning are excellent in information and communication technology, and skills in the subject are used and applied outstandingly throughout the curriculum."
>
> "The quality of teaching and learning has improved dramatically since the last inspection because of the development of a very good curriculum and the outstanding use of information and communication technology."
>
> "Learning resources are used extremely well, particularly information and communication technology equipment, to motivate and interest pupils in order to enhance and speed up their learning."

Part of the problem seems to be that the new inspection process is very rushed and, if the inspectors do not accept the school's self-evaluation prior to their visit, they do not have time to collect evidence during their visit to support their judgement. At school A, the statement in the report that the SEF was 'too generous' is not supported by evidence. The inspectors' approach to the work of the school was

cursory at best; and the report suggests that they made no attempt to understand the ICT Test Bed project's vision of raising standards in writing, reading and numeracy through embedding ICT in teaching across the whole curriculum. This raises very serious issues for government policy. It is both unfair to schools and a massive waste of public money for OFSTED to make cursory judgments of highly innovative and potentially transformative work of this kind, based on traditional judgments and statistical analysis of the outcomes from extremely small samples, regardless of the validity[5] of the data.

In order to check the extent to which the case of School A is representative of other Ofsted reports under the new guidelines, the evaluators carried out an analysis of all eleven inspections on ICT Test Bed schools during the 2005-06 school year. This is just over a third of the participating schools. The first point of note is that there is no mention of ICT in the guidance on conducting inspections[6]. This must indicate that ICT is categorised by Ofsted as a 'subject' rather than a resource that should pervade all teaching and learning. Indeed the assumption underpinning the guidelines appears to be that schools are carrying on as before rather than attempting to improve and transform their practice, since apart from a reference to tracking 'initiatives' there is no mention of 'change management' in the section relating to 'leadership and management.'

Across all the reports on these schools which have received a massive investment in ICT with the purpose of improving standards, there is very little mention of ICT. The way that ICT is mentioned suggests that the inspectors see it as peripheral to the main business of teaching and learning. For example:

> "We think that your playground is looking very attractive, and we think you are making really good progress with ICT."

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[5] Evaluation outcomes cannot be said to be 'valid' if they are based on data which are not relevant to the judgement being made, i.e. in this case including the zero score from a seriously ill non-entrant.
[6] OFSTED (2005) Conducting the Inspection: Guidance for inspectors of schools. Ref. HMI 2502.

In the majority of the reports there is no mention of ICT in relation to the teaching of literacy and numeracy. Instead, ICT is treated separately, e.g. 'standards in ICT are very high' or 'use is exceptional'. Often it is noted as a resource. When it is mentioned in relation to teaching and learning, many of the reports emphasise its role in motivating children and improving their self-esteem. In none of the reports is there any real engagement with the way in which ICT may be changing the nature of students' learning.

This brief analysis of the Ofsted reports on 11 ICT Test Bed schools carried out under the new guidelines adds weight to the findings from the two case studies presented here, indicating that the issue is not particular to the case study schools. The impact on School A of receiving a 'satisfactory grade' after three years' participation in the ICT Test Bed project and affirmation of its achievements locally from the LA inspectors and nationally from Becta and NCSL was initially devastating. The publication of the national test scores for KS2 confirming 100% achievement of level 4 in English (including the writing component), Maths and Science, went a long way to restoring the confidence of the Headteacher and staff. Their innovative work integrating the use of ICT in all aspects of the curriculum continues, itself a testimony to the ICT Test Bed project vision.

The case of School A raises very serious issues for policy makers. Together with the evidence from the other 11 Ofsted inspections carried out in 2005-06 it strongly suggests that the implementation of government policies for improving standards are not 'joined up' across different departments and agencies. The result of conflicts of this kind in policy implementation is to subject schools to gross unfairness and create a culture of risk-aversion, while seriously undermining the chances of success from large-scale investment of public money. Ofsted need to consider whether inspectors need further guidance, and training, on the use of ICT as a tool for raising standards rather than merely a subject to be studied.

3.4   Teaching and learning – A summary of gains

As is clear from the two case studies of using ICT to teach writing in primary schools, it is not the use of ICT 'tools' which is of interest but the way in which they have enabled and altered the nature of the task which teachers and learners are about. Ultimately the nature and style of learning is about teacher style more than equipment (this same view was also voiced in John and Sutherland, 2004; Smith, Higgins, Wall and Miller, 2005)

The ways in which the children speak about resources is evidence that technology is part and parcel of their everyday classroom experience. They are well aware of different functionalities and input devices associated with whole-class technologies, such as the touch screen, pens, cordless mouse, remote keyboard, projector, microscopes, scanners, concurrent viewing on a desktop PC and so on. Related, and sometimes surprising in interviewing children of this age, was their customary and correct command of technological terminology such as 'realigning' (when IWB writing is 'dodgy') and the 'control panel', 'tracking bar' and their ability to remember and recite sets of instructions, such as uploading to the shared site to enable teacher access.

Particularly for younger children, in Foundation stage and Key Stage 1, the increased independence afforded by technology use and the provisionality it enabled enriched learning, allowing them to undertake activities they might not have been able to engage in previously. This was one of benefits of IWBs argued by Glover and Miller, 2001 (see also Billard, 2002; Bell, 2002 as reported by Smith, Higgins, Wall and Miller, 2005) and relates to the ability to accommodate a range of learning styles such as kinaesthetic learning, (also identified in Beeland, 2002; Virtual Learning, 2003; Solvie, 2004).

Much of ICT activity is now so embedded that it ceases to be noticed. It is now used naturally and the initial sense of 'novelty' has diminished for teachers and learners. Pupils now expect it to be used when appropriate and sometimes found it hard to remember when it was used and when it was not as it was so much part of everyday events. There is awareness by the pupils of security and safety issues: children spoke about the need for logging on with passwords and being protected from inappropriate messages.

3.4.1   Using high levels of ICT equipment to support teaching and learning

Teachers' experiences over the project justified almost all the investment in hardware by primary schools, although some equipment was only adopted by a limited number of teachers. Breakdowns are now only rarely a problem, largely because the use of technicians had given real security and regular maintenance. Additionally, teachers had learnt through experience how to attend to simple problems. Projector bulbs go and batteries fail, but the processes for dealing with these are now in place.

Presentational technologies

All the clusters introduced presentational technologies in all classrooms from the beginning. In two clusters this was accompanied by IWBs and in the third it was supplemented by the introduction of large whiteboards, visualisers and (later) graphics tablets**.**

Projected electronic resources are able to change available curriculum materials from the static to the dynamic. That which is displayed can be changed rapidly (from screen to screen), is provisional (can be added to and deleted) and can move (video clips, animation). Smith *et al.* (2005) report on the benefits of being able to flip between screens and this being especially helpful for pupils with some special educational needs**.**

Very different from paper-based materials, this opens up possibilities for teaching (which resources can be displayed) and learning (expanded modes of representation), and hence has implications for pedagogy (interactivity). The use of display technologies enables pupils to visualise and experience material that would be more difficult to access in traditional formats. It is clear that electronic display resources create a new ambience in the classroom.

Across the clusters, the evaluators saw a range of electronic resources used in whole-class teaching: content-rich web-based materials (such as drill and practice 'games'), materials created by teachers (including an electronic talking book, a presentation on histograms, downloaded images and scanned texts) and exercises designed with standard office programs (mathematics activities using spreadsheets, for example). The quality of teacher presentation is significantly improved, not just in terms of colour and imagery, but also in the clarity of text – pupils can now read the board much more easily than before.   The ease with which text can be highlighted and changed can lead to increased pupil involvement and more pupil control over the process.

Interactive whiteboards, or similar presentation technologies, have been influential in stimulating innovation in the ICT Test Bed schools and colleges. They provided a real incentive for teachers to develop their computing skills for a purpose and effectively changed teachers' preparation and planning for the curriculum. Every teacher commented on their appreciation of, and dependence on, such valuable technology. Indeed, some teachers spontaneously expressed the view that they would in the future not move to a school without them.

The value of presentation technologies is enhanced by software packages which provide scaffolding for teachers to develop resources and provide stimulating presentations for their students. In a survey at the end of the project, primary teachers regularly expressed the view that these were resources they would not willingly be without. Many teachers have focused on the development of truly interactive resources rather than simply presenting text, and the view of the whiteboard being mainly a presentation tool is not in fact the case. Whilst it is clearly a major ingredient in presenting the 'plenary' session element of lessons, it has made those elements much more interactive and enabled more differentiation to take place. The use of animations, sometimes using their own teacher's voice, was particularly effective in motivating younger pupils used to colour and movement. 'Big books' were effectively presented on the screens with real visibility. By presenting information through the display technologies the students are provided with a clear structure. Students who had not taken adequate notes or who had missed a lesson for some reason could also access the notes later through the school intranet/learning platform, or as a separate file prepared by the teacher.

Interactive whiteboards

Interactive whiteboards (IWBs), in particular, provide a shared pedagogical space where teachers and pupils can interact with curriculum content and one another. Not only does an IWB focus the individual pupils on the learning resource, but it also provides a communal image and space and encourages socially supported learning. In terms of teaching specific skills, pupils can observe the actions of the teacher or their peers, and teachers remarked how quickly even very young pupils, having observed the teacher in action, could replicate such actions and perform the same tasks. For older students the experience of watching the teacher manipulate spreadsheets and databases is invaluable for teaching ICT skills.

Pupils and students appear to be learning skills implicitly through watching teachers manage the process on the IWB and imitating what they do.

A Year 3 teacher said, 'My actions, the ways that I navigate the system, they watch.' Year 5 children used terms like, 'e-portal' and 'full screen' as natural language in their talk.

A Foundation Stage teacher commented on how perceptive her children are and was surprised that they learned how to get a new page almost instantly simply by watching her.

On the other hand, a Key Stage 1 teacher said that she makes some skills explicit and checks skills levels by asking pupils to access resources, minimise, etc. at the interactive whiteboard.

There was clear evidence of regular student use of IWBs, not just in whole-class sessions, but as a tool for group work. This is true of even the youngest pupils. It was interesting to see children who had been in school for less than four weeks handling the pen and changing pages on the board with confidence and skill. In most of the KS1 classrooms pupils were not only invited to write on the board but were encouraged to manage its functions. The use of drag and drop activities provided a wide range of pupil involvement. For older students, their preparation of presentational packages for their peer group helps to solidify and confirm their knowledge.

The ability to annotate the pages displayed on the board facilitated the gathering of students' views and comments, while the ability to save this provided an ongoing focus for developing ideas and communal storyboards. Being able to retrieve this in the next lesson was often valuable in providing for continuity and a clear reminder of the established learning. Where appropriate, teachers took the opportunity to write additional notes and to highlight features of pre-prepared materials. This enabled them to demonstrate, to explain more fully, to respond to the students' perceived needs and to respond to student questioning. This use of the adaptability of the technologies was essential to stimulate student interaction with the lesson. It was common in Key Stage 2 for students to be asked to come forward and either write on the board or type into the computer to move the lesson forward. Similarly, FE students had frequent opportunities to take part in interactive activities using the IWBs. This was less common in secondary classrooms, though interactivity was also implicit in the questioning and discussion that took place, often stimulated by the images presented using the classroom technologies.

Simple techniques such as placing a square grid over a shape to explore area, moving elements of compound shapes around the board and simply drawing bar-charts and other graphs were certainly helpful pedagogic tools, and ones not possible non-electronically (or at least not so readily). The ability to highlight words and to use colour and the 'spotlight' tool to help structure the work has made textual analysis much more accessible. This is essentially a function of the computer-driven display equipment, but is made much easier by using the IWBs interactively. The IWB is significant in teaching the use of word processing and spreadsheet techniques to students, since not only are the results of actions visible but so too are the actions themselves when performed on the IWB. They were regularly used to

annotate text and undertake grammatical analysis, redrafting text on the boards involved students in the actual task of reorganising materials and increased their understanding of the skills involved, and the capacity to recapture information presented in an earlier lesson was invaluable.

Visualisers

One cluster chose not to install interactive whiteboards. Instead it provided data projection facilities accompanied by the use of a graphics tablet, and took the opportunity to install rather larger display screens than were available interactively. They also supplied a visualiser for each classroom as a support for making presentations and including students' work more easily in the lessons.   The visualiser provides an alternative set of valuable functions, in particular for creating a communal focus for the analysis of students' work and also for other reviewing objects and artefacts such as a motherboard. They were also useful for interactive simulations and exploring intricate diagrams such as maps. The ability to capture these on the computer, in the same way as IWB screens, was also valuable.

Manipulation of the images at the screen was replaced by manipulating them with the graphics tablet. Whilst potentially having valuable attributes, the graphics tablets have not been used as effectively in practice as might have been hoped, and this limited their impact. Although some of the facilities of the IWB were not available, the central impact of data projection on teacher planning and presentation was still evident and useful support software was also available for teachers. The major difference is the ability to easily and dynamically annotate what is displayed, which is less easy and intuitive with a graphics tablet or using the visualiser. There is also an advantage in the teacher's actions on the board being visible to the students. The space from where the teacher operates also differs in that with an IWB the teacher or student using the board is able to move across the front of the class and is not tied to the operating computer, and mobility is even more clearly a positive feature when graphics tablets are used.

Where visualisers were used they are not in themselves 'interactive', but pupils did use them to demonstrate and annotate their work (writing on a sheet of paper or filling in the answers to a workbook) and these screens could be captured for later use. Visualisers can also be used to project and magnify whatever is being done under the camera – demonstrating wiring a plug or dissecting a flower. The pupils also like putting their own completed (handwritten work) on the visualiser so that they can share it with the rest of the class through the enlarged image presented on the screen.   Unlike the IWBs, which when switched on often stay on all day and are used continually, visualisers are used when needed. The other two clusters also found visualisers very useful for supplementing the IWBs, and the price and size of visualisers has been significantly reduced, making some central provision for occasional use an affordable option.

Class Laptops

As described in the two case studies, there is good evidence of regular and effective use of class-laptops in the upper Key Stage 2 classes and in Key Stage 3. This has enhanced the individual and group activity in the classroom. Groups of classroom-based machines in other classes in ICT Test Bed schools were well used. A survey

of one group of schools led to the reporting of the following advantages of using classroom sets of computers:

> A key characteristic was the *focus* that children had when concentrating on the screens. They were seen as working independently and with greater engagement. This seemed to be true both for pupils following independent, open-ended activities or closed, self-assessment activities. This level of focus and absence of distraction extends to paired work on computers – paired children on a laptop also tend to remain focused on the task.
> Teachers appreciated being able to differentiate activities for individuals on laptops – both on open and closed activities. This differentiated work can be set discreetly.
> Independent working on laptops freed the teacher to work with other children who may need the teacher's direct help – supporting classroom management.

In order to support work in literacy, some literacy co-ordinators suggested there is a need to improve pupils' typing skills and some schools purchased useful commercial programs to enable this.

One group of primary schools followed a policy of loaning laptops to families for weekend use and this had a significant effect on parents' desire to become more computer literate, even though the take-up of this facility has been patchy (see the Home and Community Links section of this report).

In secondary schools, the impact of teachers and students regularly changing rooms made it difficult to manage the constant logging on and logging off of laptops. Some buildings were problematic in terms of wireless networking and the volume of traffic was occasionally very large. As a result, although the secondary schools bought banks of laptops for classroom use, they were unreliable and therefore used fairly lightly. Many departments set aside short periods of time every so often (such as once per term) to do some work on the laptops or in the computer suites. In Key Stage 3 the personal use of computers by pupils, excluding ICT lessons, was less than they were accustomed to in their primary schools. In Key Stage 4, however, project work and course work led to much more involvement for some students, and their skills began to be useful. One school did, however, delay its purchase of laptops and wireless networks until the third year of the project and the increased reliability of the equipment led to better usage.

Graphics Tablets

The potential use of graphics tablets for control of the classroom computer and display management was exciting, but in actual use the graphics tablet was seen in just one or two primary classrooms and only very occasionally in secondary classrooms. One problem may have been that the graphics tablets were introduced later than the data projection and hence were not seen by teachers as quite so essential – and for the teacher they represent another set of tools to master. Where graphics tablets are used, they have been found useful in the more limited role of an itinerant mouse, enabling click control from anywhere in the classroom. This is a useful facility, since it enables the teacher to move around the classroom and

enables pupils to take part in the activity. It is relatively easy to click and to 'drag and drop' with the tablet, but writing takes more skill.

When used by pupils a graphics tablet enables participation without leaving their seats and hence minimises disruption, but they tend to find it difficult to write on the tablet since their actions on it are distinct from the effect on the board. Also, as the pupils only use the tablet on occasions, rather than regularly, they do not easily develop expertise in its use. It is also a more personal action compared to the management of the IWB, for which hand movements are publicly visible, and hence feels more participatory for the watchers.

The tablet is used in one or two primary classrooms but this technology proved more difficult to embed at secondary level, in part because the constant room changes made registration of the equipment problematic, and it needed to be transported by the teacher in order to avoid risk of theft when left in the classrooms.   The best use of graphics tablets involves the teacher in utilising the software to drive its application, and most secondary teachers did not have the time or inclination to learn about the software (Scrimshaw, 2004, and Hennessy, Ruthven and Brindley, 2005, comment on lack of time being an inhibiting factor for teachers' uptake of ICT in their teaching practices).   Teachers need to see the relevance it will have for teaching and learning before they feel more willing to put in or find the time required (Mumtaz, 2000).

Digital Cameras

The use of digital still and video cameras was extensive in all sectors. They were very favourably reported on in the Action Research studies, where the point was made that quite often the simpler equipment was most effective. In the early years they serve to bring images of pupils' homes into the classroom. They are also invaluable to record pupils' work for assessment, to demonstrate their achievements and provide evidence which can be transmitted should a child change school. They were also used to record achievement in Foundation baseline assessment, and in recording creative activities and assessment tasks for appraisal in secondary schools.

> Children used cameras to illustrate their work; for display purposes (and playback on the IWB or plasma screens) and presentations, recording and evaluation purposes in science, geography or art; for developing observation skills; and for both inventive and descriptive writing and speaking/listening activities.
>
> The facility for a wide range of children with varying levels of literacy to obtain high-quality photos quickly was remarked to improve self-esteem in learners of lower ability.
>
> Videoing role play in Reception helps the teacher to analyse the pupils' behaviour, and can help the pupils themselves to learn to review what they have done, enabling them to study how they spoke and acted. This encouraged a high degree of self-criticism and self-learning as well as giving the pupils experience of how to deal with peer comment.

Making a digital video was particularly valuable for a Year1 pupil with learning difficulties who was changing schools. The supportive comment of her classmates served to boost her self-esteem and also provided a good introduction when the pupil might have appeared rather socially awkward to her new teachers and classmates.

In another school, group sessions were video-recorded and then shown to other class members, which helped the pupils to review their own language and contribution to classroom activities.

A group of students with special educational needs recorded descriptions of scientific concepts for their peers, which helped them to improve their articulation and communication skills.

Videoing a geography field trip helped the students to re-analyse the activities they were engaged in and reflect on their learning. It also helped those students who could not attend to learn vicariously from the activity, as well as providing materials for future use with students.

The easy adaptation of digital photographs has improved many school displays and made it easy to personalise the learning experience. Digital cameras or video recorders are loaned to Key Stage 1 pupils on a rota basis to take home, in order to bring back images for discussion. This helps to personalise school activities. Some video cameras are particularly easy to use and pupils made their own videos and recorded group discussions for sharing with the rest of the class. The ease of use was a significant factor and this equipment was clearly appreciated and fit for purpose in many classrooms.

Some schools received training in 'animation' techniques early in ICT Test Bed, which proved useful. Whilst over time the activity has diminished, it remained a useful activity where a teacher, or in one case a classroom assistant, has maintained his/her interest. The opportunity to produce iBook animations gave the teacher closer insight into the children's social skills and team work capabilities.

Creating videos and animations provided a focus for the pupils to think about how to communicate effectively and develop their language skills. The planning and production requirements of video also encourage focused communication and collaboration.

Teachers note children's improved self-esteem when videos or animations are broadcast to wider audiences.

Video enables children to achieve higher levels of evaluation of performance, for example when gym and drama performances are recorded.

> Video recording was also useful for school trips and school performances, providing a reminder of the activity and enabling parents to see and share the experience.

Voting Systems

Voting response equipment (sometimes called 'clickers') is either very popular with teachers (and pupils), and hence found to be very valuable, or is thought to be rather trivial and not worth the effort. The teachers doing action research into this equipment reported very positively on its use. Where it is used, the primary pupils were enthusiastic.

> "They liked the zappers a lot and one pupil explained "It comes up with the right answer and it tells you how many people got this correct and how many people got the answer wrong and it shows you when you've done it, down the bottom. When you press the button, your answer, it goes blue."
>
> They felt that this was much better than putting their hand up "because you put your hand up and you have to wait for the teacher to pick you and you're sitting there with your hand up for a long time". Also "everyone gets a go and all".
>
> Another child explained, "I think it's better because if you get the answer wrong then the teacher knows that a person needs to know more about it but the rest of the class don't know, do they?" "

The development of resources for use with voting systems has led to a clearer focus on learning intentions and better use of questioning. The pupils liked the confidentiality aspect of the voting system, since all participated and individual answers were seen in isolation. They were able to save face in front of their peers while the teacher would nonetheless know that they had not understood something. Although the teacher can see what each child has answered, the pupils still feel a comforting degree of apparent anonymity in the process, and the social context of the assessment is found attractive. When used they provided a rapid and easily analysed test situation, though clearly the technology was more appropriate for testing facts and skills than understanding.

> The voting system was admirably adapted to use in the Modern Foreign Language classroom where students could choose appropriate words to match the questions and images. In particular when the questioning moved from nouns and verbs to adjectives, the response was starkly different, providing the teacher with useful information. The ability to analyse individual students' responses later provides excellent assessment for learning information.

Other equipment

Digital microscopes and electronic measuring devices have been found to be very valuable in science. Unlike traditional microscopes, the teacher and children can both see the same enlarged shared images on the IWB or computer screen. The

images can be used as inspiration for imaginative writing with a higher quality of vocabulary being noted.

Memory sticks have proved valuable for transferring work between home and school and are very popular because of their light weight and portability. Many teachers engage in focused planning and resource building at home, and although a number of schools enable teacher access to files from home through internet connections, they do not need access to major school databases. For such planning and resource building activities the memory stick is an ideal 'briefcase'.

- - There was an increase in interest in video conferencing later in the project. In practice, however, the problems in establishing compatible and reliable technology for video conferencing limited its development and it would appear that further technological development is needed before this becomes a common school activity. When used, this technology improved inter-school support mechanisms and the sharing of rare or particular expertise. The schools are also seeking to make positive links with other countries in order to develop opportunities for citizenship education. The use of video conferencing to enable pupils to receive experienced teaching in a foreign language was also popular (Harris and Kington, 2002 also offer evidence of this in one of their case studies). One FE course was maintained by using video-conference access to the tutor who was working in the USA. The schools in one cluster with a very low ethnic minority mix sought to video conference with other schools in order to ensure that multicultural issues are aired. It is likely that video conferencing might well be usefully enhanced by the use of webcams.

FE Experience relating to hardware

The ICT Test Bed teams in all three colleges have much improved hardware resources both for staff and student use. The interactive whiteboard is recognised as a major innovation with many lecturers commenting positively on the impact of the whiteboard on their classes. As a consequence there is growing dependence on IWBs, and several tutors commented on the difference it makes to their teaching, to the ambience of the classroom and to the motivation of the learners (Smith, Higgins, Wall and Miller, 2005; Passey, Rogers, Machell and McHugh, 2004; Cranmer, 2006).

Laptop trolleys which can be used in the classroom are popular with lecturers and students, as they make access much easier and avoid problems with accessing computers in central spaces such as libraries and learning centres. Laptops need careful management to match the class requirements with the capability of the laptops, however. Nearly all staff in ICT Test Bed areas have laptops for their personal use, although these are now three years old and some staff are having problems with reliability, outdated network cards, and running new software applications.

There is a wide range of peripheral equipment in routine use by both staff and students, for example, digital cameras, video cameras, graphics tablets and visualisers. Voting systems are a new development and staff are finding ways that these systems can enliven questioning sessions.

Lecturers have found that software and learning materials need continual updating to keep them fresh and up to date.

3.4.2   Using high levels of computer-based resources for teaching and learning

The use of digital resources, whether off the shelf, customised, or created from scratch, has a positive impact on classroom practices in relation to the visual nature, structure, clarity, instant feedback, immediacy, relevance, pupil engagement and involvement, and pace.

There are choices between teachers creating and 'owning' resources and using ready-made resources. These decisions are complicated by individual preferences and styles of working, time constraints, and concerns about re-inventing the wheel and the flexibility of the resources, not to mention the impact of challenge in improving teachers' skills and enhancing personal pride.

Teachers reported that it was initially very hard work to establish and find useful resources to deliver the planned curriculum, but that this was retrospectively very well worth while in terms of the resources that they now had available and could easily modify for re-use. Teachers were clearly proud of their achievements in producing materials and the early work undertaken by some teachers on developing particular skills, such as animation or assessment recording, is still contributing to current developments.

Systems

All schools and colleges have developed a storage and retrieval system, with which the individual teachers are now familiar. The system needs to be efficiently managed and 'tidy' if teachers are to be able to access resources quickly. In primary schools these catalogues were usually year group based, whereas in secondary schools and colleges individual departments managed their own resource base. With the development of integrated learning platforms, some degree of conformity might be imposed across one of the secondary schools.

Provision of resources

In all schools, a significant proportion of resources was designed and created by teachers, often using ideas and elements downloaded from the internet. In most schools the proportion of teacher-created resource was greater than 50 per cent, with other resources being sourced from the internet or adapted from commercial packages. Ownership and familiarity seemed to be essential features of preferred resources, which placed externally provided materials at a disadvantage. In some secondary subjects, notably geography, history and religious education, the use of resources from the internet was especially valued. Resources created by other teachers were found useful for stimulating ideas but were rarely used directly, though well designed packages of resources from the internet or commercial

providers were sometimes found valuable for some subjects, such as science. A major impact of ICT Test Bed has been the ability for schools to purchase the full range of resources from the outset, rather than purchasing modules on a piecemeal basis. This has helped planning and enabled teachers to be fully aware of the structure and nature of the resource.

A number of teachers commented that the internet has given them access to information so much more quickly and easily that finding lesson content is no longer a problem; their main focus is now on presentation and organisation of the information. When they want to use the internet in class, teachers build in a hyperlink from a flip chart to other resources or to a particular website so that it is immediately available to the pupils.

Just as teachers find the internet invaluable in resourcing lesson content, so too the availability of learners to 'free range' the resources they wanted from the internet was seen as an important skill. It opens up sources of information outside the necessarily limited classroom provision of reference books. Secondary schools had invested in online encyclopaedias and reference works. Staff felt these extended the resources available to students and were more likely to be kept up to date than the paper versions.

In primary schools all the staff tended to develop their own broad portfolio of skills, with relatively little reliance on individuals developing specialisms, except for specific applications such as digital video and animations. Resources which scaffolded teacher resource development, providing clip-art and video clips as well as short lesson activities for primary teachers to manage, were found particularly valuable. Within secondary departments there has tended to be a growth of ICT champions, or 'assessment gurus' who develop resources in a particular field and then support their colleagues in their use and application. In some departments staff are becoming reliant on one or two particular pieces of software, which suggests a need for subject-specific training to maximise the use of hardware and software resources, to ensure that staff develop the skills required and do not become reliant upon that with which they are already familiar.

External content creation teams were thought to be useful, though it took some time for teachers to become aware of what expertise was available. The precision needed in the planning to advise a service based in another institution was sometimes a task which teachers found difficult or onerous and were reluctant to take on board. Their resources initially tended to be too specific. The provision of templates for a variety of resources (spelling activities, for example) was found to be a useful product of content creation teams and content is now being developed with particular pedagogical approaches in mind, as well as for different locations and contexts for learning. The content creation teams were, however, only created at the start of this project with the intention of learning how best to utilise such a provision.

In one cluster the science co-ordinators have already developed a suite of resources for joint use, and this is being echoed by geography and reception teachers. These

resources are usually used as a stimulus and bank of ideas rather than being used as they stand.

In the primary schools one teacher controls a whole class folder and this leads to a fairly simple structure which makes the need for more complex learning platforms seem less relevant.

> "Certainly when I've worked with year groups, they are very aware where the resources are. It is becoming second nature. That is a strength but it can also be a weakness if someone were to blunder in there and change things and move everything and then suddenly [nobody] know[s]………it is a like a messy desk, the person with the messy desk knows exactly where things is, until someone comes in and tidies it up".

However, learning platforms offer greatly increased functionality and may help increase the limited sharing of resources between schools. The storage and access system needs to be easy to manipulate, however, or the resource banks will become merely deposit banks without withdrawals rather than being fully utilised as a resource for learning.

> "If we ever decide that pupils need more choice in selecting their own learning materials then we will have to change the system, but at the moment for people who deliver the system it works fine."

The volume of resources developed or acquired is such that almost all the schools have had to increase the capacity of their servers. Storage space for images and other media was a particular, and increasing, problem and was rapidly filling up the servers.

The National Strategies were not seen by teachers, or subject co-ordinators, as being in the forefront of ICT development in their respective subjects, probably because they are primarily concerned with schools without a strong ICT base, but also because a rich ICT environment was rare until quite recently and many of the national strategy consultants need further experience in such settings. Their recent close involvement in the Schools Whiteboard Extension Project will undoubtedly help.

It was interesting to note that for much of the ICT Test Bed experience in primary schools the lead in the choice and review of materials was taken largely by the ICT Test Bed co-ordinators, but towards the end of the project more of this responsibility was taken on by the subject co-ordinators.

In terms of personalising and individualising the learning process, some of the commercial Integrated Learning Systems provide sophisticated support and are of particular interest. After some initial enthusiasm the experience in ICT Test Bed suggests that there was limited continued enthusiasm for these ILS products, because teachers found it hard to maintain access to and knowledge of pupils' progress and needs; ILS tended, therefore, to be used mostly for skill practice.

> "There is no thinking for children. [ILS products were not] really connected with what teachers were doing.   [...] OK, the ILS was giving [children] a score and taking them on to the next level. But teachers weren't engaging with that progress at all. Nice little activity for children to practise tables but beyond that [there was no real benefit].   [...] Teachers' understanding of what technology can do for them has changed so much." (ICT Test Bed project manager, primary school)

Whilst it may on occasions be laborious, teachers need the experience of marking and assessing pupils' work in order to understand the pupils' knowledge and skill base. The systems were, however, found to be useful in making provision for learners with special educational needs in both primary and secondary schools.

The FE experience of resources

ICT Test Bed enabled colleges to acquire specialist software for curriculum areas. Some subject-specific software was sophisticated enough to enable tutors to create individual work plans for students. Buying one or two comprehensive but expensive packages (which ICT Test Bed has enabled) proved to be better than buying large numbers of more limited, cheaper packages.

Tutors were gathering materials from a wider range of sources than before and using their new skills to adapt and refine the materials to meet the needs of the course and their learners. The sector has benefited from an ever increasing bank of resources, but it remains difficult and time consuming to search across many resource banks to find materials for specific subjects, levels and groups of learners and to evaluate the materials for suitability.   The range and amount of available material made reviewing a very difficult task. A common solution was to rely on a restricted range of sources and often to develop their own materials. There was a trend towards the colleges making use of professional content developers to work with staff and help them improve the quality of the materials they were creating.

In ICT Test Bed, the blended learning approach was integrating the new tools, techniques and equipment with traditional tools and methods (the value of this is highlighted in Sutherland *et al.*, 2004; Hennessy, Ruthven and Brindley, 2005).

Learning Platforms in FE (Virtual Learning Environments)

All three ICT Test Bed colleges had established a VLE and reported increasing use of the VLE for making learning materials available to students.   In two colleges, the VLE that was in use at the start of the project was abandoned; in one case this was due to the software not meeting the needs of the college, in the other it was due to problems with the software and its suppliers. ICT Test Bed learners had excellent opportunities to access learning materials wherever and whenever it suited them to do so. However, student use of the VLE was patchy; some students used it effectively but others – perhaps those who were less willing or able to take an increased responsibility for their own learning – were less receptive.

3.4.3   The impact of high levels of ICT on pedagogy

Presentation technologies and pedagogy

Presentation technologies can fit easily into existing patterns of classroom interaction. In all of the observed lessons the presentation technology was embedded as a mediating 'tool' for subject teaching and learning (see Sutherland *et al.*, 2004, and Somekh, forthcoming). There is a sense in which these technologies used in whole-class teaching are bound to have an impact on pedagogy and learning, and both teachers and pupils agree that they increase pace and interactivity. Ironically, although the ability to develop the materials on the whiteboard through student contributions sometimes slowed the pace of a lesson in a positive manner, this gave students time to absorb and internalise the knowledge. In a similar manner the adaptability of the images on the board allows the same idea to be presented in a number of forms, again providing valuable thinking space. Nevertheless, in some cases their efficiency reinforces presentational approaches and teacher dominance, which in turn reinforces traditional methods. This was particularly noted in some secondary classrooms.

In many cases presentation technologies created an easier forum for discussion and interaction with the pupils since the planning and presentation was already accomplished and the teacher could concentrate on the pupils and their reactions. Improved skills in managing the plenary sessions were evident. The teachers set the learning objectives, presented planned and prepared materials, and asked 'teacherly' questions. The ability to revisit the learning objectives at any stage of the lesson created a sharper focus for the teaching.

For some secondary teachers the presentation technologies have changed their practice from a didactic approach to a more interactional one. As staff have become familiar with technologies for whole-class teaching, and they become part of the everyday work of the classroom, more critical questions around impacts and potential impacts on pedagogy are beginning to be raised by teachers. Teachers are reflecting, it should be noted favourably, on the impact of presentation technologies on their relationships and interaction with pupils during the sessions (the importance of mediation is discussed in Harris and Kington, 2002; John and Baggott la Velle, 2004; Smith, Higgins, Wall and Miller, 2005). Many primary teachers already adopted an interactive approach and these technologies enhanced that approach.

Good interactive whole-class sessions were common and using the technology to support this is becoming a priority for teachers at all levels. Some teachers initially used the display technologies to deliver the same pedagogy, especially when learning how to manage the ICT resource, but as colleagues have provided new resources, many have begun to adapt to the new possibilities. Resources such as voting systems have led to a clearer focus on learning intentions and more effective questioning where they are used. The ease with which images can be brought up and words, pictures and sentences related to each other has been of particular value

in Modern Foreign Languages, and in science, geography and religious education the ability to present video clips and information so readily is seen to be valuable.

Teachers allowed students to manage the board, but almost always the context was theirs and they retained control over the content and the questions. Presentational technologies do not of themselves empower moves towards more individual and differentiated teaching but they do enable teachers to operate in that way if they wish. The national primary strategies have to some extent worked against such development, with standard lessons and standard targets. Whilst it is true that the strategies have encouraged differentiation by task, and there was evidence of differentiation within most primary lessons, it did not extend to student-managed learning programmes. In the Foundation Stage pupils often have a range of activities from which they choose, but as they progress through KS1 to KS2 the range of choice is much more limited and is usually related to within-task choices. This is also true of KS3 where differentiation is usually by providing extension materials. In the secondary school it is mainly through project work that choice is made available; and whilst this is often limited in KS3 it becomes more common in KS4.

Computers and pedagogy

In primary schools the impact of computers on the central strand of pupil and group activity has been equally as important as that of presentational technologies on the plenary elements. In those classes which have a class set of laptops teachers often plan to let their pupils work individually on their laptops during a major part of the lesson, while resources such as digital video cameras and electronic microscopes stimulate group activity. Where there are only a limited number of computers there is often a rota system for pupil activity on computer. In secondary schools the work on computers is often contained within limited periods of time every few weeks, except perhaps in core subjects, where some time each week may be devoted to working with them. Teachers are also using laptops for individualised work when doing revision and consolidation.

One area in which pupils can gain a measure of control over their work programme is where they are engaged in project work. In all sectors learners often create presentations, thereby developing their research skills as well as their ICT and verbal presentational skills. ICT is enabling students to have greater choices about how to present their work and what learning activities to undertake. Teachers commented that it is implicitly enhancing their pride in what they produce.

> In primary schools students could, for example, choose their own person on whom to write a biography, or research a geography or history project that gave scope for some wider pupil choice of materials.
> Teachers encouraged the students to develop their editing and drafting skills by requiring them to prepare segments of lessons to teach to their peers.
> As well as word processing and the use of presentation software, students were easily able to publish their ideas using animation, short films and photography.
> Displays in many schools improved dramatically, and the display work of KS4 pupils was of a very high standard.

> The ability to search the wealth of materials on the internet made a significant change from all the pupils using the same subsets of books gathered in the classroom or the school library.
> The internet enables language learning to be more authentic and real.

The implementation of a structured learning platform brings the promise of allowing more student flexibility. The development of a centralised repository of electronic teaching resources for use by teachers also has the potential to offer students autonomy in terms of pace and access, but the clearly felt need for teacher control of learning in Key Stages 2 and 3 may mean that choices remain limited.

ICT has enabled gifted and talented pupils and higher ability children to extend their activities and study in more depth. It has also enabled pupils with English as an Additional Language and those for whom the act of physically writing had been a barrier, to readily access learning.

> In Design Technology pupils' intentions can be frustrated by hand skills and hand/eye co-ordination but through the technology students could achieve better realisation of their ideas, and it has widened the scope and range of work in art and music. (For comment on ICT supporting kinaesthetic intelligence, see Beeland (2002); Virtual Learning (2003); Solvie (2004); Hennessy, Ruthven & Brindley (2005).)

The impact on pupils with special educational needs has been particularly impressive (see also Kozma in Salinitri, 2002; this was also found in the ImpacT2 project as commented on by Seng Eng, 2005). In addition to motivational factors, there is a non-judgemental and impersonal quality to using computers that can be appealing to learners who have difficulty in social interactions.

> One teacher spoke of a 'very, very big impact' on an autistic child and his brother: "It seems to have opened a door with them and they think and they talk and they're interacting with the computer."
>
> Another pupil, who was a non-speaker when she came into school, was attracted to working with another child at the IWB. This has increased the amount of communication in which the pupil engages.

The impact of ICT on pedagogy in the FE colleges

The gains in staff skills and confidence were clearly in evidence in the classroom. Much teaching was more interactive with learners increasingly engaged with interactive equipment, games and other activities (also found by Ilomaki, Lakkala & Paavola, 2006).

The presence of the ICT seemed to impart a sense of greater efficiency in the delivery. Staff believed that they could get through more in a session and reported an increased pace when using technology. However, this could be too fast for the

less able learners (but could also slow the pace 'too much' mostly for the more able learners – see Smith, 2001, for example).

Students were able to use resources on the VLE for revision, consolidation or to catch up if they had missed classes. Tutors were able to use the VLE to create learning activities and a range of tests which were automatically marked and provided instant feedback to the students on their performance. Tutors were also able to use the resource bank they had built in the VLE to provide differentiated and personalised learning experiences.

3.4.4   Using ICT for teaching and learning across the curriculum

In primary schools, although there is a well defined curriculum, there is more scope for managing this in the flexible timetabling and planning which derives from having one teacher and one class. However, there was evidence of schools reducing the involvement of pupils in ICT as the SATs period drew near, and Year 6 pupils were often limited in their access.

As ICT Test Bed has developed there is evidence that use of whole-class technologies is fully integrated into teaching and learning across the curriculum. Co-ordinators felt that as ICT Test Bed schools they are well ahead of the ICT focus in the Primary Strategy materials.

> There is clear evidence in one cluster that the ICT Test Bed schools, in conjunction with a cluster-wide Comenius project, are using technology to widen the curriculum by providing links with other children in other countries. Visits by teachers are enhanced by the range of digital images, video and still, that are then made available. Pupils can also 'converse' through email). This provides valuable vicarious experience for the pupils through web searching, video-links, digital photos and emailing. In some cases this is enhanced by associated arts projects involving creating relevant art and drama.

The literacy activities that pupils mentioned in interviews were not only evidence of use of a range of ICT resources but also varied ways of learning.

> The pupils in the 'pupil survey' in year three of ICT Test Bed commented that they wrote stories and prepared PowerPoint presentations on topics of interest, often science based.
> One Year 6 class was in the process of making branching story books for younger children in their school as part of their literacy work.
> When going out on trips they were usually required to write reports and these were enhanced by the digital images which were now available. One school used these images to prepare parents who were accompanying the trip to help their charges.   Video records were particularly valuable at secondary level in helping students reconstruct geography trips.
> One class commented on the use of the microscope to look at leaves and seeds and then to write from their imagination.

> Another class were producing biographies and ICT made it possible for this to be of people of their own choice. The enhanced drafting processes made available through ICT improved their learning of what that genre entailed.

Pupils commented on how unfinished work could be stored for the next day or taken home to work on. They were also pleased that they could save their project files in their folders – one pupil commented that he still had a project he completed two years previously. This storage of student work is important in assessment and for informing parents of their offspring's progress.

Mathematics was frequently seen as the subject in which the pupils used the classroom laptops most. This was true for both primary and secondary students. Consolidation and revision programs were used extensively in one cluster and were well liked by the pupils. In the early stages of ICT Test Bed it was using 'integrated learning systems' that led to significant use of laptops by the pupils, but their use diminished as teachers found more suitable websites. There are activities that allow pupils to engage in more individualised work-schemes and self-marking assessment using comprehensive commercial schemes, especially for pupils with special needs. Teachers are sometimes concerned, however, that they do not have immediate access to the outcomes, and they now prefer a range of websites providing equivalent but less tightly structured resources.

> A number of pupils mentioned that they had used websites for maths, and the pupils really enjoyed "learning and playing games at the same time" when doing maths problems. The pupils in another school spoke about educational 'games' in their mathematics lessons (money games, for example). There is a range of such websites now available.
>
> One pupil described how they did virtual experiments on the IWB, and the use of microscopes (especially for viewing mini-beasts) was common. One school had purchased electronic sensing equipment for measuring temperature, light and humidity and they were measuring germination of seeds and commented on how "you had to change one thing at a time". The pupils' logs for one class indicated the use of the microscope to draw up a table in a database about 'jumping bugs'.
>
> In history lessons, pupils were directed onto websites by the teacher who showed them initially what they look like on the whiteboard. It was clear from the pupil diaries that this was a subject in which there was more pupil access to computers than most others, with a wealth of internet-based resources. This was another subject in which projects were used and this led to web searching. Using computers to support homework in history was common at both primary and secondary levels.
>
> Art appeared regularly amongst the prime users of ICT, mainly for gathering exemplars of particular artists and information about their pictures, although a number of drawing and painting packages were also popular.

At one school the pupils were particularly enthusiastic about the work they had recently been doing on the computers in music. Several cited this subject as their favourite: "We were going on this thing where you can create your own tunes, you have things like drums and guitar. You can do some samples. You mix them up and you have to keep on pressing the buttons and you come up with different tunes". They liked the fact that sometimes they could get voices into their compositions as well. A number of schools found work on keyboards attracted pupil interest, and for some pupils the availability of electronic equipment at secondary level was highly motivating.

The primary children spoke about use of the computer to learn French. "It makes you learn new words and stuff for French, how to say hello and goodbye and my favourite pet and my favourite colour, and all of those things."

At secondary level there seemed to be many bespoke resources created by teachers for the intranet/learning platform for matching images and words, suitable for all levels of language learning. In some primary schools in one cluster there was an attempt to provide regular video-conferencing support from a specialist secondary school for Modern Foreign Languages, though the inadequacy of the equipment made this less than satisfactory in practice.

In secondary schools, teachers' work continues to be framed by a set curriculum with specific outcomes which may inhibit innovative approaches to teaching and learning, subject content and what is assessed. Formal examinations are still paper based and this leads to the hesitancy of teachers in accepting student word-processed assignments.and prefer students to practice their handwriting skills

Nevertheless, some innovation naturally occurs with the technology. In Modern Foreign Languages the use of video and interactive response programs has made target language work more accessible.   In Design Technology the technology has made it easier to model modern manufacturing practice, enabling new materials to be used and complex processes like computer-assisted laser cutting and laminating to be employed by students. Music, too, has been transformed in terms of students creating and planning music with synthesisers, keyboards and transposing programs. Many of these developments have had an impact, primarily on the KS4 curriculum where project work allows more flexibility and freedom to manage the curriculum than at KS3.

Pupils are not universally expected to complete homework by computer and most homework is still printed, if not handwritten. The trend to utilise ICT for homework is growing, however, and for primary schools the use of 'take home' laptops has enabled teachers to be more adventurous in this respect.

In an end of project survey it was clear that ICT is not fully embedded in terms of homework yet, but 35 per cent of students are now regularly submitting some homework electronically with a further 26 per cent doing so occasionally. However, 38 per cent of students stated that they never handed in their homework electronically. Differences between the age phases were noted, with

> 65 per cent of primary pupils stating they never or rarely submitted work electronically, in comparison to 40 per cent of secondary pupils.

The imminence of SATs has almost invariably reduced the use of computers in Year 6 to ensure that handwriting is satisfactory. In some cases this has concentrated attention on ICT in Year 5. Clearly, however, ICT has been useful for some students with poor presentational skills to enable them to produce written work that is more representative of their knowledge, because less inhibited by writing skills. At secondary level students increasingly use memory sticks or email to carry their work to and from home, and homework is often brought into school and printed off there. Teachers are increasingly allowing students to email in their work, but this only saves time if it is well organised. Teachers are also supporting some students' assessment through enabling work to be produced with ICT rather than with pen and paper.

The teaching of ICT in Key Stage 3

A key issue is how the secondary schools deal with students coming through each year with increased levels of ICT skills. Do they follow the KS3 curriculum or is it unsuited to their needs? What did ICT teachers do about this, in order that the benefits of ICT Test Bed were maintained?

Secondary teachers reported that students had good ICT skills, which meant that they could take advantage of the high levels of ICT available to them. However, both ICT and other subject teachers noted that although students had good ICT skills, their information skills were less developed. Students were able to find information easily and quickly but were less good at using, applying and evaluating that information.

High ICT skills levels have an impact on the teaching of ICT as a secondary subject. Students are used to ICT being just a part of how they learned at primary school, whereas in the secondary school they had to 'learn ICT'. In the best examples, the existing skills of the students coming from ICT Test Bed primaries were built on and enhanced; students were able to forgo re-learning what they already knew and explore some of the more advanced ICT areas, such as web design. Students coming from ICT Test Bed primaries had high levels of ICT skills, particularly in creating presentations and digital photography and video. Students from non Test Bed schools generally had lower skills levels but teachers reported that other students were very willing to help them and they were able to catch up very quickly.

> "Yes, I mean it is outstanding, looking at Key Stage 3 classes, especially the higher sets. They are doing web pages, and turning web pages into spreadsheets and downloading data and information, they are very good at it, outstanding! They are doing things that you know, seventy-five percent of the staff couldn't do." (Secondary Head of ICT)

However, ICT departments are required to follow the National ICT Strategy for Key Stage 3. ICT Test Bed schools tended to use the strategy as a framework for teaching ICT at KS3 but found they needed to supplement the units with activities

that made better use of the higher levels of ICT facilities in the schools and provided more of a challenge to the students. Cross-curricular use of these ICT skills is much less well developed, and this lack of application leads students to sometimes question the value of the high level of ICT skills they are learning in respect of, for example, spreadsheets and databases.

The quality of project work in ICT where students choose this as an option in KS4 is clearly very high indeed, but the use of ICT across the curriculum in Key Stage 4 is much more questionable. There are potential difficulties when students move to Key Stage 4 having done all the exciting things in the KS3 ICT strategy, which are then little used in Key Stage 4.

> "There are lots of nice ideas, they teach kids all these things but then when they go to Key Stage 4, they never use it." (Secondary Head of ICT)

3.4.6   The impact of high levels of ICT on assessment

The presentation technology encouraged teachers to share lesson objectives with pupils more readily. Students at all levels are increasingly involved in establishing targets and in assessing achievement against them, often by accessing their personal folder on the school's network and keeping a record of their achievements. Whilst this is part of the general 'assessment for learning' developments, it is clearly enhanced by being developed in the context of the easy sharing of information which ICT enables, making it easier for the teacher to respond to students' work.

It is clear that ICT has made a considerable difference to the way in which information is readily available to individual teachers and enhanced the public sharing of this information with other teachers and parents, especially for secondary schools where this process is more difficult. This is particularly true where a learning platform is being developed, but where this is unavailable, other schools have developed alternative modules to accomplish similar outcomes.

Lesson planning increasingly has exemplar student responses to assessment tasks linked electronically to planning, to aid consistency and provide scaffolding for students' work. This is especially important at secondary level, when a number of teachers are engaged in presenting the same work to a year group, and students are helped by seeing exactly what is required.

By focusing on the learners' outputs, assessment activity is immediately made personal and relevant. Digital video cameras and digital still cameras with the facility to record short excerpts of video have been used creatively and effectively to support peer- and self-assessment at all levels of schooling. Video has also been effectively used at Foundation level to support baseline assessments.

> At Foundation Stage one teacher established her own spreadsheet for baseline assessment incorporating images of pupils' activities. This enabled her to satisfy the external assessor and also made it easier to share assessment processes with a classroom assistant.

> It was also utilised in some secondary school departments, especially in the creative areas, to help pupils to assess their own work and support peer assessment.
> The process was also widely used at FE level to meet the needs of peer and external assessment, especially in skill-rich curriculum areas such as hairdressing.

ICT has improved the quality and consistency of marking within secondary departments by enabling teachers to store examples of student responses, through scanning and the use of digital photography. This has improved the reliability and impact of assessment. Electronic access to student marks on the shared area enables teachers to compare progress across the subjects much more easily, allowing borderline students and those needing support to be identified more easily and highlighting inconsistencies. It has also helped the SEN departments to make more focused and effective provision.

Assessment in FE

Technology is facilitating both formative and summative assessment. Interactive learning activities in the classroom and on the VLE, research and project work plus new questioning methods, are enhancing formative assessment. The development of online individual learning plans (ILPs) and e-portfolios is changing the landscape of summative assessment. ICT is increasingly being used to assist in the collection, marking and return of student work and assignments.

In one college, work-based assessors were using Personal Digital Assistants (PDAs) to record the achievement of competence in the workplace as the student demonstrated it.

In several curriculum areas, including graphic design, childcare, construction crafts and hairdressing, students were using digital cameras to take photographs and video clips to provide evidence on CD or DVD for their portfolios. Awarding bodies and external assessors were slowly becoming more willing to accept digital evidence.

ICT is being used in the colleges for a number of tasks that academic staff need to carry out in recording student attainment.

4. The impact of high levels of ICT on leadership and management

Main findings

4.1.1 Schools

- Schools which had chosen to appoint a full-time ICT Test Bed manager were able to implement the work of the project much more quickly. Where the major management responsibility was retained by the heads rather than being vested in an LA ICT Test Bed Manager, the project continued to make considerable demands on their time throughout the first eighteen months.
- The successful implementation of any new computer system requires drive and commitment from the senior managers and a significant nucleus of other staff.
- Where they were in place, it was clear that an LA with well-established structures and procedures, as well as stable relationships with schools, could take on a strong leadership role and provide very high levels of support. ICT Test Bed showed that at best this role builds on existing practices and there was no one right approach.
- ICT has made a considerable difference to the way in which information is readily available to individual teachers and enhanced the public sharing of this information with other teachers and parents.
- Remote access to the school shared folders or intranet was particularly valued by managers. Laptops or memory sticks generally served the purposes of classroom teachers for transporting their planning and lesson preparation files for use at home. For such planning and resource building activities, the memory stick is an ideal 'briefcase'.
- Change management training was needed at the start of the project rather than mid-way through the second year. Some heads felt that the sessions came too late and were consequently frustrating.
- Improved attendance and punctuality are perceived to be a positive consequence of online registration which has enabled student attendance and subject avoidance to be monitored more carefully.
- In one ICT Test Bed cluster, secondary classroom teachers have been involved in gathering data for assessment and behaviour management. However, without experience of how the analyses are carried out, significant data may be omitted and the task can seem to be merely administrative. It is imperative, therefore, that the user interface between the classroom teacher and the system is as easy to manage as possible.

4.1.2 Further education

- College finance systems were insufficiently flexible and this led to delays in procuring and installing hardware and software.

- Lack of experience in making procurement decisions, coupled with immaturity of hardware and systems development, led to some early difficulties.
- Clearly-defined management structures and stable senior management teams were important conditions for effective leadership of change in major ICT innovations.
- To use high levels of ICT effectively, colleges are likely to need to make changes to their management structures, including making new senior appointments and establishing new committees to maximise staff participation.
- Different approaches to the management of change are essential to fit the local contexts and cultures of individual colleges. These are partly shaped by the existing management structures.
- Project management for a major ICT initiative, involving curriculum and pedagogical renewal, as well as greater organisational efficiency, is a complex and challenging job.
- The status of the Project Manager within the college's formal management structure was a factor in access to services for those engaged in change.
- The procurement and installation of a substantial quantity of ICT equipment is a very major undertaking. The existing college infrastructure has to be adapted to enable effective use of the new tools and resources. At the same time, 'people' systems have to be put in place and routines of practice adapted until ICT use is embedded in day-to-day work.

4.2   Introduction

It is clear that management of the change to an ICT-enabled institution has been carried out with vision, energy and commitment in the great majority of ICT Test Bed institutions.

The introduction of a high level of ICT into a school or college poses major challenges for leadership and management at all levels: classrooms, departments, institutions and, in the case of the schools, the local authorities (LAs) too. The process of managing this change has been a complex one. Initially senior managers had to focus mainly on the imperatives of procurement, installation and solving logistical problems. At the same time the educational vision of what the new ICT equipment could offer students and staff had to be developed and actively promoted. Once the equipment was fully installed (which in the case of more complex systems was not until the autumn of 2004) the focus shifted to process management, to put into place new ways of working to maximise the value of ICT.

4.2.1   Definitions of key terms

The terms *leadership* and *management* are generally used rather loosely to cover the activities of Principals, Headteachers and members of the Senior Management Team in schools and colleges. However, it is useful to make a distinction between them, as follows:

Management is the formal processes of senior and middle managers carrying out work according to their role in the organisation, which involves accountability to a line manager and responsibility for overseeing the work of others, in both cases as specified in the organisational chart. Senior managers are responsible for the collection and analysis of data, accessing funding streams, meeting external requirements for accountability and ensuring the quality of service offered to students, their parents and the community.

Leadership encompasses the inter-related processes of developing a vision and communicating it to others in ways that unlock their energies and inspire them to give time and commitment to working towards shared goals. In practice, leadership is partly dependent upon – and constrained by – management structures, and partly depends on informal connections and the ability to understand and make use of the micro-political sub-structures that shape the organisation's culture. To change organisational culture both good management and good leadership are essential.

4.3   Two illustrative models of management

Case studies of leadership and management in two secondary schools from two different clusters provide useful models for the management of change:

In school A at the start of the project, the school senior leadership team was made up of the head and two deputy heads. Subsequently, three additional assistant head teachers were appointed and each took a specific area of responsibility in ICT Test

Bed: management information systems, teaching and learning and home–community links. This team of three were the ICT Test Bed Team who drove the project, got the equipment installed in the classrooms, managed the distribution of computers into homes etc. This period was characterised by "huge horrible times when you'd be trying to do massive amounts, recalling a hundred plus computers". However, once these tasks were done, there was less to do in that area and two members of the team were able to focus more on the management of change in teaching and learning. The school found that staff were keen to take up the new opportunities and wanted to 'run with it'. The school identified champions in the departments and the ICT Test Bed managers worked closely with the champions. Champions volunteered for the role and therefore tended to be people who were already interested in ICT.

> "Yes, they tended to be so because they were the people who would sit quietly in a room and try and get something to work and then get it to work in the classroom and then people would be saying, 'How do you do that? I want to use that'. And then it was spreading through the departments."

The management team were committed to supporting the champions and avoided imposing rules and restrictions that might limit where they wanted to get to. The champions have been instrumental in building up ICT resources for teaching and learning. "What has been created as resources in the school has gone a long way, tremendous distances. There were whole areas using what has been created within the school".

Inset days were used to train staff in using the ICT equipment; showing them how to use the machines. After that staff started to look at how they could adapt their materials and what they were teaching to make use of the equipment. Some staff experimented with video clips and sound files, which placed considerable demands on the computer equipment. Departments were given money for specific software packages. The management team was committed to avoiding staff reinventing the wheel and from the outset adopted a policy of sharing of materials.

> "We said up front that if there is something created within the school, it is shared because you are working in the school on the ICT Test Bed ethos, and it is not copyright because you are creating it under the ICT Test Bed ethos."

There have been several disruptions to the progress of the project. The school changed the buildings it occupied, which required additional network cabling and equipment. There were also changes in the management structure as the assistant head responsible for teaching and learning left to take up promotion at another school and the teaching and learning responsibility was given to the assistant head originally responsible for home–school links, greatly increasing that person's workload. The two remaining assistant heads continued to drive the project forward. Soon after this, the headteacher left the school and was not replaced. One of the deputy heads took on the role of Acting Head. The senior leadership team then ran both the school and the ICT Test Bed project. Their management style was a cabinet where every decision was a joint decision. Everything was shared and all

took responsibility. This was a good solution because the senior leadership team had all been at the school for some years and had a great deal of experience of the school and the way it operated. The cabinet management style has changed the ethos of the school so it is much more open but this has necessitated two management meetings a week which takes up a lot of senior leadership staff time.

ICT Test Bed has changed the way the school operates. For example, communication is now done by email. The MIS has changed administrative processes and capabilities. Reporting and recording have all changed dramatically and continue to evolve, and the MIS can be seen as "the 'quiet' revolution that has taken place during the ICT Test Bed time". The school now considers itself as 'data rich' and staff are interacting with the MIS, entering events on pupils which has been useful and far better than using paper-based records.

Few staff are still resistant to ICT. For many staff, it was now almost second nature to create lessons using ICT. Staff were far more familiar with using ICT. "If you go into the staff room now you will find that all the computers are being used most of the time."

Towards the end of the ICT Test Bed project, the senior leadership team created a leadership group comprising heads of departments. This group has significant teaching and responsibilities. The aim behind this move is to encourage more leadership, to put in place a group of staff 'leading from the middle'.

In School B, at the start of the project, the head had a clear vision of what he wanted to achieve and was influential in determining how the ICT Test Bed project should develop. The school had a large and strong senior leadership team (SLT) and the Head attended cluster meetings (which were held frequently at that time) and was able to take the necessary steps to make things happen. The school was responsible for the home PC roll-out and that was a huge task that took up a lot of management time. The head was closely involved in the procurement and implementation stages of the project, including the selection of the MIS; and, after an abortive experience with another system, in the procurement and development of a learning platform. He maintained involvement and overall control throughout the project in terms of ensuring that actions were in line with the vision.

> "We are very focused and we don't waste a lot of time, so we just made things happen. (…). Quite often those 'just in time' moments only come termly or sometimes yearly."

The head felt he was directive in the early days of the project in that he led the cluster but he made a positive decision to become less directive as the project became established. He reported that although he was managing the project, that was not the whole story; there was upwards management going on in that he was being managed by the senior leadership team and he in turn was managing the LA.

A new deputy head was appointed in the second year of the project who took on the role of ICT Test Bed project manager. The project manager was new to the school, felt that ICT Test Bed was very new to him and consequently didn't feel totally

comfortable in the role. The project manager felt that the school was somewhat detached from the cluster because it was the only secondary school and inevitably had different issues whereas the other schools were all primary schools so they shared a number of common issues. However, the secondary school had strong leadership and vision and its size meant that it had a lot of weight and a lot of resources behind it.

The project management role has changed over the course of the project to reflect the growing e-maturity of the staff and the systems. The MIS Manager joined the SLT during the project as the MIS gained importance in the day-to-day operation of the school. The school has also appointed a Director of Attendance.

As the project developed, the school development plan was based around the ICT Test Bed objectives which were then translated into individual subject plans. Management recognised that creating resources was an essential element of the project and all staff were given the opportunity to have some development time to create resources. Training days were used to train staff in using the hardware and software. Staff were ready to adopt ICT and change their practice and the school had very few staff who were not positive about technology.

> "So within staff timetables, we're looking to build in development time rather than expecting them to be teaching a full timetable and then in their own time doing things, because we don't really believe that it going to be as successful as it could be. Staff need quality time to develop things."

ICT Test Bed was a factor in the school being selected to establish a school improvement partnership with a nearby school which was in need of support.

ICT Test Bed has greatly extended use of the MIS. The school operates an e-portal and staff at all levels are interacting with the system on a daily basis. Attendance is recorded electronically and the school has developed a behaviour management system. Staff enter student assessment records and use the MIS to create student reports. This has streamlined report writing as curriculum areas have banks of statements linked to the national curriculum which they can use to generate their reports.

> "Increasing numbers of staff [use the system] for their day to day recording of their students' progress, but all staff in terms of summative assessment and reporting so [it is] the management tool that enables us to do all of our reports online."

Staff were able to access the school system from outside so they were able to write reports from home and manage their email which had become the main communication method in the school. However, there was a realisation that this had an impact on work–life balance.

> "It does help teachers to prepare and plan and check emails and so on. It encourages them to work longer hours, I'm sure – which isn't the purpose of it but it does make life easier."

Management of ICT – developing vision

The ICT Test Bed Project posed major challenges for leadership and management at all levels: classrooms, departments, institutions and, in the case of the schools, the local education authorities (LAs) too. Embedding ICT in ways that enabled new styles of teaching and learning was central to improving standards and changing culture within the schools. In primary schools, headteachers played an active role in getting the project started and working with staff to organise training and opportunities for staff to gain familiarity with the ICT tools.

In the early stages most staff teams writing the action plans were unable to imagine what they might achieve from high levels of ICT and lacked basic knowledge of available hardware and software. Theories drawn from socio-cultural psychology (for example Cole 1999, p.91) point to the need for people to develop interior cognitive artefacts of new tools such as ICT before they are able to use them. These mental models allow people to imagine the possibilities for use and they are more important than the acquisition of ICT skills because the latter are easily acquired once the mental model is in place and has given purpose, and hence high levels of motivation, to using ICT. In one of the three clusters a nearby primary school provided a model for innovative use of ICT and headteachers from a second cluster visited this school and found it very helpful in developing a vision for their planning. It is hoped that the senior leadership in ICT (SLICT) programme led by the National College for School Leadership will help to transfer vision from school to school and cluster to cluster.

ICT Test Bed enabled the secondary schools to make decisions and plans, bring in equipment and resources into all curriculum areas and begin to embed their use in teaching and learning. In most secondary schools, senior staff provided leadership through the SMT being seen to be positively and enthusiastically engaging with the technology and the changes it brought. Risk-taking strategies were found to bring greater benefits, when they worked. ICT Test Bed objectives were integrated into school development plans, then translated into individual subject plans. ICT and new styles of teaching and learning were seen as central to improving standards in the school development plans.

> Breaking down barriers between departments was important; in one secondary school students were invited to staff meetings to show how they had used ICT in a particular lesson. The staff then saw that the pupils could '*do it as well*' and it promoted the idea that everybody was 'in it together'.

> "We're transforming learning and we actually said we want to look at how ICT can support independent learning, how it can foster collaborative learning, interactive whole-class teaching and creativity. There are many other things but that is the thing we are particularly looking at. We are looking at raising standards of achievement; we are also looking at how ICT can foster these things."
> (Secondary Deputy Head)

The size of the project meant that responsibilities had to be shared amongst staff. Some secondary schools supplemented existing staffing resources by recruiting specialist staff. The ICT Test Bed staff team typically undertook specific roles within the project but worked together to deliver the outcomes. One model that worked well involved the team operating in a cabinet style of management where everything was shared and everyone took responsibility.

4.4.1   Handling information for managing assessment

The analysis of information has improved significantly through the use of electronic recording of outcomes. Some of this has been the result of increased flows of information from the DfES and LAs, though the increased ICT skills of the teachers has enabled the analysis of this information to be better shared amongst the school staff. The use of centrally provided information (such as RAISEonline and other management information) enabled by ICT is now being incorporated into planning. Some heads, however, commented that the increasing torrent of information was in danger of swamping the system. Although primary schools employ a wide range of regular routine assessments, some of which are computer based, day-to-day assessment is largely information held by the teacher. Many teachers expressed the view that inter-class analysis had been made much easier and had improved standards.

The ready access to assessment information is invaluable to those engaged in pastoral support, assistant heads and heads of year groups, especially when reviewing a student's progress with parents. All the secondary schools are using, or developing, the assessment manager element of their MIS. It tends not to be used in primary schools, though one or two larger primaries have found it useful. It is clearly useful for school managers (and heads of department) and cross-department services such as special needs teachers. It is often a periodic and reporting system rather than a day-to-day tool for teacher use, though many secondary departments had initiated weekly collections of assessment data to help improve consistency and coherence in their tracking and marking.

All report-writing in all three clusters is now electronic. Some schools have purchased specific report-writing software and many have found it sufficiently flexible. It invariably saved time and is generally appreciated.

> In order to capture the effects of this use of ICT for assessment, the teachers were asked how ICT had made a difference to their assessment processes. The teachers commented upon the following features:

Greater accessibility to assessment data

The ability to share information with colleagues, so the process was more collaborative

Efficiency in terms of sorting information, as it was 'no longer a paper chase', and records were 'permanent and easier to update'. One interesting perspective was 'using photographs and pupils deciding what is to be saved' by a Reception teacher.

Coherence, and said that ICT 'helps report in a structured framework', provides a 'consistent approach across year groups', 'better continuity', and 'better links to national standards'.

The ability to generate graphs in analysis and monitoring, which makes tracking 'easier', 'records from earlier years easier to compare', and enables 'better transition information' and 'easier moderation through online submission'; one school reported 'levelling put onto e-portal with access by head'

Easier target setting: 'Target setting and grade monitoring through the MIS has been crucial', 'Recording SATs and target setting has been easier'.

Easier monitoring of progress meant that targeting of support was more efficient, and enabled 'more assessment for learning'

Instant feedback was well used by the students

Use of IEPs for pupils with special needs was commented upon, as well as the improved availability of information for pastoral counselling.

4.4.2   Change management

In all schools in the early stages of the project, both headteachers and LAs were surprised by the speed of implementing change and recognised that they needed to gain proficiency in change management techniques. The change management training provided for heads and senior managers in spring 2004 by consultants from the National Remodelling Team was perceived to be excellent. The five-day course for the central team and three people from each LA involved looking at the 'instability and criticality of assumptions' and was directly relevant to project management issues in the LA. The one-day sessions for headteachers and staff from the schools were also directly relevant. They involved 'applying some of the tools and led directly into planning ways of tackling problems back in school'.

The evaluators frequently saw the various change management (paper-based) tools introduced in these courses in use in schools during visits, and often headteachers drew attention to them in describing on-going development work. However, it was generally felt that the change management tools would have been even more useful if they had been introduced earlier in the project. In the later stages of the project, some ICT Test Bed headteachers became involved in further developing these approaches through the SLICT programme led by the National College for School Leadership.

One secondary head felt that the change management aspects of the action plan were repetitive because 'you incorporate change management into the planning anyway', and in another sense it was inappropriate because change management is 'the most responsive thing you do' and hence cannot be exactly planned. In one

secondary school the action plan had been specifically written as a four-year plan and was used as a mechanism for the management of change to take forward the broader vision that the school was already beginning to develop before they joined ICT Test Bed. There was a suggestion that the change management section had been included because it was favoured by policy makers. Other things could have been included which were not, for example a section on financial monitoring. (This in part reflects the sense of a need for self-sufficiency that is held by many secondary schools and their sense of uniqueness of context.) On the other hand, in another secondary school the use of meeting time was refocused so that meetings were not just for administration but also for teams to share practice. School management directed that every agenda had to start with sharing good practice as the first item on the agenda. They also created a calendar at the beginning of the year which set out all the meeting times and what they should be used for.

It is important to recognise that the level and expertise of the human resources it has been possible to put into ICT Test Bed was in all cases limited. In this sense the project provided an excellent 'test bed' because its contextual conditions were ordinary and therefore the models of ICT leadership it developed should be easy to replicate elsewhere. In all clusters, the management of ICT Test Bed was mainly done by people who were not experienced in this level of ICT change management and all of them had other full-time roles. Indeed for many, ICT Test Bed was not the main part of their contractual job descriptions.

4.5   Developing new systems and procedures

4.5.1   Planning and installing infrastructure

The LAs, and hence the schools, were all dependent on the connectivity infrastructure in their local area. In one rural area and another inner-city area of socio-economic deprivation there was no existing commercial provider of broadband connectivity for the area as a whole including the pupils' homes.

In planning networks, schools had some difficulty in finding the right balance between usability and affordability, for example in providing wireless connectivity. A 54 MB link has proved to be essential in primary schools.

There have been major problems with theft of equipment from schools, particularly in one inner-city cluster. This brought additional costs in terms of security systems, security marking and increased insurance costs. Theft also caused disruption to teachers, students and classes and, in some cases, it was several weeks before the equipment was replaced and was once again available for use. Once schools had grown accustomed to the constant availability of the ICT, its sudden removal brought further challenges.

All secondary schools ventured into wireless networking technology in at least some part of the school buildings as early as 2003. Initially, some installed lower speed wireless (11MB) but found that this was inadequate when batches of laptops were

used at the same time. Schools switched to higher rated networks (54 MB) to get better performance.

4.5.2   Firewalls and blocking of internet sites

The LA generally provided internet access and associated systems such as firewalls. In one cluster, schools had to rely on the LA, which in turn relied on the Regional Broadband Consortium, and in the first two years of the project these connections were not reliable. Sometimes schools found that bandwidth was reduced and this caused problems when students needed to be online for a continuous period, such as when they were taking online exams.

In one cluster the LA firewalls caused frustration when certain websites that teachers wished to use were barred. It could take a long time for the LA technical staff to respond to a request for the site to be unbarred and the opportunity to do that learning was lost. The LA operated basically the same system for all the schools and that wasn't appropriate for all the levels of education. Secondary school staff said they would have preferred to have control of firewalls internally.

> "Some websites the LA deems inappropriate which…I don't know who sits in front of their firewall server and bars the websites but a lot of the websites they bar…A majority of them are games, pornography, that's fine, but some websites which, for historical reasons you need to access, or sociological…can't be accessed. So we actually have to phone them up and get them to enable those. But we also have our own 'smart cache' as well, so we have our own firewall and internet filtering for anything the Borough doesn't filter out, we can filter it out as well. Because they don't tend to filter out games websites and you'll find that a lot of students just sit at their computers all day long and try and play games."

Occasionally staff in charge of a school's network could become over-zealous in blocking access to unknown websites; in one school responsibilities of senior staff were changed to remove what had in effect become a serious internal barrier. Nevertheless, secondary school staff with responsibility for internet access were in a difficult position, conscious of their duty to protect pupils yet aware that by blocking access to sites they might be reducing the value of the internet for learning.

> "We have our own piece of software in the school that one of my team developed, that catches kids typing in inappropriate words in the browser or even attempting to get them. Of course, obviously with the nature of the internet and the nature of what we are trying to do is not to be restrictive but I have a duty of care to the staff and the children and the parents, as we all do, and it is a difficult one because if you are too restrictive then the impact, I know the impact is frustrating because they could be typing some Shakespeare, looking for some Shakespeare and some sites will be blocked although it could be quite legitimate." (Secondary Network Manager)

Anxieties about internet access were in some senses more of a concern in secondary schools because of perceptions of adolescents as likely to be irresponsible in their internet use if not closely monitored. Certainly there were

occasional problems with internet/email chatting during lessons. In some schools unhelpful blocking of internet sites that restricted the value of the internet for learning remained a serious problem throughout the ICT Test Bed project, and 36 per cent of students reported that they were frequently blocked from websites, whilst another 30 per cent reported occasional blocking.

> In an end of project survey the students were asked to indicate how often they were blocked from accessing websites at school and home when they were surfing the internet for their schoolwork. Blocking occurred most frequently at school, with 67 per cent stating that they were often or occasionally blocked at school in comparison to just 17 per cent blocked at home. Only 10 per cent stated that they were never blocked at school, compared to 62 per cent at home. At home, secondary pupils were less likely to be blocked than primary pupils, although the reverse was true for school use. Secondary students were far more likely than their primary counterparts to report being unable to access websites.

Staff in some departments had to tell the network team which sites they wanted to visit and these were then made available, but this prevented the internet from being used to answer questions as they arose in the course of teaching, and even when internet use was planned in advance it inevitably caused delays. In one cluster the LA maintained a list of barred sites and a secondary school supplemented this with another list. There was a blocked site list as well as a blocked word list. As 'MP3' was on the blocked word site, any internet address which included the word MP3 was blocked; games and chat were also blocked. IT staff could request a password which would allow them to access the sites. Even essential sites such as Google could be on this list. The password was changed frequently so that students who had used Google in one lesson were not able to use it at a later stage or share the password with their classmates.

If the benefits of high levels of ICT in enabling students to make informed use of internet resources are to be fully realised, schools and the LA need to work together to find a solution to these issues. At a policy level there is a need for the school's

legal liability in this area to be clarified and limited in order to prevent the continuation of these kinds of risk-averse practices.[7]

4.5.3   Data management and storage

Schools data in one cluster was held centrally on LA servers although there was a trend at the secondary level for data to be moved in-house onto the school's own servers. One reason for this was that the school was then independent and unaffected by downtime from the central servers. This became increasingly important as use of MIS became more central to the functioning of the school and inability to access the MIS would delay data entry, reduce efficiency of operation and damage the perception of the MIS across the school. Schools in this cluster had also experienced loss of data.

However, storage of data in-house meant that increasingly sophisticated network systems and wireless networks required more technical support and the technicians required higher levels of skills. All secondary schools had increased the level of technical support in the school. Some schools had set up systems for requesting technical support and responding to help requests. Requests were logged online using email or intranet and could then be allocated to appropriate staff. This generally improved the efficiency of responding to support calls but required management and administration. Staff required training to ensure they were able to communicate problems accurately. Such systems are not wholly advantageous; they can reduce flexibility and increase response times and don't match with working practice in all schools.

> "Technical support needs to be flexible. A more informal approach is more supportive of staff and students. We have them on call but with the technicians they are often in the classroom with us and the kids and if something goes wrong the kids will be saying "Have you tried this? Have you done this?" and it's not "Oh I'll come after school and fix that," – everybody is in together and we work together. They're not over there and we're in the classroom. I might call one of them in and say "Look, I'm trying to do this," or "What's the best way to do this?,"

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[7] See for example the Becta website: http://industry.becta.org.uk/display.cfm?resID=25588

and I'll do it with the class in there. I think you have to be prepared to say "I don't know how to do this. Or what's the best way of doing this?"." (Secondary Deputy Head)

4.5.4   Management information systems (MIS)

Primary schools already had in place some elements of an MIS before ICT Test Bed was initiated. As a management tool, full access and administrator's rights were normally restricted to the primary school head and the school secretary. Target setting and analysis of assessments in primary schools was usually the responsibility of the head and a named co-ordinator, and the co-ordination of assessment data was well developed in most primary schools in order to satisfy DfES target setting. Primary teachers in general currently only need to access a small number of elements, such as pupil profiles and registration although some had access to assessment systems.

Experience indicated that primary schools required the support of the Local Authority in setting up and running the MIS, as commercial providers had little understanding of their needs. ICT Test Bed primary schools have also benefited greatly from technical support provided by the secondary schools. MIS decisions were difficult to take and took a long time. Any new system inevitably causes disruption and leads to changes in operational processes and staff roles. Parallel running may be necessary and that also means extra workloads for the staff.

In secondary schools, MIS were being used far more extensively at the end of ICT Test Bed than at the start of the project. Systems were being used in many more tasks, including recording attendance, recording behavioural events, report writing and monitoring assessment grades. More staff were interacting with the system, teachers as well as administrative staff.

> "You are constantly entering events on children and this, that and the other, and things that need to be done and the record of events is really, really useful. Far better than trying to keep a paper-based record." (Secondary teacher)

However, secondary schools were disappointed in the lack of fine tuning of the systems to meet their requirements. The suppliers produced a generic package and appreciation of how it might need to be customised was lacking. Furthermore, the suppliers appeared not to have the resources needed to customise the product. However, one LA manager said that this provided key learning and now an agreement for technical support and staff training is always a condition of purchase at the stage of procurement.

In all secondary schools, MIS were managed by dedicated administrative staff who were responsible for the integrity of the data. Analysis of the data was the responsibility of specified members of the senior management team. Access to data was not generally available to all staff.

Electronic registration was seen as a significant benefit in all five secondary schools. One school checked attendance at the beginning of morning and afternoon

sessions, at the other four schools teachers and managers monitored attendance lesson by lesson, affording possibilities of changing the structure of the school day. It was also found that session registration was working positively to reduce truancy and unauthorised absence.

4.5.5   Learning platforms

In two of the secondary schools, decisions were made early in the ICT Test Bed project to purchase learning platforms (also called 'virtual learning environments') but the procurement process was lengthy and when first installed these systems were at an early stage of development. As a result the schools experienced a number of problems in implementation of what were at that time new systems and also in fitting the systems into their teaching and learning practices.

One secondary school bought a VLE in the early stages of ICT Test Bed but found that it unsatisfactory and the system was abandoned. In another cluster, an early decision was made that a cluster-wide VLE would not be cost effective. In the third cluster, a cluster-wide VLE was installed in 2004 and considerable progress has been made in developing its contents and use (see the Home–Community Links section). It is interesting that in both of the other clusters, learning platforms are now being procured for installation in 2007. One LA manager said that what had been learnt in the ICT Test Bed project was proving invaluable in informing decisions. The other said that it had been right to wait as these systems were not robust three years ago. He also felt that schools now had need of the facilities learning platforms offer for tracking pupils' progress and tailoring learning materials to individual needs, whereas in 2004 the vision had been limited merely to content storage. The successful system has now stimulated a great deal of interest from other schools and the cluster is now clearly an innovation leader in this field.

The installation of a learning platform is a major management decision. Where schools already have extensive shared areas on the network holding a large body of content, it is a major job to transfer this to a learning platform. A key lesson of ICT Test Bed is that very careful planning is necessary in advance of purchase. Many of the problems experienced by schools in 2004 were, however, due to the immaturity of these systems. Schools can now purchase a learning platform knowing that it has already been used by other schools.

4.5.6   Content development models

Nearly all primary schools established shared folders to organise learning materials. Materials were normally organised by year group. Experience showed that 'shared areas' on the server encouraged collaboration between teachers and extended the variety and arguably the quality, of the resources.

In all the primary schools resources stored in shared areas rapidly became extensive and it was necessary to increase server space. As the resources increased, there was a growing need to reorganise and tidy the shared areas. This was most effective where managers made clear decisions and supported staff with training, building the development of resources and quality assurance into school development plans. Where the ICT Test Bed co-ordinators were released from some teaching duties they undertook the monitoring and development of the systems, and

in smaller schools this continues to be the case. In larger primary schools, however, year group teachers generally took over the management of their own resources. The impact of subject co-ordinators on choosing and finding resources has also increased as their knowledge and skills in using ICT.

The secondary schools that did not invest heavily in a learning platform built up a mix of materials: hotlinks to internet sites, school intranets, shared areas, home-grown resources and commercial products. Resources were organised into shared folders by department and year group and different departments progressed at different rates. The growth of this new kind of learning materials created a demand for its management and all the secondary schools experienced difficulties initially in setting up new procedures for system maintenance and housekeeping. At first there was no clarity about whose responsibility this should be. Technical staff did not feel confident in doing this as they did not have the appropriate curriculum knowledge. Teachers did not feel it was their job to comment or take action on resources created by colleagues. One solution was that heads of department adopted this role; they were also in the best position to implement quality assurance processes for their department's materials. In another school, a deputy head and the network manager shared the role.

Two clusters have set up content development teams. In one cluster, the content development team was set up in the FE college to develop materials for teachers in cluster schools and the college. In the second cluster, the content development team, based in a secondary school, was developing materials to populate the cluster-wide learning platform. The plan was to develop this into a commercial venture selling materials to other schools. The work of content creation teams was significant because they were doing the sort of things that teachers have insufficient time to do and the materials they created were of professional quality. Teachers specified what they required by creating storyboards and the team worked with the teachers to develop the idea into high-quality learning materials.

4.5.7   Communications

In primary schools there was increasing use of email during the project and consequent improvements in speed of communication. Some primary schools were using email to communicate with governors, which reduced response times which had previously been two to three days. Late on in the project there were clear signs of increased use of email for contacting parents, though for primary schools this is clearly within in the context of regular daily meetings. There were clearly some concerns expressed by headteachers who were asked *'In what ways email/texting by parents was beneficial'* and whether these forms of communicating caused the heads any problems.

The high level of ICT in the secondary schools has led to email becoming the dominant method of communication in all the schools. This proved particularly valuable where the school was located on more than one site. One school had equipped senior staff with PDAs from which they could immediately access their email and transfer documents from their PCs. Staff who spent a good deal of time outside the main school site found these particularly useful. However, the rapid growth of email meant that teachers and senior managers had to develop ways of

using it that fitted their needs. Initially some found the volume of email stressful and expressed doubts about the 'email culture'.

> "If you email something to someone, you have dealt with that issue. And you have rather dumped it on someone else but it's almost that the very process of sending the email that means that it has closed the loop. And one of those new phrases in organisations is, if you say to someone "I didn't know that," or "I haven't done that," it's "Well I sent you an email three weeks ago," and it's almost end of story, but actually, no, it isn't really." (Secondary Deputy Head)

However, managers clearly recognised the improved communication that stemmed from email. Secondary schools' use of email became quite sophisticated with most schools making use of mailing lists to facilitate meetings and group communication. Staff newsletters, meeting agendae, papers and minutes were often communicated by email.

> "Email means that, for example, you can very quickly change agendas and everybody…we have an open agenda that everybody can just send an item to the head's PA and instantly it will be updated and …when you go into your SLT meeting you get the latest… We used to have the agenda sent out two days before and it was completely irrelevant by the time you got to the meeting because other things had happened that were major that needed to be discussed." (Secondary Deputy Head)

Most Senior Management Teams were starting to use electronic schedules with the aim of extending these to other managers in the near future. This means that duty rotas can also be online.

ICT Test Bed secondary schools had all given email addresses to students. Some staff encouraged students to submit their work by email and sometimes used email to return marked work. Not all staff were enthusiastic about this. A school or departmental policy needs to be negotiated and established so staff and students can use this new form of communication without disruption and pressure on either side.

As email traffic increases so does staff workload (particularly at management level). One senior manager in a secondary school reported: "I find it one of the more stressful parts of the working day, that I switch on and cross my fingers that [the number of new emails is] going to be single figures."

Email has thrown up some interesting management issues. How should a school deal with individual members of staff who have begun to send many emails to colleagues? Does sending an email pass responsibility onto the addressee and act as closure for the sender? Is email prioritised in relation to conversations and traditional letters because it is easily accessible? Should a school encourage parents to communicate via email and if so, what happens if traffic becomes unmanageable? Cunningham and Harris (2003) found primary teachers felt somewhat reluctant about allowing children to contact them via email outside school

hours and relatively few teachers comfortable about this during school hours; in practice few emails were received though they surmised this situation might change as email became more a prevalent means of communication. Perhaps there need to be clear procedures and guidelines for its use more generally as well as in relation to pupil and parent use and security issues. This is in line with issues found in more general business email usage, and again, lessons can be learned from elsewhere in developing those procedures.

4.5.8   Structures

Electronic registration offers opportunities to change the school day. With the advent of electronic registration in every session, there was no longer need to begin the day in tutor groups. One school introduced mentoring for students.

> "We don't have form tutors any more, everybody is an academic mentor for about 15 students and we have appointments and I can sit down with the children I'm mentoring and I can look across every subject and I can see how well they're doing, their attainment, their effort. Before I didn't have that. No, we don't have any forms, because we register lesson by lesson and we meet them after school. We have a 20-minute slot at the end of teaching." (Secondary Deputy Head)

High levels of ICT put demands on space. Space had to be found in classrooms for the e-registration PC. More seriously, few schools were able to provide space for sufficient PCs for individual access. In one secondary, they solved this by turning the libraries into ICT centres so as to increase the space available for ICT. Most of the library books were being moved into the curriculum departments. These spaces also made it easier for students to do independent learning at lunchtime and after school, perhaps to get their homework done. In the end of project survey it was found that over 10 percent of students used library ICT facilities at least occasionally.

High levels of ICT contributed to breaking down barriers between departments through the shared experience of mastering the new equipment and creating resources for the shared resource bank. Schools thought they had made good progress in this area and there were lots of pockets of excellence. At the same time, managers were aware that they still needed to invest time and effort in promoting this movement.

4.6   Further education colleges

Leadership and management were significantly different in the FE colleges, partly as a result of their different governance as incorporated, independent institutions, and partly because their funding was targeted on three selected curriculum areas rather than being focused on whole-organisational development. The FE colleges are therefore dealt with separately here.

4.6.1   Management of ICT – vision

The impact of the ICT Test Bed project on the three colleges has been necessarily more limited than its impact on the schools because resources were focused mainly on three curriculum areas. Focusing resources in this way has the advantage of ensuring that there is some significant impact on teaching and learning within the

curriculum even when the additional funding is small in relation to the college's overall budget. However, in all three colleges there was evidence that the IT departments found it difficult to accept that they were not included.

The work of the colleges provides evidence that clearly-defined management structures and stable senior management teams are important conditions for effective leadership of change in major ICT innovations. In one of the colleges where the whole of the senior management team was replaced within the first year, followed by major restructuring, the evaluators found no evidence that the ICT Test Bed project's injection of funding for ICT had played a role in organisational renewal. It seems clear that at times of major structural change senior managers need to focus their attention on other issues; this is not a time when a major investment in ICT is likely to be good value.

To use high levels of ICT effectively, the project showed that the active support of a senior manager, and supportive interest of the whole senior management team, is essential. Colleges needed to make changes to their management structures, including making new senior appointments and establishing new committees to maximise staff participation.

Each college set up a structure for managing the ICT Test Bed Project, in line with its perceived importance and managers' vision for how best to make use of the opportunities it offered. These structures enabled distinctive forms of leadership to emerge which were critical to the nature of the impact of the ICT. In one college, responsibility for ICT Test Bed was given to a member of the SMT, in a second, an experienced project manager was appointed from the commercial sector, while in the third college a relatively junior and inexperienced member of staff was appointed to the role. While he gained experience rapidly and was subsequently promoted to a much more senior position, he was not initially well placed to lead the cross-institution elements of ICT development effectively.

Leadership strategies need to fit the existing culture of the organisation and play to the strengths of all participants. Standard business models of project management have to be substantially changed to fit the structures and culture of FE colleges, which have very diffuse middle management responsibilities by comparison with business organisations. Two of the colleges provide contrasting models of change management with ICT in FE, which illustrate this process. They can be customised for use by other colleges. (See Appendix A for a table setting out the features of these two models.)

In one college an experienced project manager was brought in from industry to manage ICT Test Bed and adopted what he called 'a franchise model'.

> "It's like a series of franchises internally, that's the way I think of it, you have got schools, departments… you have got lecturers and each one is given an element of freedom for what they want to deliver, but they have to use the supplied materials. In the well known franchises you are all similarly branded but in essence you are almost self-employed, and you have got a larger degree of autonomy."

In another college an experienced member of the senior management team led the project as an extension of his previous responsibilities for developing ICT in the college, and he adopted what he called 'an empowerment model'.

> "Initially there were individual practitioners who were the obvious choice either because of the role they were playing or … [personal qualities]. But others have come through – the team has evolved a true sense of bottom-up implementation. At all levels it's welling up from practitioners across the piece. For example, the joinery technician has taken it on himself to video things and produce demo materials for students. It's been really empowering staff – it's about having the faith in staff to *truly empower* them, not just empower them as long as they are doing what you want."

4.6.2   Change management

In all three colleges, the ICT Test Bed project manager and senior managers made extensive use of ICT tools in the implementation of change. ICT has also provided shared environments for developing and storing resources, thereby making a significant contribution to new collaborative styles of working.

ICT tools that provide structures for (a) project management (b) collaborative working and (c) financial planning/tracking (spreadsheets) are enormously powerful in managing change and tracking its progress. In two of the colleges, the ICT Test Bed project managers have made extensive use of project management software to plan and track project developments over time. In the third, the project manager conceived ICT Test Bed as a network of projects with some inter-dependency between them and used 'a raft of tracking spreadsheets to monitor progress' rather than project management software. He also made extensive use of software to produce visual models and flow charts both to clarify his own thinking and to communicate the project's structure to colleagues.

In all three colleges the Test Bed project managers and senior managers have made extensive use of spreadsheets. One project manager described it as 'ubiquitous in any management processes', both for financial management and as a presentational tool for producing essential documents like time-tables and GANTT charts. Combined with the ease of access to data from the upgraded MIS systems, spreadsheets have been a powerful, flexible and creative tool. Although it is undoubtedly used by managers in all FE colleges, it is clear that the extent and quality of the provision of ICT in the project colleges enabled these to be used particularly creatively.

One college adopted a change management model which enabled short term projects to be undertaken, with clear and rapid outcomes. The college also established review procedures for the outcomes. This approach facilitated the involvement of all staff within the three curriculum areas.

4.6.3   Networking

ICT Test Bed enabled colleges to make infrastructure improvements which had already been planned ahead of their normal schedule. One college upgraded the operating system across the whole network. Another college installed wireless network points across the college.

In addition, colleges were able to greatly increase the availability of laptops for staff and students. One college purchased a number of wireless laptop trolleys for use by students. The other two colleges concentrated on creating well equipped ICT centres within the chosen curriculum areas.

4.6.4   Management information systems (MIS)

There is no doubt that effective Management Information Systems (MIS) are an essential element of efficient management of an FE college.

The three FE colleges had well established MIS and development plans prior to ICT Test Bed. The impact of ICT Test Bed was in facilitating and speeding up the development of the systems, their embedding in the day-to-day operation of the college and in increasing the access and usability of the systems for college academic and business support staff.

Evidence showed that the upgraded MIS were streamlining business processes across the college. It was easier for staff and students to find out about courses and enquiries were processed faster and more comprehensively. Improvements in MIS have enabled major changes in enrolment processes and the traditional delays and long queues are largely a thing of the past.
Managing students on courses was more effective and efficient. Tutors were much more aware of student needs and the progress they were making. All of these factors were tangible benefits to the students and to the operation and efficiency of the college.

Staff were much more aware of data and its role in what they do. Managers made regular use of data to help them manage the curriculum and their staff and to monitor performance. Tutors used data to manage their student cohorts and their progress. ICT Test Bed has generally brought positive changes for MIS personnel who report new systems that work better and help them to be more efficient and effective. All colleges report good and increasing student numbers in ICT Test Bed areas. Marketing of courses has been helped by CDs or DVDs which are used for publicity purposes.

Development of e-viewers (an improved front page on the MIS system) has had a major impact in making systems more accessible and easier to access via web-based interfaces. Once complex tasks such as drilling down into specific aspects of the data were now routine and required only a few clicks of a mouse.

The biggest impact has been at the curriculum management level. Managers were able to pull off tailor-made reports from the system without having to request them from the MIS section. What was previously specialist is now open to all staff across the college.

4.6.5   Learning platforms

All three ICT Test Bed colleges used some of their funding to upgrade or replace their existing VLE. In two cases the VLE selected by the college proved not to provide the expected services and a switch was made to an Open Source alternative system in 2004, but real progress has been made since then. The third college bought into a 'hosted' VLE, where the resources were stored on remote servers which had the advantage that the college needed fewer dedicated technical staff to maintain the VLE. This solution has also been a success in the college. VLE use is now much better established in all three colleges than it was prior to the ICT Test Bed project.

The success of an Open Source solution in providing a college-wide VLE should be noted. These have proved reliable, robust and expandable; they offer a high level of user customisation and the level of acceptance among staff and students is high. In the two ICT Test Bed colleges which changed their VLE during the project, this high degree of functionality has contributed to the rapid establishment of a viable VLE that was becoming a college-wide facility at the end of ICT Test Bed. Such moves will have far-reaching effects in the FE sector and the wider VLE market.

VLEs provide an online space to support collaborative working and the sharing of teaching resources. However, it is clear that, whatever the chosen solution, there is a considerable job to be done managing and supporting the platform and the online resources, which inevitably increases with the number of courses and users. The three colleges all had someone in this role but varied in the amount of time that was allocated to the role. As noted for schools, this needs to be managed and maintained within the college staffing structure after ICT Test Bed.

A VLE comprises a complex and potentially transforming set of ICT tools, but its effective use depends on it being embedded in teaching practice. In all three colleges, curriculum leaders worked with colleagues to plan how to use the VLE and establish devolved responsibilities for the production of resources. In two of the colleges, tutors were supported by specialist resource developers, and this required curriculum leaders to liaise with these specialists.

4.6.6   Content development models

Three different models for content development were in place in the three colleges. In one college, a content development workshop was established to work with lecturers to create resources of professional quality. The content development workshop also worked with schools in the cluster to help them develop resources. In another cluster, professional multimedia developers were commissioned to create materials to designs created by lecturers. In the third college, the majority of the resources were created in-house by the staff in the ICT Test Bed curriculum teams. In practice, all three colleges had a mix of resources, and staff were able to combine their own materials with commercially developed materials. As in schools, staff were skilled in adapting and customising materials to meet the needs of their learners. Staff made good use of internet resources to supplement learning materials and ensure that information was up to date. Evaluators found that in practice, it was most common to see teachers creating and using their own materials with professionally developed materials taking a secondary but specialist role.

4.6.7   Structures

ICT has had a major impact on curriculum leadership within the three chosen areas, because the new emphasis placed on the use of the ICT equipment and shared resources such as the VLE has required new strategies and procedures to be put in place to make effective use of it. Those teams also gained in skills and standing within the college.

Improved interaction with MIS has enabled senior managers and curriculum managers to monitor and manage their staff and courses. MIS have led to change in administrative jobs and created new jobs. Business support teams have been restructured and reskilled to become multi-skilled teams who ensure benefits are realised from MIS.

In two of the colleges, the ICT Test Bed Management groups have been integrated with the existing committee structures. In one case this was by establishing the ICT Test Bed group as a sub-committee of the ILT committee and in the other by merging the ICT Test Bed group with the existing ILCT Strategic Group. In this college, planning began during the second year of the ICT Test Bed Project for a substantial 'new build' to extend the facilities on the campus. The new MIS facilities enabled the senior management team to specify the college's requirements on the basis of evidence rather than relying on the perceptions of individuals. In particular, the high-quality data on student attendance gave accurate class sizes and allowed room requirements to be specified very exactly.

In one college, the structure had changed from a curriculum-led structure to a structure based on groups of students (14–19, for example). In another college, the provision of ICT was changed from large central ICT centres to having computers based within curriculum areas. Managers can be more confident about these types of major changes because of the greatly improved infrastructure and the improved information resources available to them from the MIS and, perhaps more significantly, because of their increased experience and expertise in managing large ICT-based projects.

5. Impact of high levels of ICT on workforce deployment and CPD

This section reviews the impact of high levels of ICT on work roles of staff in the ICT Test Bed schools and colleges. Continuing professional development is closely linked to change in work roles and plays an essential part in equipping staff to make the necessary changes. The section first highlights the key issues then discusses changes in roles in primary and secondary schools. The final section completes the picture by reviewing the impact of ICT on roles in the FE colleges.

5.1 Main findings

5.1.1 Overall findings

- The involvement of ICT changed the working practices of teachers and extended the roles of administrative staff and technicians.
- Well –co-ordinated and sustained professional development opportunities were important in developing ICT skills and confidence of all staff and embedding the use of ICT. Informal, on-the-job training is very effective when supported by in-school champions.
- The introduction of new technologies into all school classrooms at the same time was instrumental in developing a culture of sharing and mutual support.
- Access to reliable technology and its use on a daily basis led to rapid improvements in teachers' skills and improved management of workloads.
- Shared server areas and virtual learning environments made it easier for teachers to find, store, share, create and reuse resources and lesson plans. This ensured long-term value from the initial high investment by the workforce.

5.1.2 Change in the workforce and their roles

- Almost all teachers in the ICT Test Bed schools have become competent and confident in the use of their laptops to manage and prepare lessons delivered through the whole-class technology. Given the expressed lack of knowledge and experience with ICT prior to the start of ICT Test Bed, the speed with which their confidence and competence in using computers and other resources increased was remarkable.
- In secondary schools and colleges, equipment which is permanently installed or which is common to all classrooms, such as the display equipment, has been most effectively embedded. Equipment which is subject-specific is generally well used.
- Laptops have been a major factor in enabling teachers to gain new skills and confidence in technology. As a result teachers feel more confident in dealing with technical hitches and failures.
- Provision of laptops has clearly given flexibility and choice with regard to the location where teachers plan, prepare teaching and learning materials, complete pupil records, track progress and other administrative

work. This has been enhanced through the availability of remote access to the school networks and through the increased use of memory sticks as digital briefcases.

- The wholesale provision of presentation technologies was very influential in stimulating innovation in the ICT Test Bed schools and colleges. It provided a real incentive for teachers to develop their computing skills to a purpose and effectively changed teachers' preparation and planning for the curriculum.

- Teachers are using new methods of locating and creating resources. They are searching, creating and adapting materials using a much wider range of sources than previously to form new learning activities. Teachers are sometimes working with professional content developers who create materials from their ideas.

- Most primary schools developed shared year group plans across the whole school and these plans could be easily updated.

- In secondary schools this planning was usually done within the departments, although two of the schools had a more co-ordinated cross-school interface. The ease of sharing plans publicly and the need to prepare in more detail for the presentation technology raised the level of preparation significantly. Heads of department could see clear advantages in monitoring by having the departmental plans available on the shared areas.

- In colleges, the ICT Test Bed curriculum teams worked together to create interactive resources for their students. As for schools, the ease of sharing plans and the need to prepare in more detail for the presentation technology raised the quality of preparation significantly.

- Where schools and curriculum teams had built hyperlinks to resources into their plans this made them easier to access and use.

- The establishment of shared network access is a major instigator for staff sharing resources and ideas. A stimulus for increased in-school co-operation arose from the sudden and dramatic arrival of display technologies at the start of ICT Test Bed, providing a shared mutual need for all the staff.

- Significant support is provided by these digital resources when teachers move year groups and they are able to develop their new portfolio on the basis of existing resource provision. Digital resources also ease planning and provide continuity in the curriculum when a supply teacher is utilised.

- Where an appropriate model is in place, classroom assistants are invaluable in developing ICT use and resources. They are able to support individuals and groups in working on computers in their classrooms. They can also help ensure continuity when supply teachers are needed since they are aware of the systems and resources that are available for use with the students. Their training has given them an improved status and confidence on the classroom.

- Technicians have enhanced roles and are vital if the school or college is to maintain its high level of use of ICT. As the investment in ICT has developed, so technicians have had to develop further skills and knowledge. Their need for training was not always recognised, however.

- The ready access to databases and the ability to analyse the data has made assessment much more systematic.
- Electronically organised reporting has made the provision of information for parents much easier. It has also improved the tracking of pupil development and made the monitoring of departmental achievements in secondary schools easier to accomplish. An increasing number of assessments are required to improve the analysis and this places more pressure on teachers.
- Many more staff are interacting with the MIS.
- MIS is providing better information and better access, especially for those managing the pastoral systems and monitoring students with special needs.
- E-registration has improved student responsibility and attendance and has potential for changing the school day and the way the school is structured.
- Behaviour management systems provide immediate and more accurate records of events, though teachers require training to complete the protocols properly.
- New MIS and administrative processes have significantly made administrative roles more demanding but have produced substantial gains in the availability, use and accuracy of data at all levels of the organisation.

5.1.2   *Continuing professional development*

- Professional development was important in developing ICT skills and confidence developing professional pedagogy and increasing prestige and professionalism.
- Training needed to be co-ordinated with the introduction of the equipment. Sometimes perhaps owing to delays in receiving equipment, this wasn't possible and this reduced the impact of the training as staff were unable to practise the new skills they had learnt. Training needed to be handled carefully so that staff did not feel overwhelmed. Poor initial training can lead to staff not taking up the new resource.
- The most effective training was often informal, through team work and mutual support.
- Continuing professional development over time was important in order to maximise the use of hardware and software resources and ensure that staff developed the necessary skills and did not merely rely upon methods with which they were already familiar.
- Action research supported professional development and pedagogical change. It has been valued highly by staff who undertook it.

5.2   The impact in schools

5.2.1   *Impact on teacher roles*

Almost all teachers in the schools have become competent and confident in the use of their laptops to manage and prepare lessons delivered through the whole-class

technology. This has had significant impact on the corporate planning and provision of resources in all schools. Nearly all staff find laptops indispensable, although as teacher skills developed so did their needs and it was clear that the procurement and distribution of this equipment requires a better initial needs analysis and plans for upgrading need to be built in. Provision of laptops has clearly given flexibility and choice with regard to the location of where teachers plan, prepare teaching and learning materials, complete pupil records, track progress and other administrative work. Whilst working at home is normal, the recent welcome emphasis on worklife balance has also meant that teachers seek to limit the complexity of tasks which they do from home. Remote access to the school shared folders or intranet was particularly valued by some staff, especially managers, although it still not universally available and not always demanded or used. Laptops or memory sticks generally served the purposes of classroom teachers for transporting home the files they are currently using for planning and lesson preparation. In one school the staff laptops were automatically updated when the laptop was activated in the morning.

Given the expressed lack of knowledge and experience with ICT prior to the start of ICT Test Bed, teachers' confidence and competence in using computers and other resources is remarkable. There is no doubt that many teachers in ICT Test Bed schools and colleges have become very skilful and accomplished. Teachers select programs and files, adjust screen displays, move between resources and use tools with ease and without hesitancy or uncertainty.

Primary teachers have found personal laptops indispensable (Pearson *et al.*, 2004) and a major factor in changing their practice (TTA, 2002). Almost all teachers in the primary schools have become competent and confident in the use of their laptops to manage and prepare lessons delivered through the whole-class technology. User confidence has been widely found to be a key factor with uptake of ICT (also recognised from a number of other studies, for example John and Baggott la Velle, 2004; Smith, Higgins, Wall and Miller, 2005; Ilomaki, Lakkala and Paavola, 2006). This meant that teachers were found to be more confident about coping when technical hitches and failure occurred.

In secondary schools and colleges, equipment which is permanently installed or which is common to all classrooms, such as the display equipment, has been most effectively embedded. Equipment which is subject-specific is generally well used. Many subject areas contain relatively few teachers and although there are clearly common skills for all teachers the application of these skills in different disciplines is perceived as idiosyncratic and this tends to create some barriers. The need to develop expertise is therefore much more an individual issue and dependent on departmental priorities. The management structure in secondary school is also many layered and it is more difficult for initiatives to impinge on everyone at the same time.   It is not surprising therefore that development in secondary and FE was found to be more patchy, though great strides have been made (Sutherland *et al.*, 2004, also found that less progress had been made at the secondary level than at the primary stage).

There is strong professional support from working together on the same problems. In particular the wholesale fitting of display equipment throughout a school, and

throughout a cluster of schools, has a significant effect in producing corporate learning and professional support amongst the teachers, often noted as being a necessary ingredient in ICT adoption (recognised also by Harris and Kington, 2002; Tearle, 2004). Indeed, the effect of installing display technologies has been enormously effective in providing teachers with real need and incentive to develop their computing skills, and because this is a shared common experience, everyone is involved. This naturally produces a positive sense of team work and mutual learning. The gradual introduction of display resources which most non-ICT Test Bed schools have to employ tends to create a division between 'those who have/those who know' experts and their other colleagues and a greater dependency on ICT co-ordinators. This is no longer true in ICT Test Bed schools, where all primary teachers and almost all secondary teachers are competent and regular users of ICT.

This is a particularly effective context for primary teachers, where all the teachers in the institution, and in other institutions in the cluster, share the same concerns. The primary teacher's task is huge and although there are differences between year group teachers, it is still in many ways a common task and therefore mutual support is natural and traditional. The management structure in primary schools is also less complex and direct leadership by the head is facilitated and the ICT co-ordinator is usually in daily contact with all members of staff.

Teachers in all primary schools and some secondary departments are making daily use of technology and building it into their pedagogy. Access to information is much simpler when teachers have personal laptops. They are searching, creating and adapting materials using a much wider range of sources than previously to form new learning activities. Teachers are sometimes working with professional content developers from other organisations who create materials from their ideas. These learning materials are of a higher standard and more likely to contain multimedia and interactive elements and offer the potential of extending the curriculum.

The establishment of shared network access is a major instigator for staff sharing resources and ideas. All the ICT Test Bed primary schools, by virtue of their common sudden needs, established significant professional sharing of resources and planning from the start of ICT Test Bed. This has continued to epitomise the working atmosphere in the schools. Within all primary schools in ICT Test Bed, the staff noted improved and extensive co-operation in developing resources and planning, and this was also true in many secondary school departments. The common demands and issues related to ICT Test Bed stimulated significant cross-cluster communication between the primary schools in one cluster, initiated by headteacher co-operation, then by ICT co-ordinator meetings and then spreading as more staff need to share their related issues. This development was more variable in the other two clusters which had a different management structure. Secondary schools and colleges were largely self sufficient, and their relationship with the primary schools varied between the clusters.

Sharing of resource on the school's intranet is noticeably saving time. Teachers have, however, become used to resource development and most resources are 'tweaked' or improved before being reused to meet the needs of different groups of

students and this also takes time. Significant support is also provided by existing digital resources when teachers move year groups and they are able to develop their new portfolio on existing resource provision.

Headteachers were required sometimes for the first time to take a strategic view of the use of ICT in the school. They needed to rapidly gain an understanding of the potential of ICT for their school and their teachers and pupils and contribute to decisions about hardware and software implementation (an issue also raised by Tearle (2004) and Forkosh-Baruch *et al.* (2005) and in Somekh, forthcoming).

In secondary schools, the impact of high levels of ICT on different departments has varied according to existing cultures, individual staff preferences and attitudes to technology (also found by Mumtaz, 2000; and Levy, 2002 as cited in Smith et *al.*, 2005) and the stage of development of whole-school procedures in relation to content. As a result of this, the levels of ICT interest, competence and skill are much more variable amongst secondary teachers than primary teachers. Sutherland *et al.* (2004) found that levels of ICT use were different at primary and secondary level, which they suggest may be because primary teachers may not regard themselves as subject experts and may be therefore be more open to the impact of generic skill development such as ICT. Secondary teachers regard their subject knowledge and skills as by far the more dominant influence and therefore prioritise their development.

5.2.2   Impact on other roles

One significant development in primary schools was the changing role of the classroom/teaching assistants who received training along with the teaching staff and then were expected to play a full part in supporting the pupils as required in the TDA remodelling vision. Classroom assistants are also able to support supply teachers and new staff in the ICT Test Bed schools by their knowledge of the systems and school resources. The availability of more detailed lesson planning undertaken by teachers using presentational technologies has also helped to ensure consistency and continuity of learning when used by a variety of classroom adults.

The role of the technician has developed alongside the ICT systems and all the primary schools saw the continuing availability of technical support as essential (echoed in Sutherland *et al.*, 2004; Smith, Higgins, Wall and Miller, 2005). Indeed, nearly all ICT Test Bed schools were making plans to sustain this support when the project ends. The technician role inevitably developed as schools expanded their resources and as teachers became more proficient. The lack of an adequate staffing structure led to a significant degree of movement by these important workers and LAs need to find ways of enabling isolated primary school technician training and job enhancement to be achieved.

In secondary schools, high levels of ICT required high levels of support. In all the secondary schools new roles were created to ensure there was someone with dedicated responsibility for the teaching and learning equipment in the classrooms, to ensure it was working and provide support and maintenance. The importance of this strong infrastructure was noted by Tearle (2004). Network managers and

technical staff had to take on additional responsibilities which often provided them with increased job satisfaction and standing in the organisation.

In primary schools the introduction of the MIS reinforced the changed role of the school secretary initially brought about by the moves to self-management and more budgetary control. School secretaries now often manage the MIS in conjunction with the headteacher and this has led to greatly enhanced demands on the level of their ICT skills. In secondary schools, the introduction of a new MIS changed the roles of administrative staff and provided a good opportunity to develop and reinforce staff skills, though there were signs that some staff were reluctant to relearn a new system, having developed their own ways of operating, especially since the improvements were often more beneficial to others. ICT Test Bed also produced some tensions in financial controls due to the need to report and manage it on the one hand as a separate fund, yet it clearly had an impact on the schools' existing budgetary position in terms of additional equipment and staffing resources.

The enhanced MIS need to be secured and reliable and this additional burden is usually vested in the administrative staff and in deputy/assistant heads working in conjunction. Attendance and behaviour monitoring needs to be accurate and detailed, as do databases. Report-writing in all three clusters changed to electronic methods during the project. Some schools purchased specific report-writing software which was found to be flexible and easy to use.

Website design is often outsourced, but in a number of schools a regular weekly site update had been initiated to ensure relevance and interest. In one or two primary schools this task is undertaken by a classroom assistant.

5.2.3   Impact on lesson planning

Planning in most of the ICT Test Bed schools changed significantly for the better over the life of the project. This was largely as a result of the schools' intranet/learning platform, which made planning easily accessible and public. Most primary schools developed shared year group plans across the whole school and these plans could be easily updated. These plans often include hyperlinks to resources, cross-curricular links and websites. The ease of editing by cutting, pasting, amending and adding objectives etc. was greatly beneficial in reducing the time spent on planning, and enhanced the time available for reflection. Pupils commented on the better teacher preparation and this was everywhere evident.

In secondary schools planning was usually done within the departments, although two of the schools had a more co-ordinated cross-school learning platform. Lesson plans and weekly plans were often more detailed than before, with appropriate resources linked into the planning. In response to the *assessment for learning* initiative two or three key pieces of student work were often included with very detailed lesson planning. The ease of sharing these plans publicly and the need to prepare in more detail for the presentation technology raised the level of preparation significantly. Heads of department could see clear advantages in monitoring by having the departmental plans available on the shared areas; they could easily be updated and they knew that everyone was working to the same plan.

Most ICT Test Bed schools overcame the initial major burden of creating all their resources from scratch and by the end of the project were using the fruits of their earlier labours to ease the demands. Much of the teachers' effort could then be placed on improving the resources and making them more relevant to their current classes. Teachers became so practised in re-planning and reshaping their material that more restrictive LA centralised planning could be inhibiting rather than supportive for teachers if they did not have inbuilt flexibility.   In secondary schools short-term planning was made easier by the hyperlinking to saved lesson plans, placing more attention on medium- and long-term planning. For the SEN department, planning and assessment was a core activity, and they needed reliable whole-school systems to enable them to function properly across all the subject areas. The technology provided a new approach to enable group (rather than individual) SEN targets to be posed.

Remote access to materials on the school network was particularly valued by secondary teachers although it was not available in all three clusters. Some primary teachers, especially those with managerial responsibilities, also found they were able to work more flexibly when they had access to school systems from outside school though for most the convenient 'memory stick' was sufficient to carry their planning and immediate resources.

The use of computers for lesson planning and delivery has notably reduced the amount of photocopying.

5.2.4   Impact on managing resources

In primary schools, the establishment of shared network access has been a major driver in encouraging staff to share resources and ideas. The need to develop expertise very quickly also encouraged task sharing in order to make it more manageable. Sharing of resources in network areas was saving time (reported also by Levy, 2002; Morrison, 2003; Higgins *et al.*, 2005) although it was common to find that resources needed tailoring to meet the needs of different groups of students. There were clear benefits when teachers changed classes or when a new teacher or a supply teacher was employed.

An efficient catalogue and search system for accessing materials in shared areas is important, because without this materials are difficult to organise and locate. In primary schools the ICT Test Bed co-ordinators undertook the monitoring and development of the systems, and in smaller schools this continues to be the case. In larger primary schools, however, year group teachers generally took over the management their own resources. Choosing and finding resources was also undertaken initially by the ICT Test Bed co-ordinators but the impact of subject co-ordinators on choosing and finding resources has also increased as their knowledge and skills in using ICT has developed and the strategy teams and other subject support organisations are beginning to provide additional help. Primary teachers also appreciate the various teacher support programs for creating resources and again the responsibility for using these resources is beginning to be shared by colleagues other than ICT co-ordinators. One or two primaries introduced learning platforms and this facilitated organisation of materials within the school.

Resource banks in all secondary schools comprised a diverse mix of commercial, ready-made resources and resources created by teachers or teams of teachers. They were initially departmentally based and are often managed by the department's 'ICT champion', sometimes the head of department but often another colleague interested in ICT. Increasingly they have being supported by centralised learning platforms which provide a basic organisation and a user-friendly interface. Teacher-created resources bring 'ownership' and provided flexibility since they are better understood and easier adapted. Materials development offered challenges and opportunities for teachers to gain new skills and personal pride. However, making use of ready-made resources offers a way of reducing development time and addressed concerns about re-inventing the wheel. There are a number of specialist subject websites in most subjects from which teachers can extract valuable ideas and resources. Teachers are becoming more critical and have increased expectations of what a resource might accomplish.

In most secondary schools, VLEs were in their infancy at the start of ICT Test Bed and their learning platforms are only just becoming a reality. Some departments had well established internet sites for their learners, generally created and maintained by individual members of staff in the department who managed the site and uploaded materials for their colleagues, but the individuality of the interfaces could make it more difficult for learners to navigate. In some cases, secondary teachers were able to extract departmental materials from the centralised repository of teaching resources and make these available to students, so increasing their autonomy in terms of pace and access and enabling students to take increased responsibility for their learning. This also enabled students who were absent from the class to access the resources at home or other locations outside the classroom.

Leaning platforms, however, need to be managed and create another demand on central managerial resources and another learning experience requirement on teachers. Without adequate teacher involvement and redefinition of practices they are in danger of becoming 'window dressing'. The experience in ICT Test Bed emphasises the difficulties on making rapid progress in many secondary schools even with financial support for the continuing professional development which is needed.

5.2.5 Impact on the task of planning by teachers

Planning in ICT Test Bed primary schools changed significantly for the better, largely as a result of staff being able to share plans via the easily accessible shared areas on the network. Staff were able to plan as a team more easily. As a result of this, most schools developed shared plans across year groups. A common method was to use a colour-coded plan with hyperlinks to resources on the shared areas, cross-curricular links and external websites.

In secondary schools, it was common to find departmental plans available on shared areas where they could easily be updated and they could ensure that everyone was working to the same plan. This has initiated a new openness between members of the departments towards information, encouraging joint responsibility and corporate

planning. It was also important for heads of department who could monitor the department's provision and ensure coherence and compatibility across year groups. This was particularly important for cross-department administrators such as heads of year and SEN leaders who could scan a pupil's progress across a number of subjects and so make a more evidence-based decision on a student's particular needs.

Where heads of year were also able to access attendance data and information about behavioural events relating to individual students through the MIS, this helped them to co-ordinate more effectively with their departmental colleagues.

5.2.6   Impact on the teacher's role as assessor

In primary schools recording and ease of accessing assessment outcomes improved with the implementation of electronic record keeping. Electronic recording facilitated analysis of assessment outcomes and was found to be very useful in Harris and Kington's study (2002), which reported on a school that used a student tracking database. With the increase in centrally provided information, schools have become much more adept at analysing assessment information and this has been greatly enhanced by the efficacy of ICT systems. A number of primary schools now have an assessment co-ordinator to support the headteacher and staff in using assessment for learning.

As teachers gain confidence in managing ICT in their classrooms, the issues of assessment and recording gain higher priority. In some primary schools, the ICT co-ordinators used their development time to support their colleagues in developing robust assessment and reporting systems which could then be maintained by the classroom assistant. This had the double benefit of freeing up teacher time and at the same time enhancing the role of the classroom assistant.

In secondary schools, electronic access to learner records on the shared area enabled teachers to compare progress across the subjects much more easily, allowing borderline students and students needing support to be identified more easily, and highlighting inconsistencies in attainment (this too was an advantage realised from Harris and Kington's 2002 case study).

Formal examinations are still paper based and this limits teachers in using ICT for assessment; this was a concern highlighted by McFarlane in 2001 and it seems very little has changed. For example, many teachers are hesitant about accepting student word-processed assignments since handwritten examinations are eventually the only means of assessment. Where marking is routinely done in automatic electronic format teachers do gain time, but they worry about the loss of contact with students. The ease of storing and analysing assessment data has also, however, led to an increase in what is expected of teachers. An increasingly number of assessments are required to improve the analysis and this places more pressure on teachers. There is also some disquiet at the increased volume of work which arises when students use word-processing software and copy and paste information from the internet to produce assignments.

5.2.7   Impact on attendance of central registration

In primary schools, improved attendance and punctuality were perceived to be a positive consequence of online registration where it was implemented. There was also a real time saving for administration staff who were no longer required to enter the data themselves, although they found that the technology was not always reliable, and recovering from a failed registration was cumbersome. The immediacy of action from electronic registration was particularly welcomed and a member of the administration, the school secretary in most primary schools, could contact parents early and allay fears.

> In one school, Key Stage 1 teachers used online registration as an opportunity to develop numeracy skills – the children could see the registration screen and the teacher involved them in talking about numbers of absences, odd and even numbers etc.

Attendance recording via e-registration was increasingly used in all secondary schools. This had major benefits in reducing administrators' time at a busy period of the day and providing up--to-date data for teachers and senior staff to chase missing students. Another key factor was that the students were very aware that the school now had the information and would act on it. Schools reported that attendance was improved when e-registration was introduced. In some schools parents were able to access the attendance information and this had a further beneficial effect on attendance. Teachers and personal tutors were able to get print-outs of individual attendance and use these in tutorials and personal interviews.

> The online registration system is enabling punctuality to be monitored more effectively. Lesson Monitor is used to record attendance in particular lessons, and is valuable in following student attendance and subject avoidance more carefully, enabling heads of year and SEN leaders to locate pupils rapidly. Printing out a lesson-by-lesson attendance report for a week helped a parent recognise that their child was attending lessons selectively.

> E-registration has enabled schools to change the way students are registered. In some schools, registration happens in every session so there is no requirement for students to go to their 'form' room at the start of the day. Some schools have moved away from the form structure to smaller groupings based on personal tutor groups.

Behaviour management systems which stored data within the MIS were introduced in secondary schools and their use gradually increased. Staff are able to log events and actions taken and record future intentions. This is beneficial because "it now prompts action, it now prompts thought, it now prompts challenging the students". It is important to establish clear protocols, however, if the appropriate information is to be gathered at the time of the event and to ensure appropriate entries are made into the database.

Secondary teachers routinely use the MIS to write reports. Staff are able to complete their sections of the reports where and when it is convenient for them and these are

then automatically collated into the student's report. Some schools had built up comment banks constructed within subject teams and these saved time and were beneficial in delivering consistency and quality. The best systems allowed teachers to add their own comments and integrate these into the report.

5.3   Continuing Professional Development

All schools and colleges recognised that professional development for staff was vital in realising the benefits of the high levels of technology they were installing through ICT Test Bed (see Harris and Kington, 2002; Tearle, 2004). A wide range of training events took place.

The ICT skills of primary teachers have improved very considerably as a result of their use of computers all day through the interface of presentation technologies. Continuous access to ICT and its frequent, purposeful use have been shown to be the most effective means of staff development.

Staff development planning in ICT Test Bed primary schools appears to have been very effective. Most have followed careful plans in its provision.

> One school followed a planned four-week cycle:
> Week one involved a model lesson and demonstrating a piece of equipment.
> Week two involved team teaching.
> The following week was spent using the equipment and experimenting
> and the fourth week was an assessment of how and when to use the equipment.

In all clusters, the LAs offered training as well as the schools themselves. Local authorities carried out an analysis of staff skills which was used to develop a programme of CPD matched to skills requirements, a point highlighted by Tearle (2004). In one cluster the LA set up a steering group for CPD which was a representative group of headteachers or CPD managers from the schools. The CPD group was felt to be instrumental in making sure that staff were able to make best use of the technology and in ensuring 'quick wins'. This LA also publicised training events across the cluster and encouraged schools to share in each other's events.

Some providers of resources and equipment have provided excellent support and managers should explore with suppliers the support offered before committing to a new resource. Central systems, such as MIS and learning platforms in particular need good training packages. In one cluster the poor quality of two training sessions for a new learning platform set back the development significantly as teachers lost confidence in the system.

For primary schools a progressive programme of training for representative teachers from the schools has been cascaded back into the schools very effectively. Most schools have members of staff who have become accomplished with certain pieces of equipment and they then support and sustain activity with that equipment by their colleagues. The key has been the corporate and co-ordinated approach taken between and within the schools. Primary ICT co-ordinators also played a major role in raising skills levels within schools using their increased non-teaching time to work

with colleagues in order to develop their use of the technology. External trainers were used for specific events and the FE colleges in the clusters offered a range of training opportunities to school staff.

> "What we found was because people went out in dribs and drabs, school life is so fast that there was never really enough time for people to come back and share as much as they would have wanted. The expertise stayed in pockets. It was there but it stayed in pockets. It would have taken us a whole year for us to get to everybody to do some feedback. We have taken a unilateral decision in the last two months to do all our training with as many staff as possible, to actually buy in expert trainers." (Primary headteacher)

The focus of training has shifted from the use of the ICT tools to consider effective ways of using the tools to improve pedagogical practice. It is important to realise that it is 'how' ICT is used that has the potential to make the difference, not the equipment itself, and it needs to be used in effective ways (the significance of this was also recognised from other studies, such as Harris and Kington, 2002; John and Baggott la Velle, 2004; John and Sutherland, 2004; Sutherland *et al.*, 2004; Becta, 2006).

Secondary schools also brought in external trainers for specific subjects. Change management training organised by the LA was valuable in helping to implement the project. As the project progressed, secondary schools drew more on their own resources for staff CPD, using IT and other teachers, technicians and content developers to deliver specific training. Advanced Skills Teachers (ASTs) have played an important role in designing and delivering this training. ASTs have also been trained in coaching skills and have then coached colleagues within the department and sometimes within the wider school.

In secondary schools, some staff who were not previously using ICT have rapidly developed a wide range of often advanced skills. Whilst ICT Test Bed has included provision for staff training, some staff referred to the benefits of informal support from more technically able members of the department and the school often recognised 'ICT champions' in the departments. Indeed, training commonly takes place at department level where staff share subject innovations and resources closely related to their curriculum area. Sometimes teachers of specific year groups got together for training sessions. Much informal training and discussion takes place where staff share what they are doing with one or more colleagues.

> "What I find is there are people, you can go to people and just say 'I'm not sure about this, come and show me', and they'll quite happily come on. I think that's the sort of culture that's developed here; it's not necessarily a formal teaching day that you learn the most. I've learned more from *** or from *** about little tips of shortcutting. I think it's time we started looking at what we've got in the school and using it." (Secondary teacher)

> "We hold weekly training sessions …. the staff team get together in small clusters and train each other; show each other techniques and ideas, 'this is how I do it with my class', and they do it in ad hoc fashion. They are not told 'do it', they do it as they're professionals." (Secondary Head of ICT)

Technicians were expected to take on the installation and maintenance of a wide range of new equipment but did not always get the necessary training. It seems that managers did not have sufficient understanding initially of the new knowledge required by technicians to install and maintain new systems. The LAs need to assume a responsibility for supporting sometimes isolated technicians and providing a communal focus for training.

In secondary schools, training to use MIS was seen as important in getting staff up to speed with the new systems quickly. There has been training for teachers to manage the e-registration and in completing reports online. One effect of introducing new MIS has been the closer working together of administrative staff and senior managers in developing the use of the new tools. As in primary schools the demands on the skills and knowledge of the administrative staff responsible for maintaining the MIS have increased substantially and their training has been important.

A lot of staff started a European Computer Driving Licence (ECDL) course but many found that other priorities intervened and they couldn't follow it through. They found the course wasn't really teaching them what they wanted to learn; what they needed was more focused training on the ICT they were using in their teaching.

> "The second thing was that a lot of people have gone out on training and in schools, I think it's a common problem that people go out on training but what do they do with the training when they get back? Where is the platform for sharing what they have done? What is the benefit to the whole school? So if it has cost £200 for a supply teacher and £300 for the course, who has that benefited really? It has benefited that teacher. Possibly if they do a really good job, their immediate department, but what about everybody else? How does the school tap into that fully? What we have started to say is anybody who goes on an inset needs to provide an article for the teaching and learning newsletter. That is part of the requirements for going on the course. If you're applying to go on course but you can't picture what you'd write for a teaching newsletter, don't go on the course because it's not suited you. … That is the shift really. I think we have always said 'Well, if they want to go....', but now we are getting much more assertive in term of if you can't see the value for teaching and learning and you can't share that with the rest of the staff through this medium or through another medium then question yourself, 'Why are you booking to go on that course'?" (Secondary deputy head)

Initial training at the appropriate time was important, but the most effective learning in how to make best use of technology appeared to take place after the training sessions through staff seeing what colleagues were doing, taking part in more

informal team learning and practising with the equipment on their own. This approach was particularly effective in training secondary and FE teachers to use the VLE.

5.4   Further education

5.4.1   Impact on teachers

As for teachers in schools, personal laptops had proved a major factor in helping college staff acquire skills and confidence to make effective use of ICT. Nearly all staff in ICT Test Bed areas had laptops for their personal use although some staff were having problems with reliability, with outdated network cards and with running new software applications.

In the later stages of ICT Test Bed, the gains in staff skills and confidence with ICT were clearly in evidence in the classroom. Tutors also expressed a sense of greater enjoyment, perhaps springing from their increased skills and confidence and hence an increased self-esteem and self-worth. They have perhaps overcome the challenge highlighted by John and Baggott la Velle (2004) that ICT presents to teachers' subject identities and their pedagogical practice. They suggested that the tensions embedded in these two narratives need to be aired and explicated if teachers are to be engaged in thinking about their pedagogy and how it might be enhanced through the use of new technology (p. 324). ICT Test Bed has been an instrumental factor in this professional development.

The interactive whiteboard was recognised as a major innovation. There is growing dependence on IWBs and several teachers commented on the difference it makes to their teaching, to the ambience of the classroom and to the motivation of the students (this was voiced also by Smith, Higgins, Wall and Miller, 2005).

Teachers are regularly using laptop trolleys in the classroom and have become comfortable in the management of this resource. The laptop trolley solution was popular with teachers as it made access to software and the internet much easier, but there have been increasing problems with the operation of the laptops, particularly those procured at the start of the project some three or four years ago. The selected laptops proved to be of too low specification to meet the requirements of teachers and classes and at that time wireless networks were in their infancy and problems with wireless network speed and traffic multiplied the problems. Teachers needed to recognise the limitations of both the laptops and the wireless networks which they had not expected. As the use of the technology matured, teachers have found ways of getting round the problems.

Teachers had also mastered a wide range of peripheral equipment which was in routine use by both staff and students, for example, digital cameras, video cameras, graphic slates and visualisers. Voting systems were not often used but where they were used, staff had found them useful in enlivening questioning and testing sessions. With these tools, there was evidence of a novelty effect and a perception that they did not encourage deeper learning (Passey, 2006 voices similar concerns; additional concerns regarding the longevity of effects are made by Bateson-Winn, 2003).

Being involved in the ICT Test Bed project has been beneficial to the teaching staff taking part. Several staff have taken on new and enhanced roles within their college, for example, becoming e-learning champions, and some have gained promotion to new posts within the college. Staff have gained prestige through being seen as leaders in the use of ICT in the college.

The high level of ICT in the ICT Test Bed curriculum areas has engaged tutors who were previously not interested in using ICT; very few remain who do not use ICT.

In all three colleges, the high levels of ICT motivated staff to spend great amounts of time over and above that which was funded by ICT Test Bed in creating and developing resources.

All colleges have a VLE and this has necessitated new ways of working as tutors had to create and prepare materials for the VLE. Many, but not all tutors involved in ICT Test Bed, were making regular use of the VLE. Tutors found the VLE beneficial as they could easily upload resources for their students. Students found it beneficial as they could access resources from outside the college and were able to use them for consolidation or revision. Some tutors expected their students to do work on the VLE between classes.

5.4.2   Impact on other roles

ICT Test Bed directly affected only three curriculum areas in each college. However, the impact of the high level of ICT has been wider than this through its impact on college infrastructure and MIS enhancements. Senior managers used the project as an opportunity to develop their e-learning aims and their e-learning strategy and enhance the learning experience for their students. The requirement to procure a large amount of hardware and software at one time placed a burden on the college finance and technical departments which they struggled to manage rapidly and effectively. This caused problems and delays in getting the equipment into the college and installed so it could start to be used.

All colleges installed new or upgraded MIS during the project. This inevitably had an impact on the role of MIS staff, who have taken on new systems and processes. Much development has taken place in creating e-portals to the MIS so that a much wider range of staff can access the data held in the system. College administrative staff roles changed significantly due to the new MIS and processes. All colleges were offering online enrolment which changed the enrolment processes; some were using e-registration which changed the way registers were used across the college.

Managers can access the system to monitor the performance of their curriculum areas. Tutors can access the system to get data about their classes or individual students. Data required by agencies such as the DfES and Learning and Skills Council (LSC) is more readily produced and available for managers and the agencies. Senior managers have made use of the improved availability of accurate and up-to-date MIS information to facilitate management of the college. Data was perceived as more accurate than previously and managers had greater confidence in the data when taking strategic decisions. Curriculum managers were faced with

what was a new requirement in some cases to interact with MIS data to facilitate management of their curriculum area. In some colleges, curriculum managers were made accountable for the performance of their area; without enhanced MIS this would not have been possible.

Managers were routinely using ICT tools in their roles; email had become the major communication tool, and some were using electronic calendars which facilitated meetings and using project management software.

Colleges realised the increased need for technicians to support the additional resources, as there were many more laptops and tablet PCs. Teachers and students needed a rapid response to problems as ICT use became more prevalent. Network technicians were required to develop wireless access and some training was necessary. Technicians also needed to be able to provide support for interactive whiteboards and a range of digital tools.

5.4.3   Impact on managing resources

Teachers were gathering materials from a wider range of sources than before and using their new skills to adapt and refine the materials to meet the needs of the course and their students. In all three colleges, ICT Test Bed teams were creating digital video resources for use in teaching and learning. The range and amount of available material in the sector made reviewing a very difficult task and a common solution was to rely on a restricted range of sources. Many tutors avoided this problem by mainly using their own materials. One college commissioned materials from commercial producers and another employed content developers to work with staff and help them improve the quality of the materials they are creating.

Colleges were using VLEs as the main repository for resources. The VLE has largely but not completely replaced internet sites that individual tutors were maintaining before the project. Most staff uploaded their materials to the VLE after the lesson. Some tutors feared that attendance would be adversely affected if students were able to get the materials without attending the class, and ensured they could control the release of information.

VLEs need management and maintenance. For some colleges, this meant new roles of VLE Manager and Administrator, for others, existing technical staff took on these roles in addition to their existing responsibilities.

The prevalent approach in the classroom was a blended learning approach where tutors were integrating the new tools, techniques and equipment with traditional tools and methods. Such an approach was recognised as an important issue by Sutherland *et al.* (2004).

A single tutor is often the only person teaching a particular course module or unit and this limits opportunities for sharing resources within the department. However, there was evidence of change permeating across teams through sharing of resources and practice, of teams working together to develop and evaluate resources or to mentor colleagues in other teams. ICT Test Bed has initiated some

sharing of materials between colleges and cluster secondary schools, mainly for GCSE and AS level. It remains to be seen if this will continue after the project.

5.4.4   Impact on the planning task of teachers

A commonly held view is that the planning and preparation time will be much reduced in subsequent years. Courses, standards and syllabi are subject to frequent change in the sector and it may be that these time savings will not be realised to the extent that staff are hoping for.

The increased openness of the planning process noted earlier means that teachers need to collaborate with colleagues and share practice to a greater extent than previously. Traditionally, the FE lecturer had a high degree of autonomy and this is a major change in practice. Evaluators found that FE tutors were positive about this change and gained in many ways from the increased collaboration. This led to enhanced learning experiences for their students through staff skills and a wider range of learning resources.

5.4.5   Impact on record keeping

Staff were also collaborating on course administration tasks; for example, tutors recorded student progress electronically on the VLE in a much more transparent process than previous paper-based systems.

ICT was being used in a number of tasks that academic staff needed to do in recording student attainment. This tended to be outside the MIS; self-created spreadsheets were commonly used.

Some tutors were creating tests within the VLE which could be automatically graded and the students' grades could be stored so the tutor could review their attainment.

5.4.6   Continuing Professional Development

In the ICT Test Bed colleges, the college CPD managers were all closely involved in professional development for staff in ICT Test Bed. A wide range of training was offered. Colleges also made use of external trainers in many areas, commonly for training in the use of the MIS but also for interactive whiteboard (IWB) training and VLE training.

The most effective methods of learning how to make use of the technology were seeing what colleagues were doing, taking part in team training sessions and practising with the equipment on their own.

> "We had a CPD session. And I thought 'Yes, this is the way forward' then tried it and it didn't work so I realised I needed a lot of practice with nobody there.
>
> I think as the staff walk past and can see me using these things, they are asking questions, 'What's that you were using, how did you run the video full screen, how did you get a video on the board?' so the interest is there.

People need to work on things before they can use them in a class. I don't think the training means much in itself; it's the taking it away and making some sort of use of it." (College lecturer)

CPD continued throughout the project as new technology tools and new staff arrived and new training approaches were introduced to better meet the needs of individual staff.

Delays in implementation of equipment that were commonly experienced in the colleges made it difficult to plan and organise training at the optimum time when staff where able to practise their new skills. This meant training had to be repeated or, more often, staff were left to learn about the tools by themselves. This can lead to the situation where the new tools are used in a limited way, and possibly in ways that are not necessarily bringing benefits to learners (a concern also highlighted by Sutherland *et al.*, 2004).

6.   Cross-institution collaboration

This aspect of the ICT Test Bed project originated from a DfES interest in the positive outcomes which could be achieved by encouraging cross-institution collaboration within sectors and across sectors. This is formally acknowledged within the e-learning strategy (DfES, 2005) which states that achieving ICT maturity can be accelerated through exchanges of good practice and that greater learner flexibility can be provided through cross-sector collaboration in relation to learning pathways.

Main findings

6.1.1   Overall Finding
- Effective cross-institution collaboration required a common purpose and leadership from the top. Plenty of time for staff to meet and establish trust needed to be built into the process, with roles and responsibilities clearly identified. This was especially important in the cross-sectoral collaboration.

6.1.2   Particular Findings
- Local support for content development will not only ensure that content development will be tailored for individual and local needs and will also provide a source of expertise enabling teaching staff to become more skilled and take ownership and control as and when appropriate. Funding and quality control procedures need to be put in place to ensure that the investment of resources is worthwhile.
- Cross-sector collaboration needs a clear purpose, needs to be managed and the roles and responsibilities need to be clearly identified. Where the collaboration is between FE colleges and schools which are under different governance, this is particularly important. Additional challenges include geographical barriers and tensions between the benefits to be gained from pooling knowledge and expertise, and the need for local control and ownership.
- Cross-institution collaboration requires plenty of time for consultation initially to establish new relationships and trust. Effective and open communication between all those concerned is a key success factor.
- The close involvement of headteachers appears to be an essential requisite for good inter-school collaboration.
- Inter-school collaboration is easier when the group itself has a clear identity, either geographically or through strong cluster arrangements, and where schools have more than one issue in common.
- The embedding of email as a central communication tool within ICT Test Bed schools and FE colleges has facilitated cross-institution collaboration. Electronic links between schools, LAs and the DfES have enabled required data to be submitted electronically reducing the burden on admin staff.

- ▪ Video-conferencing, whilst clearly beneficial in some situations and for some individuals, has not been successful overall, largely owing to technical issues but also to logistical challenges.

6.2 Conception and implementation

When ICT Test Bed began, cross-institution collaboration was necessarily lower down the list of priorities than teaching and learning, and the implementation of the infrastructure. That is, institutions naturally focused on internal developments initially although the action planning process forced some collaboration to take place in the early stages.

In addition, the FE colleges received their ICT Test Bed funding a few months after the schools and found it difficult to take procurement decisions quickly enough to meet the very tight deadlines for spending. They also had a markedly different level of involvement, being limited to three curriculum areas rather than the whole institution. Whilst managers of school and colleges may have been clear about the requirements of cross-institution collaboration, those at the chalk face were thrown in at the deep end without time to plan thoroughly, without clear guidance on roles and responsibilities and without clarity about ownership.

6.3 Cross-institution collaboration

Cross-institution collaboration has been instigated at many different levels throughout the project. For example, from senior managers working closely together during the initial procurement and implementation phases, to teachers sharing good practice and celebrating successes with families and the wider community. However, in the early stages of ICT Test Bed, collaboration was formalised and often directed by the LA, whereas in later stages in many cases it became much more informal. In a bid to develop stronger collaborative links all three of the clusters organised collaborative groups with particular curricula foci (such as literacy co-ordinators or staff in humanities). However, the success of these groups in terms of outcomes (resource development, for example) varied widely although some strong one-to-one partnerships were established. In one cluster, geographically clearly delineated, already strong links where re-enforced through ICT Test Bed. The significant feature was the close involvement of the headteachers in the project which gave institutional imperative to collaboration, further strengthened by their joint involvement in a large Comenius international project. The sense of identity was a strong support to the ICT Test Bed co-ordinators in sharing CPD and expertise through the cluster.

6.4 Infrastructure

Email, video conferencing and other communication tools (discussion boards and instant messaging, for example) have all facilitated cross-institution collaboration although to differing extents. This has improved over the lifetime of the project as such tools have become reliable and embedded in day-to-day practices. Collaboration or professional networking requires face-to-face contact for maximum impact (for example, establishing trust) but electronic communication is beginning to play an important role through establishing valuable links (Carmichael *et al.*, 2006). It

has potential for supporting the transfer of practice but with limitations (Fielding *et al.*, 2005) such as additional demands on time and the need for specific ICT skills (Carmichael and Proctor, 2006). Therefore whilst the use of technology to support collaboration has great potential in reality, currently, its use is supplementary rather than transformational (Carmichael and Proctor, 2006). Where networks have been established between teachers who share a common purpose such as that of locating and sharing teaching resources, email has been an effective form of communication (Grünberg and Armellini, 2004).

Video conferencing has not been commonplace in ICT Test Bed schools. There has still been relatively little research on its use in schools generally. This technology has been available for over 15 years but video conferencing via telephone lines was costly and slow; this has inhibited its use within schools (Abbott *et al.*, 2005; Martin, 2005). Broadband and the growing use of IP telephony means that video conferencing is much cheaper, of better quality and more robust. However, there has been little teacher support and training, and therefore teachers are unaware of its pedagogical potential (Abbott *et al.*, 2005; Martin, 2005). Where it has been successful in the classroom (the Dissolving Boundaries initiative in Northern Ireland, for example (Austin et *al.*, 2004)), teachers have been supported and the use has been purposeful. Research on its use to support student teachers has also been positive (see for example Kinnear *et al.*, 2002).

Many of the issues raised in literature on schools use of video conferencing have been replicated within ICT Test Bed schools. Video conferencing was not generally developed in the first two years of ICT Test Bed because of innovation overload and prioritising of other areas. In the latter stages of the project more schools have attempted to explore its potential but with little success. In one cluster for example, technical problems have prevented schools from contacting anyone outside the LA for the duration of the project, causing a great deal of frustration for many staff and pupils. This has substantially inhibited the development of video conferencing. Part of the problem has been attributed to linking equipment from two different providers (broadband and video conferencing) and a lack of support and training. Any use that has occurred has not been typical or regular. Where regular use has been established the potential of such technology has been illustrated well for example in relation to communication skills and self-confidence (in common with the findings of the Dissolving Boundaries project, Austin *et al.*, 2004). However, evidence suggests that effective use requires careful planning, including procedures for familiarisation, technical support in both locations, small groups, strict communication protocols, and additional staff making it resource intensive. This together with other logistical issues such as timetabling (also highlighted by Austin *et al.*, 2004), the need for dedicated space, and accessing the equipment is likely to inhibit future use. It has been beneficial for linking up technical support staff and ICT Test Bed project staff. One action researcher noted that an unexpected outcome of collaborating with a teacher at another institution via videoconferencing had been to gain insights into another teacher's practices which in turn informed her own approaches. Another benefit was providing access to expertise not available in the local institution.

"We actually do [video conferencing] at the moment with nursery at the local CLC. […] Basically we just chose a group of children from each nursery and we go [to the video-conferencing suite] every week and do whatever the children decide to do. We don't plan the activities. The first one we did was literally a meet and greet, saying hello, getting used to, having a dance in front of the screen so they could get used to seeing themselves then at the end of that session we asked the children maybe what they'd like to show from our nursery to the other nursery the next week. Basically we let the children lead it at the end of each session, what they want to do the next session. As you know in early years, everything's got to be child-initiated now and it's just a good way of doing it. It's worked wonders for their communication skills. They were all initially quite shy and they didn't quite get what was going on but now the language that we're getting out of them. It's as though [the children from the other nursery are] on a table next to them. They're getting up and talking saying, 'Oh look at that, what so and so's doing'. It's like everyone's in the same room really. We've done stories where I've done a story and asked them to do an activity and we've both done an activity and shared all the work at the end. We've done construction, we've done painting, we've done drawing, we did food tasting, we've done songs. It's been brilliant.[…] But it does work better with smaller groups because you get more communication going. […] It's crossed over the personal, social and emotional side of it because they're having opportunities to have links with new children and it's also the communication, language and literacy side of it as well. […] And it's the concept that the microphone is on the floor and they're not sitting right on top of it so they realise that they have to slow down a little bit and speak up and think about what they're going to say. So it's helped them organise their thoughts and conversations I suppose really." (Action Research Report)

6.5   Cross-sector collaboration

Facilitating greater learner flexibility through multiple learning pathways (opting to take some course within the main institution but others elsewhere) is commendable but not without its challenges in relation to differences in institutional cultures such as timetabling restrictions, geographical constraints, and competition with regards to funding. There was limited evidence as to the extent to which ICT Test Bed funding enabled schools and FE colleges to develop this provision beyond that which was already in place prior to ICT Test Bed.

Links between the FE colleges and other institutions in the project were established with differing degrees of success according to individual drivers and visions. However, as schools and FE colleges are under different governance, without funding from similar initiatives it is unlikely that such links will continue. For example, the two FE-hosted projects in one cluster provided opportunities for secondary school staff to develop new skills but this has resulted in similar projects being initiated within the schools themselves rather than sustaining the initial collaboration. Clearly, local ownership and control is a big factor. In another cluster the FE college ran parent courses in the schools, but after the initial wave of involved parents it became less economic to duplicate these courses.

The provision of content development teams in two clusters (one hosted within the FE and the other within a secondary school) has not only provided teachers with a means of developing multimedia and interactive resources to meet their personal requirements, but also provided easy access to technical expertise. Some schools and 'enthusiastic' individuals have made the most of this facility generating a wide range of valuable and personalised classroom resources (that is, with the school logo). The provision of templates allows such resources to be customised further and reused. However, in some cases resources have not been used very extensively yet the process is demanding in terms of staff time. Additionally it has been difficult to encourage staff to work collaboratively with content development teams, even with a financial incentive which was offered in one cluster. This is likely to be due to lack of time but also to logistical constraints such as arranging face-to-face meetings between staff from different institutions and larger institutions (secondary schools particularly) being less ready to change. It should also be noted that as ICT Test Bed funding has now ceased, content development will incur costs for schools and when compared to commercially available products this may prevent schools from using this facility in the future.

> One primary school has made extensive use of the content development team in the cluster. The team has provided initial guidance, templates and training in web development software. This enabled the ICT Co-ordinator to develop a professional-looking online resource management system within the intranet, obviating the need purchase a proprietary learning platform. In addition, the ICT Co-ordinator has been able to take ownership of the school's website, originally created by web designers at the local secondary school. This has meant that resources can be uploaded and the site can be updated as and when necessary.

6.6   Links across school sectors

Where they have been initiated (in order to meet the project aims) links across school sectors have required substantial investment in terms of time. Bringing together staff from different school sectors with different agendas requires sensitivity and good communication.

In one cluster a cross-institution collaborative project was initiated between a secondary school and an infant school. Year 8 pupils from the secondary school visited the infant school weekly for one morning and provide supported (with guidance from classroom teachers) to Year 1 pupils on ICT activities. It was perceived as easy to organise from the secondary school staff perspective. Infant children benefited from one-to-one support on ICT activities, additional development of social skills, and improved numeracy/literacy skills. Year 8 pupils benefited from increased self-esteem and confidence, literacy and numeracy skills, development of social skills, and a sense of responsibility. Enthusiastic guidance and organisation from the project initiator was a key success factor but this means that it is harder to reproduce elsewhere. The relationships developed were strong but both sides felt that communication could have been better. In another cluster transition was eased

through the use of a 'buddy' email system enabling Year 7 students to encourage 'soon to move' Year 6 pupils.

6.7   Links beyond the cluster

Electronic links between the school and the Local Authority are now well-established in all ICT Test Bed primary schools. Data required by the LA or the DfES are routinely submitted electronically and this has been made much easier with the implementation of MIS, reducing the burden substantially on admin staff.

ICT Test Bed schools have worked closely with commercial providers to develop products such as learning platforms in all three clusters. This has enabled commercial providers to ensure that products are suitable for new markets such as primary schools, and tried and tested by practitioners. It has also raised morale of staff within Test Bed schools and ensured that products have provided the required functionality.

6.8   An illustrative case study: The digital imaging for creative industries project

School staff in consultation with college staff identified a need to provide pupils with experience of Apple Macintosh computers, professional standard digital cameras and Photoshop (industry standard equipment and software) through whole-class teaching in order to strengthen vocational elements and opportunities to develop industrial awareness. The project was developed to create a module appropriate for delivery in post-16 art or photography qualifications. It was hoped that it would embed technology into these courses and develop links between the two sectors. In addition college staff hoped that it might attract school students to higher education level photography courses. The project was designed to be implemented by school staff in their own classrooms, rather than college staff taking responsibility for delivery of the course either in the schools or in the college itself. However, the project design included an opportunity for school staff to arrange for their students to visit the college to use the professional photography studio and large format printer. The project raised a number of challenges.

6.8.1   Developing new relationships

Collaboration involved developing new relationships between staff from different (and competing) institutions; establishing ownership (of the project) and identifying roles and responsibilities. Due to the complexity of the project and the initiation of new ways of working together, both college staff and school staff found the initial meetings to be challenging. Not all active members of the group were involved from the very beginning owing to tight deadlines for producing the action plan and also to staff turnover. There was a perceived lack of structure and clarity in relation to roles and responsibilities. College staff (not unreasonably) expected school staff to drive the project or someone with an overview, whilst school staff (not unreasonably) perceived that the project was managed by college staff because they were providing access to equipment and facilities. LEA Test Bed staff (not unreasonably) felt that they were not the right people to drive the project, having little expertise in art. Ownership of the project was not really established until mid-way through the implementation. Eventually, without a formal directive, the staff at the college

adopted the role of leading the project (although they would have preferred to work more collaboratively and indeed expected to) and welcomed the presence of external group members who were seen to be very important.

Establishing relationships was difficult for all involved but eventually mutual trust was developed, as was a shared understanding of how the project would be implemented and how each of the partners could and would benefit. Scheduling meetings involving so many busy people located apart from each other was a further challenge. Lack of support from senior management in one school meant that it was difficult for the teacher concerned to obtain cover for lessons to attend meetings and training. Another teacher explained that reluctance to participate in meetings was partly due to meeting the needs of exam classes, which understandably was prioritised. Whilst earlier meetings were held at the college, subsequent meetings were hosted by schools which helped to cement the developing relationships and was welcomed by all members of the group. One of the secondary schools did not participate to the same extent as the other two schools. This was partly because of staff movement. But more importantly, with an established Photography department, the school already had a level of expertise including staff and pupil familiarity with Photoshop, and a makeshift studio area that was used to take the portraits, thus reducing the need for access to specialist facilities and technical support. The teacher at this school commented that he would have used the college facilities if it had been closer. College staff appreciated the autonomy of staff at this school but did feel less informed about progress of the project implementation within the school and perceived a need to become more involved but perhaps in different ways. However, at the end of the first year everyone involved agreed that strong and positive new relationships had been developed, as had new ways of working together.

6.8.2   Differences in ICT expertise.

In one school, lack of prior experience of Photoshop (both students and staff) proved to be an additional challenge. Staff at the college provided welcome technical support through the staff and student workshops, a 'user manual' and site visits. This was acknowledged as being very helpful and professional, but time constraints did not allow for first-time users (staff and students) to develop a good grasp of how to use Photoshop. This meant that students spent a disproportionate amount of time trying to work out how to achieve particular affects or solve technical problems, because they did not have time to develop an appropriate level of expertise in Photoshop. The teacher concerned commented that there was "no scope for discussion about the artistic qualities of the work they were doing because they were up against technical problems that neither they nor I could solve." This created an additional strain on the pressure of covering all that was required for the A/S module. There were issues relating to finding mutually convenient times for the technician from the college to visit the schools, matching availability to lesson times for example. Students referred to a need for more extensive training or greater levels of support. They were, however, happy to learn through experimentation and offered support to each other and the teacher concerned. The teacher concerned felt that this had shifted her role in the classroom as she was no longer the expert but learning how to use Photoshop alongside her students. However, she was not

comfortable with the feeling that she was 'deskilled' or not equipped to support her students in the way that she wanted to.

6.8.3   Logistical issues relating to managing the equipment.

Equipment was not always returned to the college in the required timescale which was frustrating for all concerned. College staff wanted to ensure that all schools had fair access to the equipment and that the equipment was available for their own students to use. School staff found the three-week period to be constraining when it always seemed to be raining or the class was timetabled in the late afternoon when it became too dark to take photographs outside. In addition, school staff had to stop what they were doing to make the most of the equipment, interrupting other units of work. The key message from school staff was that more flexibility was desirable. The equipment provided by the college was very expensive and so school staff were asked to follow strict guidelines concerning, for example, insurance and how the cameras could be used. This meant that students were only able to use the cameras when supervised and largely used them in the school grounds rather than taking them off site. This limited creativity and choice. In some cases, students used their own digital cameras to take photographs at the weekend but the quality of the images was not satisfactory and so they only used the images taken with the professional standard equipment for their final pieces.

6.8.4   Other logistical issues.

Due to the distances between the schools and the college it was not possible to undertake a visit in a single lesson. School staff were asked to accompany their students on any visits to the college which meant they had to find the time when they could be out of school for a day or a morning as well as the students. In addition, there were issues about arranging for students to be off timetable in relation to time to study their other subjects. In one school for example, sixth-form students were only allowed to be off timetable once per half-term in order not to affect other subjects being studied. Transport and timetabling would be a big issue if students lower down the school were to become involved in the future. Furthermore, this extension to the project would require even more sensitivity to the fact that sixth forms and the colleges would be in competition for the same students and this could have an impact on the relationships that have already been formed. Security and management of expensive equipment could potentially be more of an issue with younger students.

6.8.5   A victim of its success.

The digital imaging project served as a true Test Bed initiative, enabling the FE college to provide training and expertise in digital technologies for staff within the schools. However, an outcome of this was that the school staff were able to explore what was possible in relation to Art and Photography courses, and became more confident and less reliant on the support of college staff. In terms of sustainability the FE college will only be able to offer this service in the future if a cost-recovery model is employed and this, combined with other constraints such as geographical location and timetabling issues, is likely to act as a deterrent to the continuation of the project.

6.9   Sustainability

Collaboration between the schools and the FE college has diminished with the end of the ICT Test Bed project in two of the clusters. As a representative from one of the LAs noted, collaboration has to be purposeful and where it has been in Test Bed it is more likely to be sustained. Staff at the FE college in one cluster anticipate continued collaboration with schools through specialist training provision and joint approach (with the LA) to technical support. The difference between schools and FE colleges in relation to the importance of the project (whole-school change versus three FE course areas) has inhibited collaborative developments. National and local Government policy may enable more collaborative enterprises in the future in relation to curriculum provision (see for example DfES, 2005).

Collaboration between schools in two clusters occurred prior to ICT Test Bed and is likely to continue to take place within other initiatives. This is due to long-established relationships and a strong sense of local identity (although there has been much staff movement) rather than to ICT. However, ICT infrastructure has supported electronic communication which has grown over the lifetime of the project.

The two content development teams will be sustained beyond ICT Test Bed subject to successful revenue generation. Both groups have developed substantial expertise in content generation and can also offer training in specific techniques and products.

7. The impact of high levels of ICT on home–community links

This is the area of ICT Test Bed project work where progress has been slowest. In part this reflects the complexities of putting home–school electronic links into place and in part the schools' natural inclination to focus energy initially on the embedding of ICT within all aspects of their own internal work, as with cross-institution collaboration.

The ICT Test Bed project set out to overcome disadvantage for children in areas of socio-economic deprivation. Prior to its launch there had been considerable interest among policy makers in the possibility of overcoming social disadvantage by placing computers and appropriate electronic resources in students' homes (Hallgarten, 2000; DfES, 2002). The home–school links aspect of the project's work, therefore, had this as one of its aims. More recently, this aspect has been promoted further through the Computers for Pupils Initiative (Teachernet, 2006).

After reviewing progress across all the ICT Test Bed clusters the chapter draws heavily from a report conducted in the final year of the project on the implementation of learning platform(s) in one of the clusters.

Main findings

7.1.1 Overall findings

Loaning ICT equipment to learners helped to bridge the digital divide. The majority of students now have access to computers at home.
- ICT made it much easier to share assessment information with parents via school websites or learning platforms.
- Schools slowly increased their use of email, and in some cases text messages, to communicate with parents, enabling them to respond to parental enquiries more rapidly. However, establishing a two-way dialogue with parents was more challenging.
- Increasing home access to ICT and the internet was operationally difficult for schools. It was very time consuming and required careful planning.

7.1.2 General findings
- Successful home–community links projects require additional resources including managers and champions. This requires rewards and/or release time or additional appointments.
- Procurement and roll-out of home computers is very time-consuming and requires careful planning. The costs for schools of licences for software to use on home computers are unacceptably high. Providing connectivity in homes is wrought with problems. Providing technical support in the home is not sustainable.

- Loans of equipment for use at home can increase ICT skills for both pupils and parents. Schools were pleasantly surprised that on the whole fears about security and losing equipment were largely unfounded.
- Short-term laptop loans bring parents into primary schools. However, it is difficult to sustain parental commitment to this type of scheme over extended periods.
- A digital divide of some form is likely to always exist and schools need to address this.
- Home–community links projects can strengthen informal contacts, encourage parents back into education, and strengthen links with employers.
- Providing home computers, laptop loans and connectivity will not in itself inspire parents to support their children's learning in the home. Parental scepticism needs to be overcome through education and clear communication.
- Communication between home and school will remain paper based for the foreseeable future.
- ICT Test Bed primary schools have developed very successful interactive websites with a rich supply of curriculum information for parents. Even where schools establish a learning platform, a website is needed for wider community access

7.1.3   *Learning platform innovations*

- Where the learning platform is beginning to be embedded, changes are being driven by enthusiastic staff with strong and effective leadership.
- The provision of a content development team ensured that a strong support structure was in place.
- Most staff (including support and admin) used the learning platform at least for email and for storage of and access to some documentation and resources.
- Benefits included sharing ideas, better communication, more flexibility in working practices, and access to up-to-date information.
- There was some evidence of exemplary use at both primary and secondary level by hard-working enthusiasts who could see the potential benefits of a learning platform.
- Pupils at the secondary school were able to use email regularly to submit work.
- Pupil use in most primary schools was limited to classes led by teachers who were enthusiastic.
- The learning platform was used to provide general information for parents together with access to resources to support continuing education. Access to attendance, achievement and behaviour data was enabled in the secondary school and had increased parental usage.

Developments in home–community links

At the outset of the ICT Test Bed project, in the autumn of 2002, two of the three clusters aimed to establish electronic links between schools and students' homes, and make both information and learning resources accessible by parents and students from homes. The third cluster, perhaps because of the poor infrastructure available in a rural area, decided to adopt a more piecemeal approach to using ICT for home-school links, including for example purchasing laptops to be loaned to children to take home. However, this cluster did operate a scheme to provide reconditioned computers to pupils at the secondary school, managed by the FE college. At the end of six months, one of the clusters had established that the cost of placing computers in all students' homes would be well beyond their budget. This cluster had three secondary schools and it was a useful lesson that costs of placing computers in homes are related to school size. However, one of these secondary schools and its associated junior and infant school did collaborate and roll out computers into homes, although without financing connectivity. Since then, over fours ago, the availability of computers in homes has moved on a pace and recent evidence suggest that over 90 per cent of homes in the ICT Test Bed clusters now have some access to computing at home, which leaves those without access more disadvantaged. There was also some evidence of learners using the library resources, both school and public, to support their learning.

The procurement process and the technical issues that needed to be resolved delayed the roll-out of computers into homes in two clusters. Whereas schools which did not engage in this process were able to implement projects and initiatives, such as laptop loan schemes and community resources, much sooner in many cases.

ICT Test Bed primary schools already have well developed communication strategies with their parents which may reduce the perceived need for the new system. Several ICT Test Bed primary schools developed the use of classroom and/or school-wide servers and procedures for storing files and electronic resources. This provided staff and students with some of the same facilities as a commercial

learning platform at a much lower cost, although home access was not always facilitated. In one cluster, however, a working learning platform was established towards the end of the ICT Test Bed initiative and this provided the opportunity for widespread community access. This development is described below, but a more detailed description will be found in the ICT Test Bed Evaluation report on the learning platform on the Becta Evaluation website[8].   In some cases resources were made available for home access by pupils and parents via the school website. In another case, parents had access to the school intranet but only if they used the community facilities within the school.

However, as communications and initiatives for parents became increasingly easier to implement electronically, it became more apparent that there was a tension in primary schools between this and a strong desire to encourage parents to come into school. One of the initiatives that alleviated this tension were the laptop loan schemes in primary schools as they necessarily required parents to visit the school. In at least four primary schools, courses for families were run successfully on school premises, often staffed by the FE college within the cluster, and some schools established dedicated community workshop facilities.

7.2.1   Websites

Several different models were explored. One primary school, for example, outsourced the development of the school website to a professional company. Once the structure was in place staff were easily able to maintain it. In another example a member of the technical support staff at the secondary school developed websites for two of the local primary schools as well as the secondary school itself. This led to a consistent feel for families whose children might progress from the primary to the secondary school. However, staff at one of the primary schools felt that the website was not easy to maintain and that control was limited. Without a sense of ownership and with difficulties contacting the web designer at the secondary school this model did not work. The solution was to redesign the website again (using the existing

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[8] ICT Test Bed: A Case Study of the Learning Platform(s) in One Cluster on www.evaluation.icttestbed.org.uk.

content as the basis), drawing on technical expertise from the cluster content development workshop who provided training in web development software and developed templates for school staff to update the site more easily.

> School A, an infant school, has an extensive website designed to support existing parents and prospective parents. The site is well designed and effectively provides a wealth of useful information within a simple and manageable structure. It is easy to navigate and uncluttered. Digital photographs provide a means of quickly showcasing and recording key events. Parents can access static information such as the school prospectus and school uniform guide, as well as policy documents relating to home/school and internet use, for example. They can also access information that is updated termly or annually such as lunch menus, important dates and after-school clubs. Finally, parents can access a summary of their child's lessons which is updated weekly. This presents information on each subject and identifies how parents can help their child at home, identifying weekly spellings for example. This information is updated weekly and systematically by two teaching assistants. In addition, the monthly newsletter is made available and presentations from information evenings, on for example how to learn to read, can be downloaded. The website is up –to date and this can be attributed to the systematic approach and clearly delineated responsibilities for updating areas. In addition the requirements for updating the site are manageable. One issue still to be addressed is that parental interest as manifested in attendance at the launch event for example has been limited. However, the school continues to publicise the site at every opportunity such as in the paper version of the monthly newsletter.

The factors contributing to success of school websites are support of senior managers, clearly delineated responsibilities, ownership (the ability to maintain it locally although the initial design could be outsourced), and making it purposeful yet keeping it simple (in relation to content and structure). There is no doubt that the quality of the websites and the range of support resources from parents contained within them has improved considerably, in part because the technology to maintain them has become simpler and easier to operate.

It is notable that the websites of the schools in the cluster which have focused resources and efforts to date into developing a learning platform were either not yet in place or not extensively developed. Whilst parents in this cluster arguably could access such information within the learning platform, as this is a closed and secure environment it means that the limited public web presence suggests 'e-immaturity' when this is actually not the case. As a school website might well be one of the first ports of call for potential new parents, and also as the information is likely to have been formatted for online presentation within the learning platform, it should be a simple matter to address this. On the other hand this could lead to duplication of effort. This suggests that public areas of school websites should be fully integrated with learning platforms to maximise reach and efficiency, and ensure that information is presented consistently.

7.2.2   Communication

Some, but not all, primary schools had begun to communicate with and/or receive communications from parents using email. For example, one infant school regularly sent its newsletter via email. In another school, parents were encouraged to notify absences via email. In contrast, in another school email use with parents was a concern. Parents who contacted the school via email were responded to in writing.

The beneficial aspects that were noted were the immediacy of dealing with problems and the ease with which the record of the query (including the date and time) was kept. There were issues, however, such as overload (in a separate communication one parent was emailing a headteacher daily) and there were also clearly issues about just who had sent an email or text (the pupil or some other parent creating problems?) and just who should reply. If emails came into the school, deciding whether the teacher or the head should deal with them was not always straightforward and confidentiality could be an issue. Email can also be a means of avoiding face-to-face contact; it is often easier to be critical when not present. There is also the well known problem of the poor or ambiguous language which emails (and texts) encourage which might cause unnecessary problems and which raises the issue of monitoring such 'official' communications. Clearly there needs to be established some protocols for writing and dealing with emails between parents and the school. One head did question the issue of communication through text messaging; texting is by its nature ephemeral, and most official school communications are anything but ephemeral and need careful recording and monitoring which is not easily managed by text messaging.

In addition, school websites were used to disseminate information such as newsletters, other letters, calendars and notification of events. In many cases these were archived and available to download.

In one secondary school parents have the email addresses for heads of year and so can email regarding any issues, at a time convenient to themselves, rather than trying to contact the staff via the telephone.

Parents in three of the five secondary schools can access the MIS and obtain information about their child's attendance, achievement and behaviour. In the cluster that had implemented a learning platform, when parents were given access to this information, statistics from web usage suggested an increase in activity. In another secondary school hard copy reports have been replaced by online access via the MIS except where parents do not have online access.

> "When we issued the first lot to Year 7, we did hard copies for the parents who didn't have access and we gave the other ones their password and then the kids were coming back the next day and saying 'Oh yeah, my mum went round my Nan's' or 'she realised she could do it at work.'."

7.2.3 Supporting learning in the home

Support for learning in the home has been achieved through short- and long-term equipment loans. This includes the home computers provided in two clusters and laptops provided in the primary schools, some of which have had internet access disabled in order to deal with some of the security issues. The laptops did, however, have useful resource programs loaded and this avoided some of the licensing problems found by other schemes. Other equipment such as digital cameras has also been taken home. Some primary teachers have given children technologies such as talking books and digital cameras to take home to collect images and make tape-recordings, and report that this has a very beneficial impact on increased parental participation in their children's learning.

> In one secondary school a laptop loan scheme was operated for selected groups of students, who received the laptop for a six-week period. The year head commented, "So for instance with my Year 11s, they had a laptop for home use whilst they were putting together their coursework and I had parents in and met with them. […] The students managed their deadlines much more carefully and parents were actually involved as well. So when there was an issue with a deadline, with a piece of work, I would contact the parents to see what was happening." However, with a change in staff this initiative was not sustained and the laptops were distributed across the school.

In one cluster the roll-out of computers into homes was well organised and efficient and initially created considerable excitement from children and goodwill from parents. The roll-out of connectivity however, despite similar levels of planning, proved to be very challenging and there was some considerable delay. Considerable resources of time and money have also been put into the development of a learning platform to be accessible from both schools and homes in this cluster (described below). Substantial progress has been made in challenging circumstances and much has been learnt.

However, there is limited evidence of how some of the equipment is being used to support learning, particularly in relation to long-term loans of PCs. Furthermore, in the cluster that provided connectivity to homes that needed it, for a variety of reasons beyond the control of individuals involved, 100 per cent coverage was never achieved. Barriers to take-up of both equipment and connectivity include concerns about safety, concerns about being monitored in the home, and technical issues relating to telephone lines and the growing use of mobile phones rather than land lines.

There is evidence that, despite considerable expenditure on placing computers in homes in two of the clusters and a high level of motivation on the part of many teachers and school leaders, interactive links between home and school have not been achieved. The vision is a good one which clearly has the potential to provide students in areas of socio-economic disadvantage with a powerful educational resource but it seems likely that the lesson learnt from ICT Test Bed project is that another way needs to be found to put this into place. On the one hand the development of the learning platform, particularly in primary schools, is not yet fully

embedded and on the other hand connectivity is not sustainable and financial support for this will be withdrawn in July 2007.

In one cluster some technical problems relating to home computers were dealt with by school technical staff rather than directing parents to the dedicated full-time technician at the secondary school, and this was not seen to be onerous. The maintenance costs of the reconditioned computers initiative in one cluster secondary school were high, however. It has required the service of one full-time technician who has spent most of the time visiting homes and providing some support for the community learning centres.

All but one or two of the learners in a sample interviewed in 2005 had their own computers at home, and this has been supported by the quantitative evaluation. These had generally been bought by the children's parents. In one cluster there was still some enthusiasm for taking home laptops from school, even though they were internet-disabled because teachers were anxious both about the importing of viruses and their responsibility for the dangers of pupils getting onto undesirable websites whilst at home.

There are early signs of a shift from teachers avoiding homework reliant on ICT because of concerns about digital divide issues to assuming that pupils will have some form of access whether at home or at school. This was particularly noticeable in a cluster that was beginning to embed a learning platform across all schools (although to differing extents). In a survey at the end of ICT Test Bed ICT[9], 35 per cent of students reported regularly submitting some homework electronically with a further 26 per cent doing so occasionally. However, 38 per cent of students stated that they never handed in their homework electronically. Differences between the age phases were noted, with 65 per cent of primary pupils stating they never or rarely submitted work electronically, in comparison to 40 per cent of secondary pupils.

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[9] ICT Test Bed: Additional Questionnaire Data, Summary of Findings

In one cluster, some online homework was being provided to primary pupils through a learning platform but on an ad hoc basis and by teachers who were enthusiastic users of the technology. In another cluster, all but one of the primary schools were providing homework and activities to support literacy and numeracy for use at home via the school website. This varied from all weekly lists of spellings and maths homework sheets based on the LA maths scheme, to weekly planning with guidance for parents on how to support their children at home. Similarly, many of the primary school websites contained basic guidance on how to support literacy and numeracy development. Moving electronic work between school and home did not seem to be a major concern for many primary schools although one or two schools had installed software to facilitate pupil access to school intranet files from home.

> In interviews in one cluster, secondary students said they were pleased to have received a home ICT Test Bed computer but were frustrated that connectivity had been so heavily delayed, with the consequence that those without a home ISP were unable to link it up with the school.

> Disparities in internet access were evident across the secondary groups in one cluster. One student commented, "I have one of my own and the school's, and when I want to go on the internet I use my Dad's and every time I just want to do work, I use my own." Another uses the internet to revise with Bitesize. The students also saw a potential benefit of connectivity as being able to access web information for research in subjects across the curriculum, and that this was "really boring before" (i.e. when it had to be done with books).

All five of the secondary schools provided access to school resources from home for staff and pupils, four via software facilitating external access to the intranet and one via a learning platform. There was some use of pen drives to transfer work between school and home. In some cases, MP3 players have been used for the same purpose.

7.2.4 Parental involvement

A wide variety of initiatives were developed by ICT Test Bed schools to improve parental involvement.

In primary schools, laptop and other equipment loans has necessarily brought parents into school, including those who were previously difficult to reach. However, it should be noted that in longstanding programmes of this nature it was not easy to sustain this commitment from parents. Similarly in the secondary schools which provided home computers were able to insist that parents attended information events and attended training. The need to seek technical support also offered another lever bringing parents into school. However, staff at many schools that offered training and accredited courses were disappointed by attendance levels. There is a social message in that parents of younger children were more likely to participate, partly because they are on the whole younger parents and less likely to be seeking employment and partly because of the greater involvement of parents of younger children in the schools.   Parents who did attend courses were perceived to

have benefited in many ways including improved ICT skills, increased confidence and a greater awareness of how they could support their children's learning. In the areas of social deprivation that these areas serve, purchasing a computer for home use was not always high on the family's lists of priorities. Providing a computer for homes could enable families to "tap into resources they couldn't before".

> "We are actually seeing a positive affect. Parents are coming in wanting to know more about the school, wanting to know about homework, wanting to know what is available and wanting to come in for drop-in courses.   We [did not have] a big uptake but we are getting a steady flow of parents coming through and want[ing] to learn about […] the computer and beginning to realise they need to upskill themselves."

These projects have required additional staffing to ensure success and this was provided through rewards, release time, and new appointments.

Disseminating information about homework and how to support students' learning generally clearly has potential but there is little evidence on the extent to which this information is being utilised.

7.3.5   Support for community learning

This has been offered in a variety of ways across the three clusters. In all clusters, some ICT resources were provided within existing community spaces. In some schools provision was made for parents and the community to use resources on site, either in purpose-built accommodation or by adapting accommodation within the school or enabling the community to use ICT suites at particular times of the day. In some cases, extended opening hours were offered. Schools in all three clusters brought together a variety of services and adult education programmes to support families, in some cases terming the facility 'a community hub.' These offered information, support and training, and a place to meet other families and network.

> 'We have made it our aim to create a training environment for supporting parents/grandparents in using ICT to develop their child's learning. We regularly write to parents/grandparents offering a variety of different courses that are run from our Community Hub.
>
> We try to match the needs of our parents/grandparents by asking for feedback and suggestions. The majority of the courses that are run from our Hub involve parents/grandparents working with their child/grandchild. If your child goes to [our primary school] please feel free to come and visit us in our Community Hub and enrol on one of the following courses (you will receive a letter nearer to the dates) that are regularly run here; 'Learning Spanish with your Child', 'Family Fun with Computers', 'Parents Online Week' and 'Grandparents Online Week'
>
> We will be offering families the opportunity to take a laptop home for a week and use it together. We are regularly updating them with new educational software.

> When we carried out the pilot loans last year we found that the children enjoyed being able to use software that was familiar to them.' (Primary school website)

In two clusters the FE colleges contributed to the provision of adult education courses for parents and families, in some cases tailoring the courses to meet specific community needs. In one case, the FE college provided many educational programmes for families and the community, either run from community rooms attached to the schools or the college itself. Some courses targeted skills that would have broad appeal, such as operating digital cameras, and were informal, flexible, short and involved small groups. This was perceived to be one of the reasons for success as many students progressed onto accredited courses once they had gained confidence. Parents returning to formal education is likely to be of benefit to children.

> In one LA it was perceived that the alignment of relevant LA support teams, for example local learning partnership and adult education services, was a success factor. It was also noted that schools, particularly primaries, made the most of opportunities for developing awareness of and facilitating access to community learning. For example, one school used 'help your children with maths' sessions to engage parents and bring them into school so that they could see what the children were doing with ICT. Adult learning opportunities were then signposted and made available.

In the third cluster, alternative arrangements were made with other providers which meant that the FE college in this cluster did not benefit from this specific source of ICT Test Bed funding. Many schools reported over the duration of ICT Test Bed that take-up of family learning opportunities was limited.

7.2.6   Further education colleges and home–community links

External ICT linkage is strongest in the three FE colleges which have traditionally worked closely with the community through work placements of their students. They all have websites that provide information about the college, its courses and activities; and they all have the facilities for students to access the learning platform from outside the college and download resources. Evidence from learning platform logs, and interviews with system administrators and staff showed that by the autumn of 2005 there was regular use of the learning platform in more than half of the ICT Test Bed curriculum areas and it was well integrated into the course structure/materials. Students interviewed in summer 2005 were able to talk in detail about how they used the particular system in their college. However, students' use of the learning platform from home is less frequent than their use in college. Colleges see establishing links with parents as irrelevant to their business as their students are in the post-compulsory sector.

In interviews, increasing numbers of students said they were using their home computers to access learning materials from the college using the learning platform or websites created by their tutors.

> "Having stuff on the learning platform is helpful. We can revise for tests. If we miss a class we can get the notes easily. There are videos of class demonstrations."

Some tutors have created assessments for the students to do on the learning platform. Students said they liked these as it helped them revise by giving them an idea of how much they knew and what they still had to learn.

In interviews it was clear that the ability to access materials from outside college has helped specific groups of students such as NVQ plumbing students who are mainly self-employed and sometimes cannot get into college if they have a job to do. Another student had a long stay in hospital but was able to continue with her course by accessing the course materials from the hospital.

To realise these gains, learners are not only being expected to learn new ICT skills but are being asked to work in different ways. Many students have a traditional view of education and may find it difficult to interact effectively with resources within a learning platform, for example. However, in general, students are appreciative of being able to access their course materials online. They now have the opportunity to take more responsibility for their own learning and even to take control of the learning. On the other hand, a learning platform can be merely a way of presenting documents; the tutor controls what is there and when the learners can access it. Learners then have little or no additional responsibility for their learning and may even have less independence than with traditional methods.

A very small minority expressed a general reluctance to use ICT and these tended to be more mature students, female students and students for whom English is not their mother tongue. More mature learners have generally used ICT less than younger learners, and language problems can make using ICT more difficult for some learners.

Use of learning platforms has continued to develop during the last year of ICT Test Bed. Some tutors have been making increasing use of the facilities in the learning platform which can be accessed from home, and set homework requiring its use, printing out copies of it for those who do not have access at home. Others still have concerns relating to the digital divide. The FE college in one cluster had developed a learning platform for its students including auto-marked assignments. However, as the selected learning platform solution did not have email facilities, one tutor noted that there were no opportunities for communication via this route. It was perceived as being beneficial for students who had missed classes as they were able to access the teaching materials retrospectively. Some students had accessed the learning platform from home and 'fast-tracked' through the course. Some students are submitting work electronically and there has been some development of digital portfolios. In this college students can also access the intranet from outside the campus which, for example, facilitates communication with students in outreach centres.

Email between tutors and students is used more routinely and a wireless network at one FE college has enabled students to bring in their own laptops from home and access the internet and their online folders whilst on campus.

7.3   Establishing a learning platform

The development of the learning platform in one of the ICT Test Bed clusters has been trailblazing, which has meant that there have been many challenges and decisions to be made at every stage, each of which has impeded progress. Furthermore, it is not simply a matter of identifying technical solutions but also a matter of major cultural change. This requires a significant focus on change management but can also take longer to achieve in larger educational institutions. Therefore, is not surprising that the learning platform is still at a relatively early stage of development at the end of the ICT Test Bed funded period, yet the significant achievements to date and the resulting wider impact across the LA should be recognised and celebrated. The use of the learning platform at secondary school in this study is more advanced than in many secondary schools in the UK owing to the hard work and commitment of staff and senior managers; that it is still not fully embedded is hardly surprising given the enormity of the task. The lessons learned so far will be valuable in view of the subsequent policy developments; this has been a genuine 'test bed' initiative, laying a trail for others to follow. This study represents a snapshot in time of the implementation and development of a learning platform in the cluster of schools.

It should be noted that there are many alternatives to providing some of the functionality of a learning platform and, before taking the decision to purchase one, schools – particularly primary schools – should give careful consideration to what is in place already within their institution and what requirements, if any, still need to be met.

This is a summary of the substantial report on the implementation of the learning platform(s) which can be found in 'ICT Test Bed: A Case Study of the Learning Platform(s) in One Cluster' [www.evaluation.icttestbed.org.uk]. The underlying rationale was to maximise the impact of the provision of computers in the homes and promote e-learning and engagement. The original vision was that the learning platform would be an indispensable one-stop shop for all stakeholders, broadening opportunities and in particular facilitating personalised learning (DfES, 2004) for pupils. A further element was to increase family engagement and access hard-to-reach communities. Finally, the potential for improving efficiency and sharing resources was also recognised at the outset.

Staff perceived that there were varying degrees of engagement with the learning platform across all ICT Test Bed schools (and indeed within schools). Five of the seven primary schools were using the learning platform for the school diary, and document storage including planning. In some cases, individual teachers were storing all documents within the platform rather than within the school intranet as this facilitated home access. All school staff and all pupils had been given email addresses. Parental access to the learning platform (Family Portal and Skills for Life

training services) had been made available and offered (via a letter and invitation to attend training) in at least two of the primary schools and at the secondary school. The secondary school had also just enabled access to additional data relating to attendance, targets and achievement, the timetable, merits and behaviour (via the integrated management information system). Some of this facility was introduced in primary schools in September 2006.

The development of the learning platform was driven through strong leadership and vision of what might be attained rather than what was at the time available. In the secondary school it was perceived by the LA that there had been significant progress. The factors contributing to this were perceived to be the content development team and strong leadership. The learning platform had been most successful in schools that were proactive through the involvement of individual enthusiastic staff. Following a lengthy procurement process, difficult decisions and unfortunate delays, the solution the cluster finally opted for was based on a set of products in their early stages of development. At the time of implementation in September 2004 the products had only been used in one other secondary school and no primary schools. Initial implementation included an environment which supported communication and resource management, together with the curriculum management system which was implemented in May 2005.

7.3.1   Email and communications

The LA web-based email system was replaced with email facilities offered through the learning platform. The strategic intention was that this would be a quick win as teachers were already largely using email and this would help to familiarise staff with the features of the learning gateway. In the primary schools email exchange was mainly in relation to student concerns or seeking homework help, and was seen to be beneficial. Staff at both primary schools in the study noted that the school diary, notices and staff meeting minutes were held in the learning platform. One primary school had trialled a discussion forum with staff, but there had been no responses.

Email was used in the secondary school between staff and pupils for sending and receiving work, and asking questions. For example, in IT pupils emailed their work to the teacher during weekends and holidays. The concept of 'homework' was radically changed in the secondary school, shifting from a traditional paper-based practice to one which was online, automated and accessible anywhere and anytime, though this was still under development in the summer of 2006 with an initial focus on core subjects in Key Stage 3.

There were concerns relating to pupils' email use and etiquette. One primary school had set up protocols which stated that pupils should not expect responses from emails to staff immediately (an expectation arising from their experiences with instant messaging) and that language should be appropriate. Due to security concerns pupil emails were based on alpha-numerics rather than their names but pupil names could be used as an alias internally. Children were instructed not to email anyone they did not know. School staff had some concerns about pupils disclosing serious problems via email and it not being picked up straight away. However, if email makes it easier for children to express their feelings about such

serious issues then it might bring such matters to someone's attention more promptly.

7.3.2   Development of resources

Development of resources for the curriculum management system began in May 2005 and by July 2006 there were some 460 units (each about an hour's worth of learning resource). On the whole these had been developed by the content development team who were able to produce animations using Flash. Content development had become increasingly important, particularly as it was perceived that selling content to schools beyond ICT Test Bed would contribute to sustainability. There are challenges relating to creating content (it is time-consuming and even with reimbursement there has not been as much take-up as hoped due to lack of time) and buying in commercially produced content (which might not suit needs and is not necessarily easy to use).

There was a strong focus on new content development which has caused some concern for the LA particularly in relation to the primary schools. The LA was trying to raise awareness of managing existing content and communication tools within the learning platform, which had the potential for 'quick wins'. One teacher noted that there had been some minor delay in generating resources owing to inevitable development bottlenecks both within the content creation team and because of limitations of staff time. One solution was to buy in ready-made content but there was still a requirement for staff to identify which elements would be useful. Although funding was made available for teacher development of units for the homework system, it was problematic. At primary level, funding was made available for 136 units but only four had been developed at the time of the study.

The curriculum management system enabled staff to create basic activities (without animations) using a wizard and templates. Teachers were also designing interactive resources which the content development team then developed using tools such as Flash and which were then imported into the learning platform.

Sharing of ideas was happening within schools rather than between schools.

> "There doesn't tend to be much sharing of resources, physical resources if you like, but what there has been is a sharing of ideas. Because the information, because all the planning here is uploaded every week and it's visible to everybody, because of the transparency of the thing, there has been a sharing of ideas. One of the teachers actually said to one of the others, 'I saw that you were doing such and such in your planning. That is a brilliant idea. Can I use it?' Now had they had their planning in a folder stuck on their desk that would never have happened, so there is a sharing of ideas, more so than actual learning resources." (Content development team)

Sharing resources and planning amongst teaching teams had also become much easier, as once the documents were uploaded they were accessible by any staff:

> "I was off ill at the beginning of the year, and it just happened to be a Sunday night that I was ill, so it meant that the planning was already up there so there was no problem for the next day regarding cover." (Primary teacher)

Home access meant that staff were able to be more organised and to work at times that were convenient to them rather than being forced to stay in school in order to store and access documents on the school intranet. The flexibility for staff offered through ICT was also recognised in the pathfinder project relating to the Workforce Reform agenda (Butt *et al.*, 2004). The learning platform enabled staff to enhance delivery, manage and organise their workload, and collaborate and communicate more easily with other stakeholders.

7.3.3   Homework

Printed alternatives were available for students without internet access at home or they could attend a homework club or access the technology in school at other times. Once submitted, assignments could not be changed and could be auto-marked if the teacher chose, providing immediate feedback for students. Alternatively, assignments could be sent to the teacher for marking.

In some of the primary schools involved in the study, the learning platform had not yet been used in relation to homework. At one primary school homework was set online on a regular basis, with the teacher printing off the activities for the small number of pupils in her class who did not have home internet access The curriculum management system had been used in two primary schools but only by the 'learning champions' in KS2 and not extensively. In one primary school the content management system had been used to create a class home page for a Year 6 class.

It was perceived (by the LA) that the national Primary strategies had not yet harnessed a strategic approach to ICT and this had inhibited developments in the project primary schools as well as more generally.

The focus in the secondary school at the time of the study (March 2006 – July 2006) was on implementing an online homework facility in English and maths in Year 7. Some staff in science had been trialling resources but the system had not been implemented across the whole department due to the range of teachers' experiences of ICT (a common issue with ICT implementations per se as identified by John and Baggott la Velle, 2004; Cuthell, 2005). More generally, it was perceived to be very effective and to have had a positive impact on levels of homework submission which has been problematic in the past. It was believed to be more motivating for lower ability children and effective for high ability children. It had a positive impact on workload for staff who were using it regularly. Previously, chasing up outstanding homework used to be a laborious process. In relation to other year groups, use was ad hoc and it had not yet been embedded.

There were issues that had not been resolved surrounding activities that cannot be easily marked automatically such as English composition and whether or not this approach generally over-mechanises assessment. In modern foreign languages,

teachers believed that whilst such an approach was beneficial for assessing listening and reading, more teacher intervention was required to assess speaking and writing. Assessment of these two core strands of language learning cannot be so easily automated. It is possible that such a system might influence teachers to focus on those elements which can be easily assessed.

There is also a need to ensure that the assignments contribute effectively to teaching and learning through moderating assignments and uses of the curriculum management system.

> "It takes the routine admin work away for the teachers. […]But again the strength [of the curriculum management system] will depend very much on the quality of those assignments. […] It gives the access potentially but again it depends what goes in there. If there is a raft of closed activities in there and no encouragement to go beyond, you will not have autonomous creative learners." (Senior officer, LA).

7.3.4   Parental access

Parents had access to a family portal which was specific to each school. It was available for each of the primary schools but had not been developed by some, and access had not been provided in all schools. The family portal could include general news, school newsletters and other school information, information about individual children, and an easy means of communicating with the school. The learning platform provided access to Skills for Life training resources such as ESOL courses from NIACE and other direct links, such as local job centre vacancies. Parents of secondary school students were given access in March 2006 and training was under way. This enabled them to access information relating to their own children such as attendance, attainment and some information on behaviour. In one of the primary schools the learning platform was being used to showcase pupils' work and show photos of events.

A successful strategy in relation to parental support was to identify and employ 'learning champions'. In the ICT Test Bed project there were three, two of whom were parents.

> "One was just somebody [from] outside the area. He was very intelligent; he knew the area very well; he had actually had some ICT training. He had been a tutor for adult education; he could speak their language; he was still down to earth and could still engage with them." (Learning co-ordinator)

These champions talked to parents when they initially came to collect their computer from schools or in the library or at the school gates, dealt with problems, and encouraged parents to enrol on courses and visit schools. One learning co-ordinator commented that "Engaging parents before the [learning platform] was very difficult". It was believed by staff that many parents had become more ICT skilled, more confident, came into school more and chatted about homework amongst themselves, with their children and with school staff.

Challenges for involving families in the learning platform have included a lack of ICT skills and lack of confidence (also identified in Cranmer's study, 2006), technical faults, losing passwords and language barriers. In an area of deprivation with high levels of mobility, staff noted that many families had concerns about providing information, which could act as a deterrent to participating fully in a learning community.

> "I don't know why it is but we have things like questionnaires, parental questionnaires and they are not being filled in. I think there is a certain amount of fear from the parents about giving out information." (Content development team)

Staff at primary schools expressed concerns that online communication and dissemination means that parents could see less need to come into school. This could have implications for provision of ICT resources in schools which should be meeting the needs of the community, but potentially could be underused. However, in ICT Test Bed in this cluster face-to-face engagement was a key element for encouraging use of ICT with families. Learning Champions attached to each school ran coffee mornings and non-related ICT courses, all with the aim of developing relationships to provide the opportunity for deeper understanding of use of ICT.

7.3.5   Change management

The learning platform was largely introduced to staff in small steps with training, slowly replacing previous paper-based systems with electronic ones. There was a strong drive by many individuals to identify 'quick wins'. One such example which was used as a catalyst for change was the switch from a web-based email system to the email system embedded in the learning platform. This has subsequently been used to raise awareness of other communication and management tools provided with the learning platform.

> "Getting them to do simple things, like just sending us announcements to put on the [learning platform]. I think that was hard for staff to suddenly go from using memos in trays to thinking 'Well, I can post something that everyone can see and I don't have to post letters in everyone's trays'." (Content development team)

A wide range of other 'hooks' was devised by individuals to increase usage of the learning platform. For example, one teacher organised a 'Sudoko challenge' with a small weekly prize which was considered to be successful.

Early adopters (selected in many cases as 'learning platform champions' due to their enthusiasm) acted as a catalyst for others, and accelerated the processes of developing the learning platform and embedding it into management, teaching and learning. This approach has been successful elsewhere (Tearle, 2004; Russell *et al.*, 2005; Harris, 2006). However, this strategy has not been without its problems. Each school was asked to send two members of staff to change management training for the learning platform implementation in December 2005. They were asked to send a member of the senior management team and a 'mover and shaker' who was a respected member of staff. Where full management support was given, this requirement was addressed fully. Irrespective of this, those selected did not always

maintain their role either because to leaving the school or because they found the additional workload to be too much. In addition, attributing the title 'learning platform champion' to these staff caused ill-feeling in at least one of the primary schools as it was interpreted as expertise (whereas it was intended to represent enthusiasm).

The establishment of a content development team (of 10 employees at the time of the study) undoubtedly contributed to the success of the learning platform within the cluster. The team was established prior to the introduction of the learning platform and was initially responsible for developing online resources and websites. The team was supported by a company which initially helped to design and develop the chosen learning platform at the secondary school. A representative of this company visited approximately once a month to help the content development team to deal with any problems.

With the support of other schools in the cluster, one primary school initially developed a learning platform from a different provider. The member of staff from the provider was very enthusiastic and worked closely with the school business manager during the developmental phase of the product. The school were pleased to be helping to shape a product that would meet their specific needs and the needs of primary schools generally. The individual from the provider with whom staff at Primary School A were working closely visited the school regularly and pointed out aspects of the functionality, providing ideas for further development. However, after an initial push, this person left the company and the momentum seemed to be lost. The company did not seem to be interested any longer in developing the product for primary schools.

As a result of this history, this primary school had not yet begun to make the most of the cluster solution as they had implemented a solution as an individual institution rather than within a group. The staff and pupils were not engaging with it to the same extent as some of the other schools in the cluster. There are clearly benefits relating to everyone being in a similar situation which means that a maverick approach does not always reap rewards, although the intentions behind following a different pathway were well-meaning (and justifiable in a project intended to be a test bed). Despite implementing a learning platform before the rest of the cluster, a senior manager acknowledged that in terms of development the school had not made as much progress overall in this aspect.

7.3.6. Technical and functional limitations

The chosen learning platform was not designed for use across institutions so the original schools' 'shared site' did not provide full functionality (no surveys or questionnaires, for example). To overcome this, another 'institution' was created which everyone had access to. This site provided shared resources and a library of useful websites, and some school staff had begun to request advice and information. However, staff were not visiting this site regularly, tending just to use their own school site. As a result, the content development team sent emails to all teaching staff when information had been updated but this is not an efficient or desirable activity.

The learning platform was perceived to be largely reliable and effective but with the inevitable technical problems that occur when products are in development. For example, when homework was marked it appeared at the bottom of a list of all homeworks set during the year, so that students had to scroll down to locate it and find out how they had done.

At the time of the study the curriculum management system was described as being 'push out'. That is, students were only able to undertake activities that had been assigned to them. It was possible to undertake other activities within the learning platform but the outcomes of these were not recorded for individual students. In order to truly support personalised learning the curriculum management system needs to enable students to choose their own pathway through resources.

The integration of data and automation of services is desirable, but not surprisingly it proved to be a challenge initially as different providers (of learning platforms and MIS) worked together with school staff to identify solutions. This problem seems to be a major block for many other schools (Harris, 2006; Twining *et al.*, 2006, p.31). At the time of the study, content development team staff were trying to resolve technical difficulties in relation to linking the existing MIS to the learning platform. The desire was to ensure seamless integration of all systems so that for example, when a new student was created in the MIS (on entry to the school) a profile for the student would automatically be created in the learning platform. The technical difficulties were believed to lie within the MIS.

7.3.7   Management issues

The scope and scale of the implementation used a lot of resources, some of which may have been more effectively deployed according to the perceptions of the LA.

> "[I]t is an important development that really systematises ICT instead of being bits and pieces here and there. It's big, it's scary and it takes a lot of resource. […] [I]t takes some serious project planning at a time when a lot of other things are going on." (Senior officer, LA).

As a trailblazing project it is perhaps not surprising that a major investment of resources had to be made and demands on capacity were high. It highlights the need for effective change management strategies and meticulous planning. The LA also had concerns about whether there was sufficient capacity to support the primary schools' development, given the significant demands of the implementation and the differing context of primary schools.

Staff turnover inhibited the embedding of the learning platform, particularly in the primary phase. Changes of headteacher in five of the seven primary schools impeded progress.

'Behaviour event recording' in the secondary and primary schools was still being addressed. All schools involved in this study were facing the challenge of how to deal with information about children: what to keep private (internal to school staff)

and what to make public (available to parents). An upgrade to the MIS should make this process easier in the future by developing separate entries for parents and staff.

The day-to-day management of the learning platform was an issue. There were staff concerns about workload. The content development team believe there "needs to be a delineation of roles and responsibilities". Staff noted that linking school and home with ICT cannot be relied upon as the sole means of communication, which means it has to be run in parallel with other systems, perhaps requiring duplication of activity.

It was perceived (by the LA) that the school-managed approach meant that sometimes the leaders did not listen to external advice which might have been helpful in resolving or avoiding some of the difficulties encountered. This innovative approach is changing accountabilities between schools and the LA. An additional layer of complexity had also been introduced with new types of relationship: school as provider and schools as their customers. This different approach has meant that some LA staff and individuals have not always felt totally comfortable. For example, some interviewees commented that the school-managed approach had led to some resistance and resentment from other schools in the area. However, this approach was supported by the LA, has been beneficial in other ways and school-led collaboration was being increasingly encouraged.

As a cluster of schools leading the development of learning platforms, the content development team and the 'learning champions' found there to be a lack of external support and working examples. Obviously over time this should no longer be a problem.

7.3.8   Sustainability
Income generation opportunities will be maximised in order to sustain the content development team. The LA has identified some funding to schools to support the financing of the learning platform development. There is an expectation that schools will fund the learning platform partly from the school budget, and incorporate ICT provision fully in their financial planning with the cessation of 'earmarked' ICT grants from government.
It is intended that both content and learning platform expertise (particularly implementation) will be marketed beyond the LA. Staff had been appointed to act as advisors to potential new schools, providing a strategic overview of what can be achieved and information about the funding and content, for example.

7.3.9   Advice to schools on adopting a learning platform
Based on this trail-blazing development in one ICT Test Bed cluster the following guidelines are offered.

- Get users involved as soon as possible to identify what is needed (teachers, pupils, parents and governors). Sites for each of the groups need to be relevant and purposeful.
- Consider the functionality within a commercial learning platform in relation to what already exists within the school. What functionality is

required in relation to communication and collaboration, document and content management, MIS, home access, record keeping, administration and security[10]?

- Visit other schools that have a commercial learning platform or alternatives in place.
- Identifying staff to lead by example can be beneficial and accelerate the processes of development and embedding, but there needs to be strong support from senior leadership. That is, change management should include bottom-up and top-down drivers.
- The change management tools, developed by the National Remodelling Team in 2003 to support workforce reform agenda, are very helpful when implementing a learning platform. [see http://www.tda.gov.uk/remodelling/managingchange/tools.aspx]
- Think creatively about 'quick wins' and hooks to encourage use by all stakeholders. Introducing the learning platform features in stages can ensure that all staff have positive experiences. Changing to the learning platform email system at the outset encourages regular use and develops familiarity.
- Staff need time to familiarise themselves with new tools and techniques, and to develop resources. Some staff will undertake this of their own accord as a result of personal interest. Others may need incentives such as funding, release time, or mandatory staff training. Engaging staff to design content can ensure that resources meet individual needs but even with financial reward it can be challenging for teachers to find the time to engage in this process.
- Shifting document storage to the learning platform enables access from anywhere and reduces the need to print. Thought needs to be given to organisation and access of such materials.
- To maximise efficiency, introduce a cultural change from sending out information (via whole school email) to requiring staff to search for information (visiting bulletin boards regularly).

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[10] A helpful | starting point is the Becta matrix for learning platform functionality: http://matrix.becta.org.uk

- There is strength in numbers; implementing a learning platform as a cluster of schools offers mutual support and encouragement, the sharing of good practice and ideas, and access to a wider range of content and resources.
- To promote family engagement with a learning platform, one-to-one training is beneficial, and maintaining personal contact through appointed staff or parent representatives can also help.
- Shifting from traditional homework practices to online homework combined with a rewards system can be motivating, increase homework submissions and may reduce workload. However, issues of quality and potential over-mechanisation need to be addressed.

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Appendix A

This section of the report presents two successful models of leadership and management to maximise the effective use of high levels of investment in ICT. Other colleges might like to adopt and customise one or other of these models to their own needs and traditions. The key message here is that no one model is generalisable across all colleges, but much can be learnt from the experience of these two ICT Test Bed institutions.

In Table A1 the two models have been given 'key descriptor' labels used by the ICT Test Bed Managers in interview, and further explained below. Each of the approaches is more complex than may at first be apparent, but the power of any model is in simplification of complexity to enable clarity of analysis. The subsequent sections of the report fill out the detail of the work through description and analysis of particular aspects.

Table A1: Two models of leadership and management

	College A	College B
Key descriptor	The 'franchise' model	The 'empowerment' model
Size and location	Large, single campus, inner city	Small, single campus, rural
Catchment	Culturally diverse, dominated by white working class families	Mono-ethnic, high proportion of unemployed adults with low levels of education
College leadership when ICT TB began	Stable and established	Stable and established
Project manager (PM)	Experienced project manager employed specially for the job	Experienced member of the senior management team given the role
Stability of project manager	Change of project manager after one year – a second experienced PM employed for the job	Stable throughout
Stability of staffing	Stable with a fair balance of full time and part time staff.	Stable with few part timers, but some vacant posts due to skill shortages.
Relative importance of ICT Test Bed in the college	Used as a key initiative to upgrade ICT systems and establish shared ICT resources	Used as a key initiative for curriculum renewal and staff development
Leadership style	Oversight of 'a programme of networked projects'. Liaising with curriculum teams, with	Hands-on leadership with ownership of decision-making devolved. Strong inter-

	good access to senior managers. Developing strategies to deal with problems as/when they occur.	personal links with staff at all levels. The small size of the college is a factor enabling this.
Project manager's access to staff	Difficult to set up meetings with staff	Easy to set up meetings with staff
ICT Test Bed Committees and their function	The ICT Test Bed Committee has been merged with the ILCT Strategic Group to become the college's main ICT Steering Group	The ICT Test Bed Group (sub-group of the ILT Committee), representative of all college groups, meets regularly.
Provision of technical support	Technical support provided by existing IT service. Made possible because ICT TB funded an upgrade to the system, making it more reliable which reduced the demand for technical support.	The special needs of the ICT TB project catered for by additional staffing and integration with existing services. Support reported by staff to be 'fabulous'.
Strategies adopted for staff development	(1) In yr 1 formal training for specific technologies from internal and external providers. (2) Extensive in-house training in basic IT skills, IWBs and the VLE. (3) Training weeks twice a year contain ICT TB events. (4) ICT TB staff now train other staff. (5) PM found a more person-centred approach needed than in commercial organisations. Need to find ways of involving staff in planning & change.	(1) In yr 1, training programme over a term for staff across cluster (with options). (2) ICT TB staff asked to provide sessions in college's annual training days. (3) In year 3, ICT TB staff provide training for other staff and act as mentors to other course teams.
Working relationship with the cluster of schools and LA	Agreed with LA TB manager and heads of schools to host Content Dev. Workshop at college. On-going activity in support of schools.	Active leadership; regular contacts with Heads and LA TB manager; college provision of CPD and technical support to cluster.