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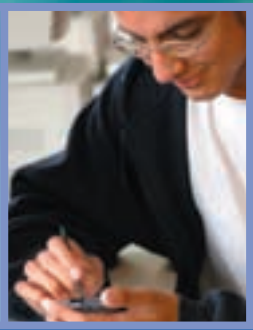
# The Becta Review 2005

## Evidence on the progress of ICT in education



Becta
ICT Research

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# PREFACE

Over the last five years we have seen significant strategic leadership and investment in ICT by the Government, which has led to a position where ICT policy has now become a key aspect of an ambitious educational reform agenda.

This review draws on a range of recent evidence to set out the progress that has been made in schools and the learning and skills sectors and to understand current challenges in realising the full potential of ICT in education in a new policy era.

It confirms there has been recent significant progress, especially in the areas of learner access and institutional ICT provision. Practitioner ICT confidence and levels of use in learning and teaching have shown considerable growth over the last two years, and we have evidence of a positive impact on standards. International comparisons suggest that the UK is one of the leading nations when it comes to the development and use of ICT in education.

There is now, however, a need to move to a new phase of strategic development in order to meet the needs of a rapidly changing environment in which the role of technology is fundamental to educational progress.

This means focusing specifically on supporting leaders and institutions to develop coherent ICT provision, and embedding ICT practices which improve the quality of learning and teaching.

The last five years have seen the establishment of the foundations for fundamental changes within the education system through the use of ICT. However, to date, we have not delivered the full range of opportunities offered by ICT. Furthermore, where significant change has taken place, it is not systemic, and often not embedded. It is now reasonable, and indeed necessary, to expect that by the end of the next five years there will be effective, embedded and systemic ICT practice which has transformed educational opportunities and achievements for all our students and educators.

The e-strategy currently being developed by the DfES will take forward many of the issues covered in this review and will define a new ICT and e-learning vision. Becta, with its new responsibilities, is keen to support both the development and the delivery of this new strategy.

We are also keen to receive comments from you as to how we may improve this review in future years.

Owen Lynch
*Chief Executive*

# EXECUTIVE SUMMARY

### The Becta Review

The Department for Education and Skills' Five Year Strategy for Children and Learners sets out a vision and an agenda for the education system in which ICT is seen as a critical enabler of progress. The deployment and use of technology is now central to educational change. However, the effective implementation of ICT to personalise learning and improve learner choice presents challenges at all levels in the system.

The Becta Review seeks to assess the progress of ICT in education and offer an analysis of challenges to future progress. It uses evidence from recent surveys and research studies which allow us to draw conclusions about the picture at a national level.

The main audiences for this review are Becta's key partners – including the DfES and education sector agencies – and Becta's key stakeholders, including institutional leaders, LEA policy-makers and advisers, researchers and commercial companies. While the main audience will have a national focus, this review may be useful to those engaged in local policy delivery and others working at a local level. The report is not targeted specifically at learning and teaching practitioners.

### Infrastructure developments

Spending on ICT infrastructure, including hardware and connectivity, has been a key element of the Government's ICT policy. The impact of this spending can be seen in significantly improved computer-to-learner ratios, internet connection speeds and networking, and fast-increasing levels of use. This has been the case in all sectors over the last five years.

Similarly, access to wireless networks and supporting technologies such as interactive whiteboards is improving rapidly. The overall percentage of teaching areas equipped with such presentational technology is rising quickly.

Despite sustained progress, there is variation in infrastructure provision between schools in most areas. Overall, provision is better in secondary schools than in primary schools, but there is variation in provision between schools in each sector. A significant minority of institutions has poor access to ICT.

Variation in ICT provision within the FE sector is less marked than in the school sector. As with schools, in FE there has been rapid improvement in all areas, including a significant drop in the number of institutions with poor computer-to-learner ratios.

Variation in both sectors is most likely to be accounted for in terms of institutional planning strategies. However, there are specific barriers related to the design of buildings and various technical issues, especially in the case of primary schools.

The sustainability of ICT provision is an issue for many educational institutions in both sectors. The majority of institutions have yet to fully achieve this. There is a broad awareness and understanding of sustainability issues, but a failure by many institutions to translate this fully into effective resource planning. There is evidence that specific support and advice improves the ability of institutions to implement ICT sustainably.

The use of ICT to fully support a range of educational processes is a considerable challenge and is likely to demand central intervention to facilitate the development of an appropriate national ICT 'architecture' which supports both the provision of learning opportunities and data management across the system.

### Educational content

The Government has developed specific initiatives for the provision of educational content to support learning and teaching in a variety of ways, including e-Learning Credits to schools, and NLN materials development in the post-16 sector.

There is clear evidence of a trend towards better supply of content for schools, indicated by the registration of Curriculum Online products. Core subjects appear to be best served in terms of the number of available resources, but there is a trend towards improved supply across the curriculum. Research into teachers' perceptions of content availability, however, indicates differences in perceived ability to locate 'appropriate' resources based on key stage (more difficult at Key Stages 1 and 2) and subject (reported as more difficult for science and English than for other subjects).

There are no direct indicators of educational content supply in the post-16 sector. However, in-house development of e-learning content accounts for a significant proportion of electronic materials used with students. Demand for content in this sector appears highest in core curriculum areas and in business administration and ICT, but is relatively low in trade-related vocational subjects.

Regular use of educational content in lessons by teachers is growing. The use of educational content in the post-16 sector is in the early stages of embedding, but is also growing. Levels of use of VLEs (Virtual Learning

Environments) and MLEs (Managed Learning Environments) are higher in FE colleges than in schools, where use is very low.

There is evidence that high-quality educational content enables the realisation of learner attainment gains, but only if accompanied by pedagogically-informed practice.

On the basis of current data, it is difficult to assess the quality of existing educational content and there is a need for a more sophisticated analysis of the dimensions of quality in practice.

### Institutional development

Institutional differences account for the variation in learner experience of ICT to a large extent. It is important to understand the progress of institutions in embedding ICT and the factors which determine how well ICT deployment serves educational goals.

The overall effectiveness of schools' ICT management and leadership, as judged by Ofsted inspectors, has improved considerably over the last few years. In 2003, it was judged good or better in two-thirds of schools. However, there is variability in the quality of school leadership of ICT.

ICT is fully and sustainably embedded in a small proportion of institutions – estimated at between 10 and 16 per cent of schools and 8 per cent of FE colleges, according to a recent DfES-funded study. Of the rest, a large proportion of institutions (76 per cent) in both the schools and FE sectors were making some progress, but had yet to embed ICT fully. Of these, half were firmly committed to embedding ICT in learning and teaching.

Success in deploying ICT to support learning and teaching requires:

- effective ICT leadership and management
- appropriate workforce skills, not just to use ICT but to use it effectively in learning and teaching
- curriculum and content which takes account of available technology and uses it to best effect
- links both within and outside the institution to share information and effective practice with others.

Though the use of ICT for administration is widespread, not all teachers and lecturers use ICT for these purposes. School use of MIS (Management Information Systems) focuses generally on data entry and collation, rather than data transfer or analysis to support planning. Deploying technology to support learner tracking is problematic for many FE colleges.

ICT can help to address a number of elements of the teacher/lecturer workload, but benefits are achievable only where the workforce is confident and competent in using ICT.

Institutions are only at an early stage in developing the use of networked technologies to facilitate learning beyond the institution.

### Learning and teaching

Levels of workforce confidence and competence with technology have improved and overall use of ICT has risen sharply since 2002. Teachers' and lecturers' personal access to and ownership of ICT is likely to account for much of the rise in use.

There is variation in levels of use of ICT in teaching based on subject area in both schools and FE, with highest levels of use found generally in core subjects.

There is a general pattern across key stages for pupils to spend more time using computers at home than at school. Overall, use of computers in subject learning increases with pupils' age.

Quality of use of ICT in schools, as judged by Ofsted, is rising. However, Ofsted observed that there is unmet potential to achieve a positive impact on pupils' learning.

There is a growing body of evidence relating to the positive impact of ICT on learner attainment and other outcomes, but we need to develop further our understanding of effective ICT pedagogies and how they can be supported. Factors which account for whether there is positive impact on learning include subject tradition with ICT, use across the curriculum, and quality of leadership and teaching.

In colleges, staff are enthusiastic about the use of technology in learning and teaching, but the picture at the moment is one of under-utilisation of the potential of ICT and an over-reliance on generic uses.

Little comprehensive national data is available about the use of ICT to support assessment in schools and colleges.

### Progress, issues and challenges

This discussion offers an analysis of the challenges related to four areas of impact:

- Learners
- The educational workforce
- Educational institutions
- The educational system as a whole.

Realising progress in these areas entails moving beyond adoption, deployment and use of ICT towards a position whereby decisions about ICT are focused on the aim of supporting a learner-focused, responsive, effective and efficient education system.

### Learners

Learners have experienced an increasing use of ICT in learning and teaching, but at the moment there are profound differences in the level and quality of ICT-based learning opportunities available to them.

Key factors that govern the nature of the learner's ICT experience are:

- institutional differences based on local leadership
- accessibility and reliability of ICT infrastructure
- practitioner knowledge, commitment and time for integrating ICT into learning and teaching
- learner circumstance, especially with respect to home access to the internet
- the subject under study, especially in the case of post-16 learners studying trade-related subjects.

Learners increasingly expect institutions to provide high-quality ICT resources and e-learning opportunities.

Teachers' understanding of the potential of ICT to support learners is critical and there are considerable differences between educational practitioners in the use of ICT in learning and teaching. There is a need for further continuing professional development and the development of communities of subject-specific ICT practice.

Evidence is limited as to the extent and nature of ICT use in different subject areas, the link between pedagogy and positive impact on learning, and the nature of current technical and infrastructure barriers to progress.

### The educational workforce

The increasing use of ICT has been accompanied by considerable improvements in practitioner competence and confidence in using ICT in subject teaching. However, levels of technical reliability and support can have a negative effect on confidence. Recent levelling off in teacher ICT confidence may be an indicator of increased expectations and realisation that achieving capability is more challenging than previously thought.

Continuing (and targeted) professional development is important in both the school and post-16 sectors, and will need to focus on developing a more learner-focused and enhanced learning experience, including supporting local decision-making on how to improve the learner experience within different contexts.

Peers and professional networks play a key role in practitioner understanding of ICT and in the development of professional practice, including the defining, developing and spreading of effective ICT pedagogies. ICT can support this process but we need to know more about what is effective.

Institutions and institutional leaders are critical in driving change in the use of ICT. Future research will need to identify and clarify the specific institutional and practitioner factors that contribute to the extent and quality of ICT use, and increase understanding of how to develop and spread effective ICT practice in the workforce.

### Educational institutions

A key challenge for institutions is to develop effective and innovative ways of using ICT to extend learning beyond the traditional boundaries of their organisation, and in doing so support practitioners in delivering more learner-focused educational experiences.

There are technical and pedagogical challenges related to ICT becoming a natural platform for learning materials and support. There are still challenges in relation to supporting the minority of learners who do not have home access to an internet-connected computer. Institutions need support in addressing infrastructure barriers to embedding ICT.

ICT has potential to address workload and productivity issues, but institutions and practitioners need a better understanding of how technology applications can realise efficiencies. The development of frameworks and guidance about what works are clearly needed to take this issue forward.

A small minority of institutions display a high level of ICT maturity but a large core are struggling to deal with issues of sustainability and effectiveness.

There are current limitations in evidence relating to:

- strategies for linking learning inside and outside institutions
- issues and challenges in achieving efficiencies in teaching preparation
- quantifying the impact of ICT on productivity and efficiency.

Existing baseline measures of institutional ICT maturity will need to be applied through follow-up studies to assess the distance travelled over the next two years. New baseline measures are needed to measure progress in the achievement of efficiencies.

### The education system

Embedding effective innovation across the system is a key challenge which entails drivers for progress being put in place. The public policy challenge is to develop strategies for delivering change in institutions in different circumstances, such as those developing from a lower base in terms of ICT leadership and overall teacher/lecturer expertise.

In order to realise an ICT system which is joined up and adds value for learners, the following issues need to be addressed:

- Ubiquitous access – such that technology can be used extensively to support a full range of educational processes
- Reliability – to provide practitioners with dependable use of networked ICT
- The use of ICT to fully support a range of educational processes – current fragmentation not only restricts efficiencies, but is also a barrier to developing embedded use
- Workforce expertise – practitioner and manager knowledge of the potential for ICT is limited and a unified system entails system and sector-wide views of what constitutes ICT and e-learning expertise
- Lack of a national ICT system – use across educational processes is a significant challenge and is likely to demand central intervention to facilitate the development of an appropriate national ICT 'architecture' which supports both the provision of learning opportunities and data management across the system.

# 1 THE BECTA REVIEW

This review comes at an important time for the education system. In 2004, the Department for Education and Skills (DfES) published its Five Year Strategy for Children and Learners. This sets out the challenges for education and skills and offers a vision of a system which better meets the needs and aspirations of learners. Several principles underpin this, including greater personalisation and choice for learners and high-quality support and training to improve assessment and teaching. A key element of their development is for learning to be designed around the needs of the individual and available at a time and place which suits their needs.

In realising this vision, the deployment and use of information and communications technology (ICT) is a critical enabler in achieving change:

*We believe the ambitious and imaginative use of technology will be a central element in improving personalisation and choice across the system.* (DfES, 2004, p.88)

ICT is viewed as an important tool in facilitating new levels of learning support. In addition, the intention is that ICT will facilitate more productive working for teachers and other practitioners, making it easier to mark and monitor learner progress and deliver administrative and management functions. The process of teaching itself will be also further enriched through the use of ICT and improved via networks which make new forms of collaboration and sharing between practitioners possible. This means that, as opposed to being peripheral or a 'bolt-on', ICT is now central and critical to educational processes and to learning and teaching.

However, though ICT is central to improving personalisation and choice, delivering positive impact brings its own challenges. Effective implementation of ICT to personalise learning and improve learner choice is challenging to deliver – at all levels in the system, from the learning practitioner, through to the institution and the broader system. In taking this agenda forward, we need to assess where we are now, and understand the issues and challenges to be met in order to deliver change effectively across the education system.

This review presents findings from recent surveys and research studies which allow us to draw conclusions at a national level and offers an analysis of the progress made to date. It identifies key challenges to address in making further progress and highlights gaps in current evidence.

The evidence and research cited here draws primarily from:

- national statistics and large-scale and national-level surveys, such as the DfES survey of ICT in schools and the Becta survey on ICT and e-learning in FE, and including some international comparisons
- national and large-scale research studies of ICT implementation and use
- projects to evaluate national ICT programmes, such as the evaluation of Curriculum Online
- inspection data and reports from Ofsted
- systematic reviews of literature relating to ICT in education.

The value of a review of this kind is in pulling together a range of sources in an attempt to construct a single picture. However, studies of this kind cannot tell us everything and are often limited (for example, institutional surveys offer a limited picture of learning and teaching practice). Overall, this review offers a more reliable picture of provision than of practice, but nonetheless provides some good indications of the latter.

The review covers schools and the learning and skills (post-16) sector, but excludes higher education. Given the limitations of available evidence, work-based learning cannot be covered in this review. Becta is currently working with the Learning and Skills Council (LSC), e-Skills UK and the DfES to develop the evidence base in this area further. Due to issues of availability of a range of evidence, this report relates primarily to England.

The evidence is organised broadly in terms of ICT provision followed by ICT practice. It is presented in the following way:

- Infrastructure developments
- Educational content
- Institutional development
- Learning and teaching.

The final section, 'Progress, issues and challenges', offers an analysis and assessment of the major issues arising from this review in the context of current ambitions of the education system, drawing on the DfES Five Year Strategy for Children and Learners. This discussion addresses four key areas of impact identified in Becta's vision for ICT in education: the learner; the education workforce; the institution; and the education system as a whole.

***For learners:***
Learning needs to be not only enhanced but also transformed by the use of ICT. ICT offers the potential to personalise learning in many ways, for example, through the use of innovative and effective forms of ICT-based assessment for learning. Tools and information systems help teachers plan differentiated learning experiences, and online resources support learners so that they have good opportunities to direct and develop their own learning where and when appropriate. Differentiated learning experiences are particularly important in realising and enhancing educational inclusion. Inclusion can be supported in a variety of ways, for example, by providing communication aids to enable access for learners with specific communication disabilities, allowing geographically dispersed learning communities to come together to learn skills which might otherwise be economically unviable to deliver, or enabling providers to reach out to specific groups, such as travellers, or children who cannot attend school owing to illness or other reasons.

***For the educational workforce:***
Developing practitioner knowledge and skills is vital. This will allow teachers and other practitioners to better support ICT-based learning, including blending this appropriately with other learning experiences. Practitioners will increasingly deliver and support learning and teaching, including whole-class teaching, using a range of media. Far from being diminished, practitioners' specific knowledge and expertise, combined with pedagogical understanding and ICT skills, will need to be enhanced to underpin the quality of learners' educational experiences and to enable learners to maximise learning opportunities. ICT must also play a key role in enhancing the professional development of the workforce, allowing access to distributed communities of practice, for example, and providing platforms which facilitate the sharing of effective practice.

***For educational institutions:***
Links between educational institutions and services and the outside world need to be transformed, enabling greater continuity of experience, for example, between the home and the school or between the workplace and learning provider. This entails building on current uses of ICT and developing increased remote access to learning resources and information. In addition, institutions need to realise increased efficiency and effectiveness in information management, both to deliver learner information which supports personalisation and differentiation, and to achieve efficiencies in information management. This entails, for example, online enrolment and sharing of pupil/student records between institutions, automation of attendance record-keeping and analysis, streamlined procurement processes for school and LEA purchases, and the re-use of data at different levels in the system. Overall, it is imperative that institutions become 'e-confident' – able to lead and implement ICT in the furtherance of educational goals.

***For the educational system as a whole:***
ICT must enable increased joining-up in learning provision, particularly to support increased curriculum choice for those aged 14 to 19. ICT should support the management of learners who use more than one learning provider. The management of learners must become increasingly a function that happens between, rather than purely within, institutions. In addition, ICT needs to deliver online support and guidance for learners which is tailored to individual needs, and must enable efficiencies in data collection and analysis between institutions, LEAs and the Government.

System-wide opportunities also need to be put in place for sharing innovative and effective practice where it is identified, so that learning can take place across the system. Similarly, effective mechanisms are required to allow those implementing ICT locally and regionally to influence the national system. Overall, improving the value of ICT-related services across the system is important.

# 2 INFRASTRUCTURE DEVELOPMENTS


### Summary

Spending on ICT infrastructure, including hardware and connectivity, has been a key element of the Government's ICT policy. The impact of this spending can be seen in significantly improved computer-to-learner ratios, internet connection speeds and networking, and fast-increasing levels of use. This has been the case in all sectors over the last five years.

Similarly, access to wireless networks and supporting technologies such as interactive whiteboards is improving rapidly. The overall percentage of teaching areas equipped with such presentational technology is rising quickly.

Despite sustained progress, there is variation between schools in most areas of infrastructure provision. Overall, provision is better in secondary schools than in primary schools, but there is variation in provision between schools in each sector. A significant minority of institutions has poor access to ICT.

Variation in ICT provision within the FE sector is less marked than in the school sector. As with schools, in FE there has been rapid improvement in all areas, including a significant drop in the number of institutions with poor computer-to-learner ratios.

Variation in both sectors is most likely to be accounted for in terms of institutional planning strategies. However, there are specific barriers related to the design of buildings and various technical issues, especially in the case of primary schools.

The sustainability of ICT provision is an issue for many educational institutions in both sectors. The majority of institutions have yet to fully achieve this. There is a broad awareness and understanding of sustainability issues, but a failure by many institutions to translate this fully into effective resource planning. There is evidence that specific support and advice improves the ability of institutions to implement ICT sustainably.

The use of ICT to fully support a range of educational processes is a considerable challenge and is likely to demand central intervention to facilitate the development of an appropriate national ICT 'architecture' which supports both the provision of learning opportunities and data management across the system.


## DEVELOPMENTS IN SCHOOLS

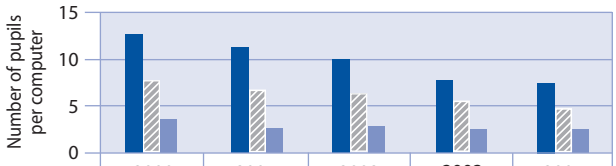
### Provision of hardware

Overall, there has been a sustained improvement in key areas of infrastructure provision over the last five years, as indicated by data for computer-to-pupil ratios, internet connectivity and networking in Figures 2.1, 2.5 and 2.6. There has not been a marked improvement in special schools over the last five years, but the baseline figure here was already good.

The rate of improvement in computer-to-pupil ratios is particularly marked in primary schools, but the ratio is still significantly above that of secondary schools. Portability of computers is improving rapidly, too, as shown by the reduction in the ratio of desktops to laptops in schools. The balance between the number of desktop and laptop computers is shifting towards laptops (Prior and Hall, 2004).

The ICT in Schools Survey 2004 includes indicators of variation in computer-to-pupil ratios between schools (see Tables 2.1, 2.2 and 2.3). Most secondary schools are near to, or better than, the mean; few are worse off. However, a significant minority of primary schools have a worse ratio than the mean. As with secondary schools, the ratio in most special schools is near or above the mean; few schools have a significantly worse ratio.

**Figure 2.1: Mean number of pupils per computer used for teaching and learning**




| | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| Primary | 12.6 | 11.8 | 10.1 | 7.9 | 7.5 |
| Secondary | 7.9 | 7.1 | 6.5 | 5.4 | 4.9 |
| Special | 3.7 | 3.2 | 3.4 | 3 | 3 |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

The evidence indicates variation between schools in key aspects of infrastructure provision. Ofsted suggest that, despite record spending levels and high overall computer-to-pupil ratios, many schools struggle to provide for the range of ICT requirements:

*Even where a secondary school has a favourable overall ratio, this may not translate into appropriate levels of access for all subjects. Some 10 per cent of primary and special schools and 20 per cent of secondary departments have unsatisfactory access to resources.* (Ofsted, 2004, p.11)

There is evidence that many school buildings restrict the development of ICT, including the ability to site computers in classrooms. This may account for some of the larger differences between primary schools. In 2004 around two-thirds of schools reported that their buildings restricted ICT developments, either because of size, age or layout (PwC, 2004a). In addition, Ofsted has noted that there is inadequate space in some schools which are popular and overcrowded (Ofsted, 2004).

### Other supporting technologies

Inspection data indicates that the use of digital projectors and interactive whiteboards is becoming more widespread and supports some very high quality teaching:

*Interactive whiteboards are becoming increasingly prevalent, despite their cost, with teachers using their power and versatility to produce some excellent lessons.* (Ofsted, 2004, p.32)

Evaluations of the DfES Schools Whiteboard Expansion programme are currently in progress. This research will provide a robust assessment of the impact of using interactive display technologies on learning and other outcomes; to date, evidence of impact has been on a very small scale, and difficult to generalise to a larger picture. We do know, however, that interactive whiteboards and related technologies have a positive impact on pupil and teacher motivation in learning and teaching (Passey et al, 2003).

There has been a recent very sharp rise in the provision of whole-class display technologies (see Figure 2.2 for digital projectors). In 2004 most schools reported having access to this technology, and the rapid rise in adoption suggests that many classrooms will become equipped over the next few years. At the moment, however, levels of whole-class display technology are low compared to the total number of classrooms in schools.

**Table 2.1:**

| Pupils per computer in primary schools | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pupils per computer | Less than 5 | 5.00-5.99 | 6.00-6.99 | 7.00-7.99 | 8.00-8.99 | 9 or more | All | Base (primary schools) |
| % of schools with this total | 14 | 14 | 17 | 18 | 14 | 23 | 100 | 1079 |

**Table 2.2:**

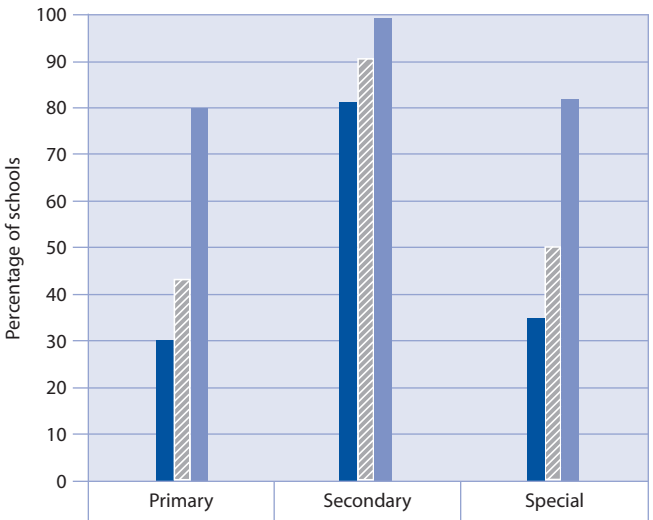
| Pupils per computer in secondary schools | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pupils per computer | Less than 3 | 3.00-3.99 | 4.00-4.99 | 5.00-5.99 | 6.00-6.99 | 7 or more | All | Base (secondary schools) |
| % of schools with this ratio | 9 | 23 | 31 | 19 | 9 | 8 | 100 | 893 |

**Table 2.3:**

| Pupils per computer in special schools | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pupils per computer | Less than 2 | 2.00-2.99 | 3.00-3.99 | 4.00-4.99 | 5 or more | All | Base (special schools) |
| % of schools with this total | 28 | 26 | 25 | 10 | 11 | 100 | 458 |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

**Figure 2.2: Percentage of schools with digital projectors**




| | Primary | Secondary | Special |
|---|---|---|---|
| 2002 | 30% | 82% | 35% |
| 2003 | 43% | 91% | 50% |
| 2004 | 80% | 99% | 82% |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

Supporting technologies are particularly important for pupils with special educational needs (SEN). In 2004, 63 per cent of special schools had specialist equipment for SEN pupils and pupils with disabilities, such as speech-recognition software and other specialist peripherals. In mainstream schools, 35 per cent of secondary and 19 per cent of primary schools had such specialist equipment for pupils with special needs (Prior and Hall, 2004).

### Connectivity and bandwidth

Evidence from lesson observation in the evaluation of broadband (Underwood et al, 2004) indicates that increased bandwidth can result in improved pace of lessons and use of time, increased pupil motivation for ICT work, and better quality lesson outcomes. The key benefits of using broadband identified from the research are summarised in a review of the literature (Underwood et al, 2003) as:

- enhancing the learning experience
- improving co-operation between educational institutions
- delivering new potentialities, such as delivering real-time satellite images into the classroom
- improving efficiencies in existing educational provision
- widening access to education with significant impact on lifelong learning.

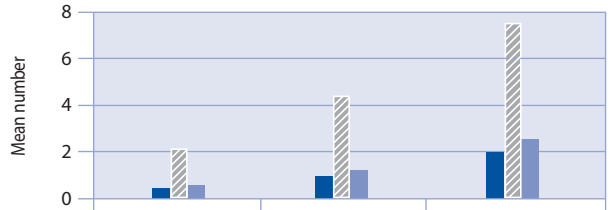
Ofsted maintains that increased bandwidth, and broadband in particular, has:

*…had a significant impact on the quality and range of work that schools can undertake. In particular, it has made systems faster and more robust.*

As with client-computers, there have been significant improvements in internet bandwidth availability to institutions over the last five years. Non-broadband connections are declining rapidly, although dial-up modems and ISDN connections are still common in primary and special schools. In 2004, 8 per cent of primary schools, 28 per cent of secondary schools and 12 per cent of special schools had broadband connections of 8Mbps or higher (Prior and Hall, 2004). Over 95 per cent of secondary, 45 per cent of primary and 44 per cent of SEN/PRU schools had a broadband connection of 2Mbps or above (Becta, 2004a).

As would be anticipated, primary schools fall behind secondary schools in this respect. But again, there is a marked variation between schools in the same sector (see Figure 2.5).

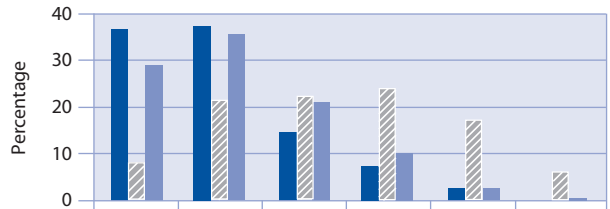
**Figure 2.3: Mean number of interactive whiteboards per school**




| | 2002 | 2003 | 2004 |
|---|---|---|---|
| Primary | 0.4 | 1 | 2 |
| Secondary | 2.1 | 4.3 | 7.5 |
| Special | 0.6 | 1.3 | 2.6 |

Source: *ICT in Schools Survey 2003 and 2004 (The Stationery Office 2003; Prior & Hall 2004)*

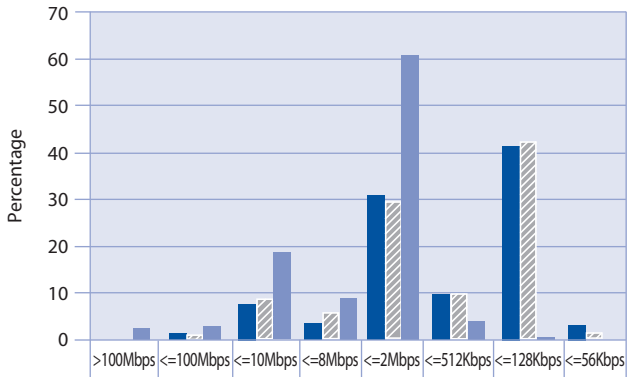
**Figure 2.4: Number of interactive whiteboards per school**




| | None | 1 to 2 | 3 to 5 | 6 to 10 | 11 to 20 | 21 or More |
|---|---|---|---|---|---|---|
| Primary | 37% | 38% | 15% | 8% | 3% | 0% |
| Secondary | 8% | 22% | 23% | 24% | 17% | 6% |
| Special | 29% | 36% | 21% | 10% | 3% | 1% |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

**Figure 2.5: Internet connection speeds**




| | >100Mbps | <=100Mbps | <=10Mbps | <=8Mbps | <=2Mbps | <=512Kbps | <=128Kbps | <=56Kbps |
|---|---|---|---|---|---|---|---|---|
| SEN/PRU | 0% | 1% | 7.8% | 3.9% | 31.4% | 9.8% | 42.2% | 3.9% |
| Primary | 0% | 0.9% | 8.8% | 5.9% | 29.7% | 10% | 42.9% | 1.8% |
| Secondary | 2.5% | 3.0% | 18.9% | 8.8% | 61.9% | 4.4% | 0.5% | 0% |

Source: *Survey of LAN Infrastructure and ICT Equipment in Schools (Becta 2004a)*

Despite differences in school sizes, which demand different bandwidth availability, teachers' perceptions of the speed of their internet connection in fact relate fairly directly to the actual connection speed. In the case of secondary schools, teachers' perceptions are generally that their internet connection speed is good, but primary teachers are more likely to judge the speed of their connection as poor (Becta, 2004a). It may be that there is a particular need to prioritise primary provision in this respect, though it is important to understand impact in the context of other potential bottlenecks, such as LAN speed and reliability.

It is also important to recognise that upgrading to a particular connection speed does not automatically deliver an enhanced experience for users. As Ofsted notes:

*Few schools as yet make significant use of applications that specifically require broadband.* (Ofsted, 2004, p.5)

Exploiting the full educational benefit of broadband is something that Ofsted sees as a requirement for the future and recommends as an action area at both LEA and regional level.

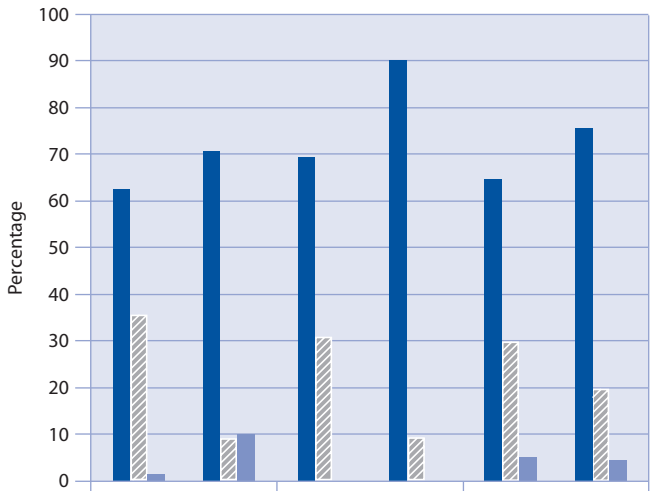
### Networked classrooms and wireless networks

The pattern of marked infrastructure improvement over recent years can also be seen in networking. An increasing number of institutions have access to classroom networks. However, as with other areas of infrastructure provision, a considerable minority of primary schools have limited classroom networking and are clearly starting from a low base in terms of embedding ICT.

Though the design of some school buildings is a known barrier to ICT deployment, there is evidence of a recent improvement in networking of teaching and learning areas in primary schools. In terms of those who are not improving their networks, it seems that among both primary and secondary schools, the smallest schools are those least likely to be implementing networks across the school (see Figure 2.6).

Ofsted notes that the use of sets of laptops on trolleys, wirelessly linked to the school network from different parts of the school, can have a profound impact in providing access to the school network, where this has been undertaken as a sustained programme of development to improve the uptake of ICT across subjects (Ofsted, 2004).

**Figure 2.6: Extent of networking in different areas**




| | Primary | | Secondary | | Special | |
|---|---|---|---|---|---|---|
| | Teaching & learning areas | Management & administration areas | Teaching & learning areas | Management & administration areas | Teaching & learning areas | Management & administration areas |
| All | 62% | 71% | 69% | 90% | 65% | 76% |
| Some | 36% | 9% | 31% | 9% | 30% | 20% |
| None | 2% | 10% | 0% | * | 5% | 5% |

* Equals less than 0.5% but greater than 0

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

More than a fifth (21 per cent) of primary and special schools and 54 per cent of secondary schools have some access to wireless networks, and this is growing (Prior and Hall, 2004). There are still particular technical challenges in this area, though, and schools require support to deal with these. For example, in 2003, 12 per cent of secondary, 20 per cent of primary and 25 per cent of SEN/PRU schools did not have sufficient security for operating wireless elements of their networks (Becta, 2004a).

There is a potentially critical networking barrier to the integration of curriculum and management information (covered later under 'Institutional development'). In a significant minority of schools, the network does not support both curriculum and management functions (Becta, 2004a). In addition, some management and administrative computers in schools are not connected to the internet, suggesting that the underpinning infrastructure is not in place for integrating learning and data services (see Figure 2.7).

### ICT service provision

Little is known about the comparative effectiveness and efficiency of different forms of ICT support and maintenance. Ofsted observes that that the amount and quality of technical support can vary considerably between schools (Ofsted, 2004). Primary schools generally were considered to have insufficient

technical support, although those involved in shared schemes within clusters of schools or an LEA generally achieved good value for money. Ofsted concluded that:

*Most schools, however, do not make systematic cost-benefit analysis of their technical support and it is rare for senior management to make use of the information available on how their network is used.* (Ofsted, 2004, p.17)

Emerging findings from the forthcoming report, ICT Test Bed Evaluation Year 2, indicate that the presence of an on-site technician to 'troubleshoot' at initial stages was critical to the success of embedding technology into practice.

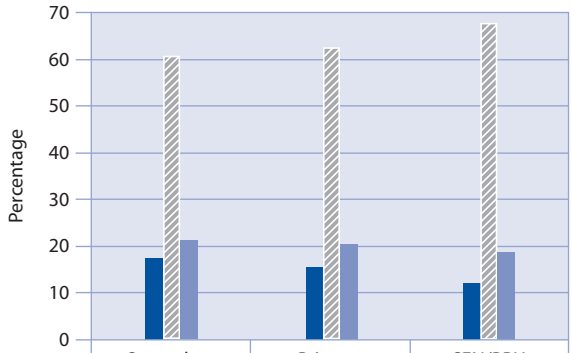
Ofsted notes that many schools do not provide such support or have to make ad hoc arrangements to meet their needs. Not only does good technical support boost staff confidence, it improves the reliability of resources. Many primary schools do not yet recognise the necessity to plan for technical support in the total cost of ownership of ICT. Ofsted recommends that, at a national level, consideration should be given to ways of stimulating schemes for sharing technicians among primary schools and at LEA and regional level, ensuring that adequate technical support is included as an essential element of planning for ICT. Ofsted also identifies the need for a national structure of accredited training programmes for school-based technicians, which incorporate schemes already available (Ofsted, 2004).

### Sustainability

As the number of computers in schools has increased over time, schools need to manage both the purchase of new computers and the re-use or disposal of older equipment. The ICT in Schools Survey 2004 found that in primary schools, 47 per cent of computers used for teaching and learning were more than three years old. The actual number of computers over three years old in secondary schools has increased since 2003, from 66 to 75 on average per school.

Becta's Total Cost of Ownership (TCO) pilots are a source of indicative information on the sustainability of institutional ICT provision. A Becta publication drawing on material from the TCO pilots will be published early in 2005, followed by further project reports on strategic financial planning. This work indicates that institutions benefit from support in planning for sustainability. There are also indications that if schools are supported in strategic planning for ICT, they can achieve sustainable provision without incurring large increases in ICT spending. However, owing to the low sample size, further research is required to assess the value of this kind of approach for the sector as a whole.

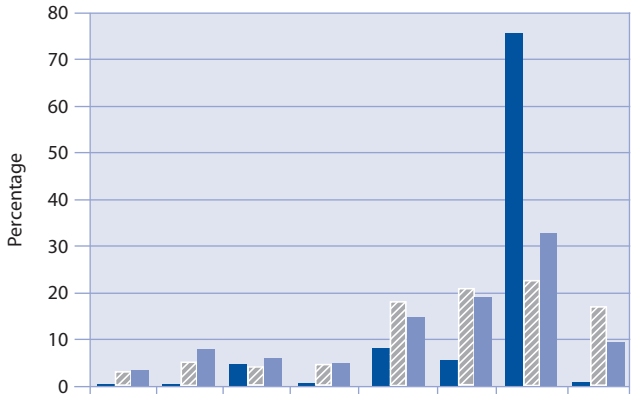
**Figure 2.7: Principal role of networking**




| | Secondary | Primary | SEN/PRU |
|---|---|---|---|
| Administration | 18.2% | 16.3% | 12.2% |
| Combined | 60.7% | 62.9% | 68.7% |
| Curriculum | 21.0% | 20.9% | 19.1% |

Source: *Survey of LAN Infrastructure and ICT Equipment in Schools (Becta 2004a)*

**Figure 2.8: Day-to-day maintenance**




| | Unknown | Other | Partially managed service | Fully managed service | Outsourced support contract | LEA | In-house technician | Teacher |
|---|---|---|---|---|---|---|---|---|
| Secondary | 0.4% | 0.6% | 4.8% | 1.3% | 8.2% | 6.9% | 75.9% | 1.7% |
| Primary | 3.2% | 6.1% | 4.6% | 5.6% | 18.5% | 21.4% | 23.6% | 17.0% |
| SEN/PRU | 3.5% | 7.8% | 6.1% | 5.2% | 14.8% | 19.1% | 33.9% | 9.6% |

Source: *Survey of LAN Infrastructure and ICT Equipment in Schools (Becta 2004a)*

Inspection evidence suggests there is anxiety in many schools about basic maintenance and replacement costs and whether these can be sustained (Ofsted,

2004). PricewaterhouseCoopers (PwC) also identified concerns about future levels of ICT funding in relation to institutions' ability to plan for sustainable provision. While most schools had a broad awareness of ICT sustainability issues, many – particularly primary schools – were not planning effectively in this respect (PwC, 2004a). One in three primary schools indicated that their plans did not allow for the replacement of equipment after its life expectancy had expired, for example.

Sustainability is linked to procurement processes and the way funding is allocated. The PwC survey found that approximately three-quarters of all institutions (including special schools) bought major items of ICT equipment and 10 per cent leased equipment, with a further 16 per cent using a combination of leasing and buying. Case study data involving 18 schools found that leasing may be useful in some circumstances. It allowed schools to implement major upgrades without incurring a major capital outlay at the time of delivery. While this did not result in a reduction in the overall cost, it permitted a school to use funding in a more effective way and could allow planning to be more easily controlled.

## DEVELOPMENTS IN THE LEARNING AND SKILLS SECTOR

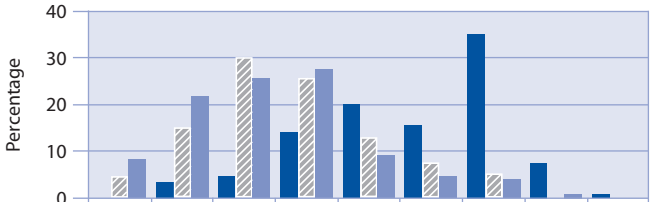
Much of the evidence on infrastructure in the learning and skills sector comes from the Becta ILT survey (now renamed the ICT and e-learning in Further Education survey). This, however, covers FE institutions only; while NIACE has produced a recent survey of adult and community learning (ACL) provision, this does not give a representative picture of ACL providers.

### Provision of hardware

As with schools, there has been similarly sustained improvement to student-to-computer ratios in FE colleges. The mean average number of full-time equivalent (FTE) students per computer has fallen from 8.2:1 in 1999 to 4.4:1 in 2004. The median value (the ratio of colleges at the middle of the range of values) is 4.3:1, compared to 7.6:1 in 1999.

Figure 2.9 shows the pattern over the last five years – a considerable reduction in the percentage of institutions with very high student-to-computer ratios. However, there is a slightly wider disparity between colleges in 2004 compared to 2003, although this is not statistically significant.

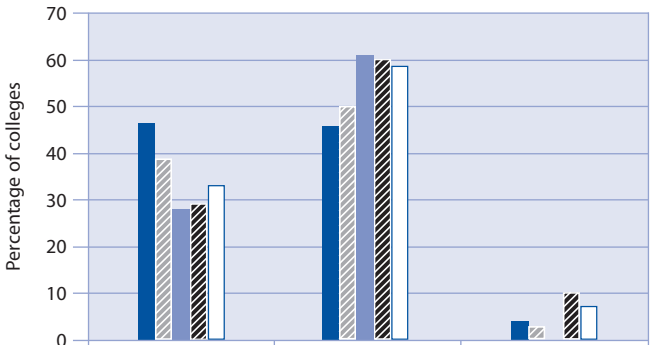
**Figure 2.9: Ratio of FTE students to all computers**




| | Better than 3:1 | 3:1 | 4:1 | 5:1 | 6:1 | 7:1 | 8:1 to 11:1 | 12:1 to 20:1 | 20:1+ |
|---|---|---|---|---|---|---|---|---|---|
| 1999 | 0% | 3% | 4% | 14% | 20% | 16% | 35% | 7% | 1% |
| 2001 | 4% | 15% | 30% | 26% | 13% | 7% | 5% | 0% | 0% |
| 2004 | 8% | 22% | 26% | 28% | 9% | 4% | 3% | 1% | 0% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

**Figure 2.10: Meeting student demand for computers**




| | Difficulty meeting demand | Sufficient capacity for demand | Sufficient capacity for greater demand |
|---|---|---|---|
| 1999 | 47% | 46% | 4% |
| 2000 | 39% | 50% | 3% |
| 2001 | 28% | 61% | 0% |
| 2003 | 29% | 60% | 10% |
| 2004 | 33% | 59% | 7% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

While ratios have improved, a significant proportion of institutions state difficulty in meeting student demand. The general rise in institutions able to meet student demand stalled in 2004 – possibly due to increased student numbers. Increasing FTEs are consuming the extra ICT capacity (see Figure 2.10).

### Other supporting technologies

As with schools, there has been a rapid growth in access to display screen technologies. Nearly all colleges (98 per cent) use data projectors; two-thirds

describe their use as frequent. Interactive whiteboards represent a fair proportion of this, and are becoming more popular – 31 per cent of colleges say they are used frequently, up from 21 per cent in 2004 (Becta, 2004c). Results from the National Learning Network (NLN) e–learning survey (LSDA/NLN, 2004) suggest that full-time staff were more likely than part-time staff to use a whiteboard and data projector. Three-quarters of staff surveyed had never used mobile devices such as PDAs in class.

The survey of ILT in adult and community learning (Rawicka et al, 2004) found that LEAs have access to a relatively wide range of equipment to deliver and support learning, including digital projectors (65 per cent), interactive whiteboards (40 per cent) and wireless equipment (38 per cent). However, the report noted that subsequent research suggests that they have only a limited number of each item. The overall picture would appear to be that developments are at an early stage, with pockets of innovation and evidence of potential benefits.

### Connectivity and bandwidth

A picture similar to that for student computers can be seen in capacity to meet demand for internet access, that is, one of steady improvement. There remains a proportion of institutions reporting that they cannot cope with demand for internet access, despite recent investment across the sector (see Table 2.4).

### Networking

Network capacity is the one area in which the improvements seen over the last few years have been sustained. However, institutions claiming that they are overstretched have remained fairly consistent over the last three years at between 5 per cent and 7 per cent (see Figure 2.11).

Another success is in the provision of computers for staff. In the FE sector, the median permanent staff-to-computer ratio has reached 1.0. It is reported that some colleges have bettered this (see Table 2.5).

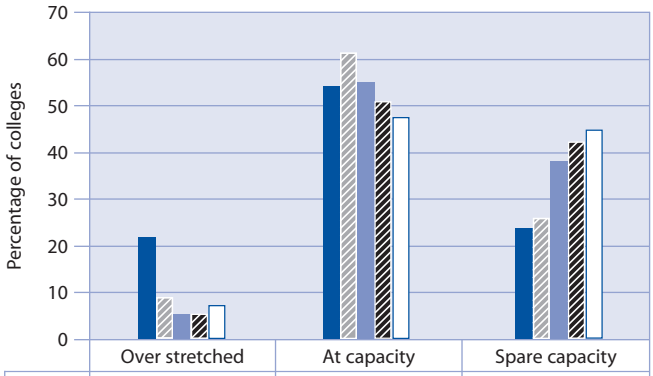
There is a trend by colleges away from plans for increased internet bandwidth over and above the 2Mbps minimum for most colleges. Becta's ICT and e-learning survey suggests that colleges have judged that the benefits of increasing the bandwidth do not outweigh the costs. However, a minority of colleges are planning to increase bandwidth considerably, which is an indication of variation between institutions, and possibly polarisation.

**Table 2.4:**

| Meeting student demand for internet access | | | | | |
|---|---|---|---|---|---|
| *College capability* | 2004 | 2003 | 2001 | 2000 | 1999 |
| Cannot cope with current demand | 25 | 25 | 25 | 39 | 54 |
| Can cope with current demand | 61 | 63 | 58 | 45 | 25 |
| Can cope with greater demand | 12 | 11 | 11 | 7 | 5 |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

**Figure 2.11: Network capability to meet demand**




| | Over stretched | At capacity | Spare capacity |
|---|---|---|---|
| 1999 | 22% | 54% | 24% |
| 2000 | 9% | 62% | 27% |
| 2001 | 5% | 55% | 38% |
| 2003 | 5% | 51% | 43% |
| 2004 | 7% | 47% | 45% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

**Table 2.5:**

| Median ratio of teaching staff to internet-connected computers | | | | | |
|---|---|---|---|---|---|
| | 2004 | 2003 | 2001 | 2000 | 1999 |
| All teaching staff | 1.9 | 2.4 | 3.5 | 4.1 | 12.0 |
| Permanent staff | 1.0 | 1.4 | 1.9 | 3.0 | **7.0 |

**Estimate based on 1999 data
Source: *ICT and e-learning in Further Education (Becta 2004c)*

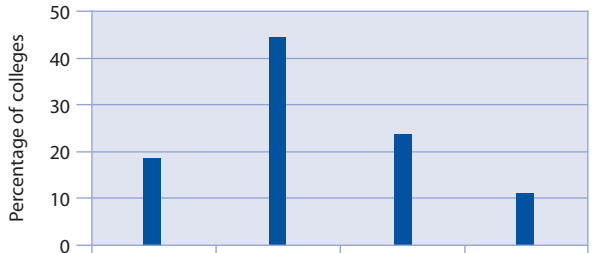
### Sustainability

There is little data on sustainability in FE. However, the 2004 Becta ICT and e-learning survey asked institutions about their replacement policy for computers. There was some variation here, with 35 per cent of institutions

reporting that their policy was to replace computers every four to five years or when they cannot be repaired (see Figure 2.12). As would be anticipated, institutions with these policies recorded older computer stock.

PwC (2004a) found that the case study colleges they visited did not tend to lease equipment. As replacements were made on a four-year cycle, there was considered to be little difference between paying a lease payment of 25 per cent of the value of all machines and simply replacing 25 per cent of them outright each year. In addition, colleges usually arranged purchasing agreements with preferred suppliers on an annual basis.

**Figure 2.12: Replacement policy for college computers**




| | 3 years or less | Every 3 - 4 years | Every 4 - 5 years | When cannot be repaired |
|---|---|---|---|---|
| % of colleges | 19% | 44% | 24% | 11% |

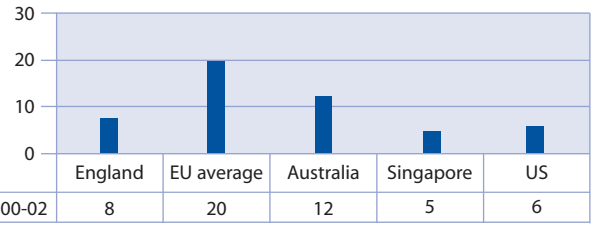
Source: *ICT and e-learning in Further Education (Becta 2004c)*

## INTERNATIONAL COMPARISONS

What data there is relating to international comparisons is almost exclusively to do with infrastructure provision. However, making international comparisons is not straightforward for a number of reasons. Some EC data may relate to surveys conducted in 2002 or earlier. In addition, the way the data has been collected makes it difficult to make like-for-like comparisons, or the data is not comprehensive across the same range of countries.

Ofsted (2004) considers that ICT resources for schools are at record levels and compare well with other countries. In terms of pupil-to-computer ratios, England compared well with other EU countries in the latest figures available. However, the US and Singapore were ahead of the UK in 2002 (see Figure 2.13).

**Figure 2.13: International comparisons of pupils per computer**




| | England | EU average | Australia | Singapore | US |
|---|---|---|---|---|---|
| 2000-02 | 8 | 20 | 12 | 5 | 6 |

Source: *English and EU data from Eurydice report 2004 (original data from OECD PISA database); Australian, Singaporean and US data from OrbIT INESCO G8 report 2000*

The RM G7(8) Report (RM, 2000) found that in 2000 the UK provided the widest spread of access to hardware and internet connections (especially at secondary level), although compared to Canada and the USA, UK pupil-to-computer ratios were higher. Among the G8 nations (the others being USA, Canada, Japan, Italy, France, Germany and Russia), the UK is unique in defining entitlement to ICT across the full age range from 5 to 16. The report also demonstrated that the UK was maintaining its five-year position as a leader among the G8 nations, providing equity of access to resources across the country, entitlement to technology training for 5–16-year-olds and considerable investment in teacher training.

The OrbIT 2000 Report (OrbiT, 2000) identified that the UK had integrated ICT into its national curricula more than many other countries, and compared favourably with developments in Canada, France, Germany, the Netherlands and Sweden in this respect.

# 3 EDUCATIONAL CONTENT


**Summary**

The Government has developed specific initiatives for the provision of educational content to support learning and teaching in a variety of ways, including e-Learning Credits to schools, and NLN materials development in the post-16 sector.

There is clear evidence of a trend towards better supply of content for schools, indicated by the registration of Curriculum Online products. Core subjects appear to be best served in terms of the number of available resources, but there is a trend towards improved supply across the curriculum. Research into teachers' perceptions of content availability, however, indicates differences in perceived ability to locate 'appropriate' resources based on key stage (more difficult at Key Stages 1 and 2) and subject (reported as more difficult for science and English than for other subjects).

There are no direct indicators of educational content supply in the post-16 sector. However, in-house development of e-learning content accounts for a significant proportion of electronic materials used with students. Demand for content in this sector appears highest in core curriculum areas and in business administration and ICT, but is relatively low in trade-related subjects.

Regular use of educational content in lessons by teachers is growing. The use of educational content in the post-16 sector is in the early stages of embedding, but is also growing. Levels of use of VLEs and MLEs are higher in FE colleges than in schools, where use is very low.

There is evidence that high-quality educational content enables the realisation of learner attainment gains, but only if accompanied by pedagogically-informed practice.

On the basis of current data, it is difficult to assess the quality of existing educational content and there is a need for a more sophisticated analysis of the dimensions of quality in practice.


The UK has a long history of software development for learning and a long, but at times fragmented, history of central and local support for development. Along with action to improve levels of ICT infrastructure and internet connectivity, government policy has sought to improve the availability and use of high quality and appropriate educational content, while also developing teachers' abilities to use these resources effectively.

A key element in this programme is the provision of e-Learning Credits to allow schools to purchase digital resources. In the post-16 sector, the NLN materials programme has the same aims, but is based on the delivery of centrally-commissioned learning content in key areas, rather than direct supply by commercial and non-government suppliers.

# DEVELOPMENTS IN SCHOOLS

### Defining 'content'

The term 'educational content' in the context of this report will be taken to refer to the full range of assets and data, digital learning resources, and software tools which teachers and learners can use to explore, analyse, communicate and interact with others. A key component is the technology and management software needed to manage digital resources, their application and their use.

### Supply and availability of content and software

The CAB analysis of Curriculum Online registrations showed that there are over 11,000 titles currently listed; 7,200 are priced products, supplied by 454 content providers, while 3,800 are free. Products intended for use in English, maths, science and ICT account for the majority of priced products currently available (Becta/CAB, 2004a, 2004b). On the face of it, it would seem that the supply of content is healthy, and that there are no real challenges to meet in improving availability to schools (see Figure 3.1).

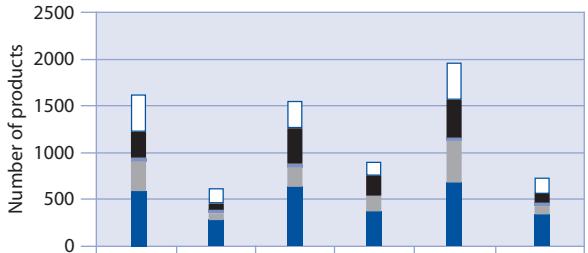
Closer analysis of the products registered, however, shows that some subject areas are served better than others, though there is a clear trend towards increased publication of products across the curriculum – see Figure 3.2 (Becta/CAB, 2004b).

There appear to be differences in teachers' perceptions of availability. The Curriculum Online baseline survey (Kitchen and Finch, 2003) found that while 20 per cent of secondary school teachers said that it was very easy to find relevant software for their subject for Key Stages 3 and 4, only 12 per cent of primary school teachers felt the same for software at Key Stages 1 and 2. This may be due to differences in teachers' access to personal internet computers to download information on software, rather than a problem with the supply itself.

There were differences between subjects in this respect. Areas reporting relative difficulty in locating software were:

- Key Stage 3 English (32 per cent reporting it was not very easy or worse)
- Key Stage 4 modern languages (38 per cent reporting it was not very easy or worse)
- Key Stage 4 English (36 per cent reporting it was not very easy or worse).

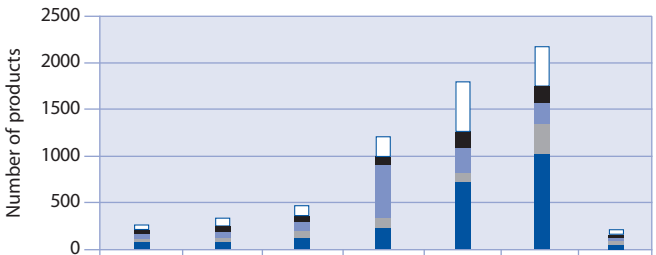
**Figure 3.1: Number of priced products by major subject area and learning resource type**




| | English | ICT | Maths | Science | Other | No subject |
|---|---|---|---|---|---|---|
| No category given | 592 | 233 | 676 | 350 | 691 | 309 |
| Reference materials | 330 | 61 | 226 | 148 | 465 | 115 |
| Application/Tools | 6 | 28 | 13 | 0 | 16 | 6 |
| Assessments | 253 | 57 | 381 | 202 | 393 | 87 |
| Curriculum based resources | 408 | 192 | 262 | 124 | 408 | 173 |

Source: *Content Advisory Board report to the Secretary of State (2004)*

**Figure 3.2: Number of priced products by year of publication and major subject area**




| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| English | 55 | 64 | 100 | 213 | 721 | 1083 | 56 |
| ICT | 14 | 9 | 53 | 62 | 121 | 328 | 14 |
| Maths | 19 | 35 | 90 | 575 | 282 | 450 | 8 |
| Science | 10 | 22 | 26 | 52 | 195 | 152 | 9 |
| Other | 27 | 65 | 82 | 236 | 567 | 429 | 23 |

Source: *Content Advisory Board report to the Secretary of State (2004)*

A majority of teachers (56 per cent) reported that it was easier to find relevant material for teaching in textbooks than on the internet, though most respondents in this survey thought that there was a lot of useful material for the curriculum to be found on the internet (77 per cent of primary teachers and 79 per cent of secondary teachers).

### Quality

In terms of impact, systematic reviews of existing small-scale research (Cox et al, 2003a) have found that high-quality, interactive learning resources are

more likely to be related to higher learning gains for pupils than other resources. The reviews point to substantial evidence of the impact of specific uses, for example, using simulations and modelling in science and mathematics. However, impact is dependent on teachers' use and quality of implementation.

As yet, there is no universal agreed framework for content quality. Quality of educational resources includes technical aspects such as interoperability and accessibility, system facilities such as those to track learner progress through a package, plus content and pedagogical design aspects such as whether it is suitable for learners with particular needs or learning styles, and appropriate for the curriculum or subject area it seeks to address.

Teachers' perceptions of software offer an indication of overall levels of quality, but are unlikely to represent the full picture. The Curriculum Online evaluation baseline survey of schools and teachers (Kitchen and Finch, 2003) suggests that in one respect – relevance of content – teachers' perceptions are generally positive. The survey found that across all key stages, 70 to 80 per cent of teachers reported software to be 'quite good' or 'very good'.

An earlier finding from the ImpaCT2 case study research (Comber et al, 2002) found that teachers were concerned about the proliferation of educational software and the difficulty of knowing what was useful or appropriate. Few were aware of the range of help and advice available; judging the usefulness of software before purchase was regarded as difficult and time-consuming. Most teachers relied on word-of-mouth advice or software catalogues. Teachers' judgements of relevance of content varied considerably between key stage subject areas.

According to the 2003 Curriculum Online survey, subjects which teachers judged relatively poorly served for relevant content were:

- Key Stage 1 science (40 per cent rating software 'not very good' or 'not at all good' for relevant content)
- Key Stage 2 science and English (only 5 per cent in each case rated it as 'very good' for relevant content)
- Key Stage 3 and 4 English (27 per cent rating it as 'not very good' or 'not at all good' at Key Stage 3, and 35 per cent giving the same ratings at Key Stage 4).
- Music teachers were the most likely to rate software for their subject as 'very good' for relevant content, both at Key Stage 3 (27 per cent) and Key Stage 4 (41 per cent).

Between 75 per cent and 82 per cent of teachers across all key stages rate the technical quality of software as either 'very good' or 'quite good.' It is possible, however, that teachers are poor at making judgements about the technical quality of software. Overall, there are no reliable indicators of the quality of content supplied to schools, or routine monitoring of improvements in the quality of supply in place. Further evidence is clearly needed in this area.

### Demand and use

In 2003, only 20 per cent of secondary schools and 30 per cent of primary schools reported that the level of funding for software was about right or more than needed (Kitchen and Finch, 2003). However, since the introduction of the Curriculum Online programme this has improved significantly, and it is likely that this programme has helped meet demand for software. In the 2004 follow-up survey, 45 per cent of secondary schools and 68 per cent of primary schools reported that the level of funding was about right or more than was needed (Kitchen and Finch, 2003).

Schools' choices from the available software, however, are very narrow. Curriculum Online data suggests that content purchases by schools tend to be concentrated on a relatively small number of suppliers and products which dominate the schools content market. As the 2004 CAB report states:

*…spend is concentrated on a relatively small number of suppliers – 61 per cent of spend goes on 2 per cent of registered suppliers of priced product (10 companies). These suppliers provide only 12 per cent of the registered products… 48 per cent of spend in 2002-03 related to the most popular 20 products.* (CAB 2004, pp.6–7)

Curriculum Online evaluation (Kitchen and Finch, 2003, 2004) surveyed teachers' views on how easily they located relevant curriculum-related software. The 2004 follow-up survey suggests that the ease of finding software had not significantly improved since the baseline survey, with the exception of Key Stage 2, where the proportion of subject-level respondents reporting it was easy to find software rose from 68 per cent to 73 per cent (Kitchen and Finch, 2004).

However, availability is just one challenge. Teachers interviewed as part of the Curriculum Online qualitative study considered that the standard of their existing hardware, and the time required to evaluate materials thoroughly and embed them into practice were constraining their use of educational content and affecting related spending of their e-Learning Credits (Dixon et al, 2004).

The 2004 Curriculum Online survey found that the most commonly used resources for primary teachers are 'computer packages', that is, office applications (for example, word-processors, spreadsheets) and subject-

specific software applications. In secondary schools, the highest figures for frequency of using ICT resources in half or more of lessons by subject teachers was 14 per cent for computer packages and a similar figure for subject-specific software applications. (A more detailed analysis of the 2004 findings by key stage and subject is considered in the 'Learning and teaching' section of this review).

### Learning platforms and virtual learning environments (VLEs)

In contrast to the learning and skills sector, VLEs are not as much a feature of school provision as they are in FE colleges. In 2004, around one-quarter of secondary schools reported they had a VLE, and only 6 per cent in primary schools (PwC, 2004a).

Evidence of the impact of VLEs and related technologies in schools is limited to case studies from early adopters. Nonetheless, as schools expand their collections of digital learning resources, as appears to be the case from spending of e-Learning Credits, the need for improved learning platforms to support and deliver interoperable content is likely to become increasingly critical to successful content deployment and use.

## DEVELOPMENTS IN THE LEARNING AND SKILLS SECTOR

### Supply and availability of content and software

Evidence on the supply of content to the learning and skills sector is very limited.

We know that free materials are available for institutions via the NLN materials programme, which has provided learning content in a range of priority curriculum areas. Initial choices for provision have been based on subjects prioritised by *Success for All*.

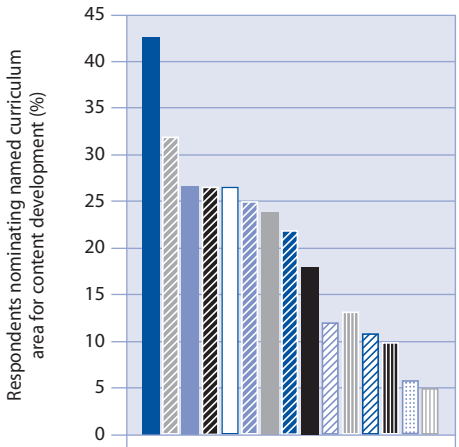
There is also data on Ufi/learndirect resources. This is not covered in detail in this report. However, Ufi/learndirect materials are extensive, covering many thousands of hours of learning content. The supply emphasises skills for life – literacy, numeracy and ICT – and vocational/professional skills where there is an employer market.

**Table 3.1:**

| Frequency of using ICT resources in lessons | | |
|---|---|---|
| | Primary teachers *(% half lesson or more)* | Secondary teachers *(% half lesson or more)* |
| Computer packages | 26 | 14 |
| Internet-based resources | 14 | 10 |
| Interactive whiteboards | 11 | 11 |
| Subject-specific software | 18 | 14 |
| Base: All teachers | 733 | 1212 |

Source: *Evaluation of Curriculum Online: Report of the Follow-Up Survey of Schools (Kitchen & Finch 2004)*

**Figure 3.3: Requests for development of e-learning content by curriculum area**




| | |
|---|---|
| English, languages and communications | 43% |
| Foundation programmes | 32% |
| Business administration | 27% |
| ICT | 27% |
| Visual and performing arts and media | 27% |
| Health, social care and public services | 25% |
| Hospitality | 24% |
| Humanities | 22% |
| Science and maths | 18% |
| Hairdressing and beauty therapy | 16% |
| Land-based provision | 13% |
| Other | 11% |
| Retailing, customer services | 10% |
| Engineering, technology and manufacturing | 6% |
| Construction | 5% |

Source: *NIACE/NLN The Potential of e-learning (2004)*

Little is known about the commercial supply of content for the learning and skills sector. However, as post-16 provision is fragmented, with a myriad of qualifications and a diversity of learners, it is unlikely that many curriculum areas – apart from skills for life – are large enough to support direct commercial provision. Commercial provision is most likely in the case of the overlap with school curricula, that is, popular A-levels. Informal evidence suggests that commercial providers provide resources for these curricula (for example, A-level psychology).

Though coherent evidence on content supply is limited, there are indications of a lack of current supply of materials across the curriculum from a NIACE/NLN survey of adult and community learning providers – many of whom are FE colleges. Evidence of demand may be seen from the requests for the development of e-learning content indicated in Figure 3.3. The most requested subjects for materials were English, languages and communications (43 per cent). This was closely followed by foundation programmes (32 per cent) business administration (27 per cent), ICT (27 per cent), and visual and performing arts and media (27 per cent).

Though also technically a demand indicator, the Becta ICT and e-learning survey estimates that in total FE institutions spent £7.5m last year on electronic materials, suggesting that the commercial sector is supplying in some areas, as NLN materials are provided freely to colleges.

In addition, the survey found that there was a significant amount of in-house supply of electronic learning materials for use with students in FE institutions (see Figure 3.4). Given that, unlike schools, not all college-based subjects of study have the 'critical mass' to support independent or commercial development of content or courseware, colleges develop proportionally more of their materials and models in-house than schools (PwC, 2004a). In this context, colleges considered that intellectual property was an important issue to address.

### Quality

There is currently no routine mechanism for monitoring the quality of content provision in the post-16 sector. There is some evidence, however, on quality from the use of NLN materials which was studied in six colleges (Becta/NLN, 2004). The research offers some clear indications of users' views on quality. Learners value materials with multimedia presentations, including audio, manageable chunks of information, and self-assessment and feedback. Tutors value support for differentiation in learning, diversity in learning design and the 'learning object' approach. They recognised that NLN materials set the standard for quality and represent exemplars to the content industry.

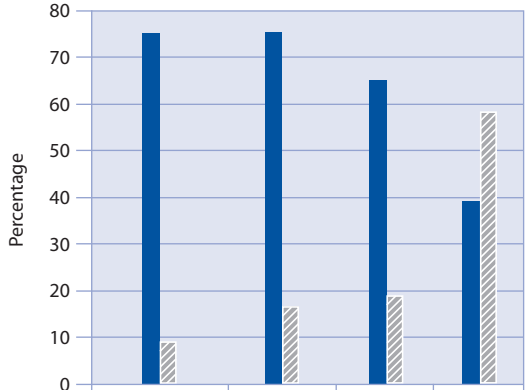
### Deployment and use

Becta's 2004 survey of ICT and e-learning in the FE sector indicates that NLN materials are at an early stage of embedding – but their use is growing. The internet was the most frequently reported source of learning materials, being used in 97 per cent of colleges (94 per cent in 2003) and in common use in 58 per cent (43 per cent in 2003). Of the 84 per cent of colleges who use NLN materials, 9 per cent described their use as common practice, an increase from 5 per cent in 2003.

Colleges were asked to rank sources of learning materials in order of importance. The ranking corresponded to the level of use, with internet resources ranked as most important and NLN materials ranked fourth (see Figure 3.4).

NIACE surveyed local authorities, FE colleges and voluntary and community organisations on behalf of the NLN to gauge levels of use of e-learning across post-16 curriculum areas (see Figure 3.5). ICT was the curriculum area where most respondents claimed to be already delivering e-learning content (52 per cent), followed by foundation programmes (31 per cent),

**Figure 3.4: Electronic learning Materials used with students**




| | NLN materials | Bought-in | In-house | Internet |
|---|---|---|---|---|
| We do this | 75% | 75% | 65% | 39% |
| This is common practice | 9% | 17% | 29% | 58% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

English, languages and communications (28 per cent), business administration (23 per cent), and visual and performing arts and media (19 per cent) (Rawicka et al, 2004).

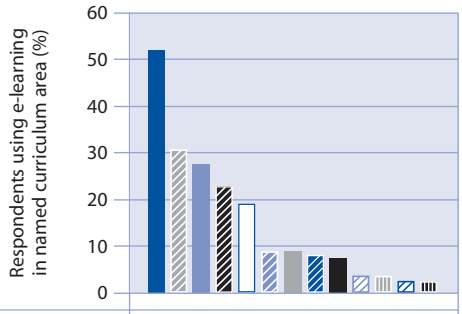
Robust evidence of impact of the use of content in FE is very limited and is mainly based on perceptions data or case study research. The Becta/NLN study which examined the embedding of NLN materials into the curriculum, for example, offers accounts from learners of their experience of learning more effectively while supported by NLN materials. The LSDA/NLN evaluation study found that a significant percentage of both learners and tutors believed that the use of online resources improved learning and attainment.

### Learning platforms and virtual learning environments (VLEs)

Since 1999, when the NLN provided every FE college in the UK with varying amounts of funding towards the development of VLEs, they have grown in popularity. An ILT survey conducted by Becta in 2001 reported half of colleges as having a VLE in place. By 2003, 70 per cent of colleges were making use of them as a learning platform. Nearly a third (31 per cent) of institutions reported using them either frequently or as the main learning platform in the institution.

The PwC report on e-learning (PwC, 2004a) found that, given the scale of FE colleges' infrastructure investment, the cost of software licences was prohibitive, especially when it came to 'full organisational licences' (which allow colleges to load software on lecturers' own machines for home use) and the actual licence fee charged by VLE suppliers.

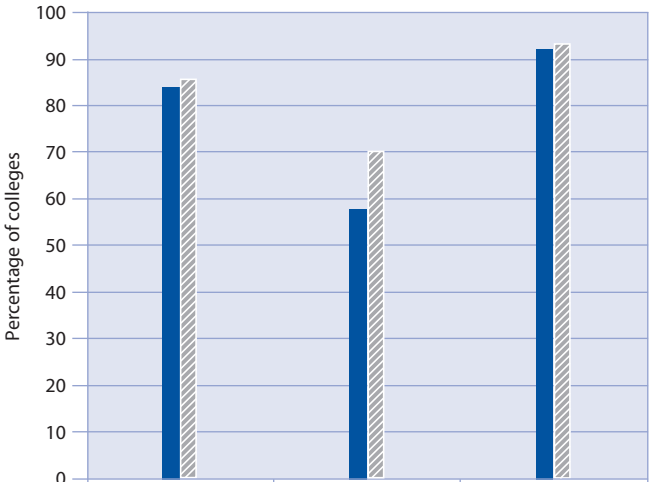
**Figure 3.5: e-learning by curriculum area**




| | |
|---|---|
| ICT | 52% |
| Foundation programmes | 31% |
| English, languages and communications | 28% |
| Business administration | 23% |
| Visual and performing arts and media | 19% |
| Science and maths | 9% |
| Humanities | 9% |
| Health, social care and public services | 8% |
| Hospitality | 7% |
| Construction | 3% |
| Retailing, customer services | 3% |
| Land-based provision | 2% |
| Hairdressing and beauty therapy | 2% |
| Engineering, technology and manufacturing | 0% |

Source: *NIACE/NLN The Potential of e-learning (2004)*

**Figure 3.6: College learning platforms**




| | Intranet | VLE | Network |
|---|---|---|---|
| 2003 | 84% | 58% | 93% |
| 2004 | 86% | 70% | 94% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

# 4 INSTITUTIONAL DEVELOPMENT


**Summary**

Institutional differences account for the variation in learner experience of ICT to a large extent. It is important to understand the progress of institutions in embedding ICT and the factors which determine how well ICT deployment serves educational goals.

The overall effectiveness of schools' ICT management and leadership, as judged by Ofsted inspectors, has improved considerably over the last few years. In 2003, it was judged good or better in two-thirds of schools. However, there is variability in the quality of school leadership of ICT.

ICT is fully and sustainably embedded in a small proportion of institutions – estimated at between 10 and 16 per cent of schools and 8 per cent of FE colleges, according to a recent DfES-funded study. Of the rest, a large proportion of institutions (76 per cent) in both the schools and FE sectors were making some progress, but had yet to embed ICT fully. Of these, half were firmly committed to embedding ICT and/or e-learning.

Success in deploying ICT to support learning and teaching requires:

- effective ICT leadership and management
- appropriate workforce skills, not just to use ICT but to use it effectively in learning and teaching
- curriculum and content which takes account of available technology and uses it to best effect
- links both within and outside the institution to share information and effective practice with others.

Though the use of ICT for administration is widespread, not all teachers and lecturers use ICT for these purposes. School use of MIS (management information systems) focuses generally on data entry and collation, rather than data transfer or analysis for planning. Deploying technology to support learner tracking is problematic for many FE colleges.

ICT can help to address a number of elements of the teacher/lecturer workload, but benefits are achievable only where the workforce is confident and competent in using ICT.

Institutions are only at an early stage in developing the use of networked technologies to facilitate learning beyond the institution.


Research evidence and inspection data have shown the important role and impact that school leaders and college managers can have on classroom and curriculum practice, and on organising and encouraging ICT developments within institutions. Such developments require a whole-school or college approach in order that ICT becomes pervasive and is used effectively across the whole institution, rather than being characterised by pockets of good practice in certain areas of the curriculum.

## DEVELOPMENTS IN SCHOOLS

### Overall effectiveness

Ofsted inspections provide indications of the number of institutions making effective use of ICT. Ofsted's 2004 report on the impact of ICT in schools noted that ICT resources are now at record levels and compare well with other countries. In terms of the gap in provision between the best and worst, however, inspectors consider that the gap has widened since their last report. Overall, leadership and management of ICT has continued to improve. ICT leadership was judged to be good or better in over two-thirds of primary and secondary schools and in just over half of special schools. However, variation between schools in the quality of ICT leadership is an issue.

Becta's analysis of national performance data against inspection data (Becta, 2003a, 2003b) has identified five key consistent enablers of effective ICT use ('effective' defined in terms of attainment outcomes), namely: ICT resources; school leadership; ICT leadership; general teaching; and ICT teaching.

In schools which make best progress with ICT, senior managers have been involved in planning whole-school provision with a clear understanding of how ICT can enhance teaching and learning (Ofsted, 2004). Such vision and understanding is considered crucial in providing a context in which ICT can flourish. PwC states:

*The vision for education has to be clear and realistic and needs to precede the vision for ICT: in a sense the 'learning' needs to precede the 'e'… It is essential for issues relating to funding, as well as those relating to the ICT infrastructure, to be shaped and driven by the overall vision for teaching and learning.* (PwC, 2004a, p.8)

The ICT in Schools Survey 2004 provides a measure of 'e-confidence' for schools based on the measures of ownership of ICT equipment, networking, internet access, staff confidence, and use of ICT in English, maths and science. While the researchers did not consider this to be a measure of quality ICT usage, they did identify a set of characteristics typical of more e-confident schools. These characteristics indicate that e-confident schools are those that provide appropriate support and training for their staff, display high levels of ICT use across the curriculum, and use ICT to address issues within the institution, such as support for students with special needs and the reintegration of pupils with poor attendance or behavioural problems.

PwC (2004a) developed an indicator to assess the overall extent of e-learning 'embeddedness' within institutions, based on objective indicators, plus schools' and colleges' self-assessment of their development. Key indicators included ICT infrastructure, training and technical support, and institutions' stated willingness to embed ICT.

Across all schools, there was a core of late adopters, that is to say, institutions that recognise that they have not embedded ICT into teaching and learning. This evidence suggests that institutions are likely to require advice and support which is targeted to their particular stage of development.

### Resource allocation and management

Where ICT funding is allocated can be critical in determining the success of embedding ICT in institutions. The study by Somekh et al (2002) of ICT Pathfinder LEAs found both strengths and weaknesses to institutional-level (as opposed to LEA/regional) control of ICT funding. This could increase staff enthusiasm for (and motivation towards) ICT and was more likely to allow institutions, where they wanted to and had the capability, to tailor provision to local needs. However, it had the disadvantage of failing to establish a coherent infrastructure, and thereby made maintenance and support more difficult and sometimes more expensive. This suggests a balance is needed which reflects institutions' differing capabilities and development stages.

**Table 4.1:**

| Spectrum of e-enablement by school type | | | | | |
|---|---|---|---|---|---|
| | Late adopters | Ambivalent | Enthusiastic | e-enabled | Sample size (N) |
| Primary schools | 7% | 44% | 39% | 10% | 118 |
| Secondary schools | 11% | 41% | 34% | 14% | 85 |
| Special schools | 16% | 35% | 33% | 16% | 43 |
| All schools and colleges | 13% | 36% | 40% | 11% | 345 |

Source: *Moving Towards e-Learning in Schools and FE Colleges (PWC 2004a)*

Within institutions there are different systems for allocating funding. PwC (2004a) found that in institutions that were 'e-enabled,' funding tended to follow the identification of needs rather than leading the process. Internal bidding processes among these institutions were widely used, operating in nearly a half of primary schools and two-thirds of secondary schools. The use of this mechanism was related to institutional size, with primary schools generally using it least and larger institutions, mainly secondary schools, using it the most.

A further important factor in resource-related decision-making in a school was the importance of curriculum managers having strong ownership of the purchasing decisions relating to the material for their subject specialism. Clearly, an internal bidding process could be a further mechanism for promoting ownership across the organisation.

### Leadership of ICT and e-learning

In 2002, Ofsted's report on ICT in schools indicated that there was variability in quality of leadership:

*ICT leadership within secondary subject departments… is good or better in four in ten, but unsatisfactory in nearly a third… The monitoring and evaluation of ICT use in departments are particular weaknesses in over four in ten departments.* (Ofsted, ICT in Schools: Effects of Government Initiatives, 2002)

In terms of the leadership qualities required, Ofsted (2004) notes in its most recent report that good ICT leadership is characterised by: pragmatism; clear educational principles to inform ICT developments; and an ethos that encourages innovation and risk-taking.

At a broader level, Ofsted has identified the following factors as critical in schools with the best provision and most improvement:

- ICT informs rather than leads continuing discussions about effective classroom practice and how to engage all pupils
- The issue of resource deployment is addressed head-on, often with a move to more flexible approaches (for example, sets of wireless laptops linked to the school network or clusters of machines placed strategically around the school)
- The need for effective technical support is recognised as a central element of the whole-school strategy for ICT
- The role of ICT in supporting this involves all staff.

The co-ordination of ICT varies considerably in its effectiveness. It is good or better in 60 per cent of secondary and special schools and 50 per cent of primary schools, but unsatisfactory in 10 per cent and 20 per cent respectively. Good co-ordinators understand how ICT can enhance teaching and have the skills to promote its development across the curriculum.

While all teachers had an entitlement to NOF ICT training, school leaders were excluded. Headteachers have relied instead on provision made available through LEAs and/or professional organisations. In order to address this situation, the National College for School Leadership (NCSL), in partnership with Becta, developed a programme for school leaders entitled SLICT: Strategic Leadership in ICT. Launched in the autumn of 2001, the programme seeks to help headteachers focus on their strategic role in leading and managing ICT developments and the use of management information for school improvement. Around 2,000 staff took part in the pilot course in 2002-03 and the intention is for up to 10,000 headteachers to participate in the programme between 2003 and 2006; to date the programme has engaged school leaders from 138 LEAs (NCSL, 2004). Feedback from participants indicates that benefits include:

- the opportunity to share practice and network with others
- strategies to improve the clarity of vision for ICT in school
- an understanding of the links between ICT and learning.

An independent evaluation of the SLICT pilot programme found that it had a positive impact on headteachers' vision and strategy for ICT in their schools and on resource management and ICT provision (NCSL, 2004). The PwC e-learning report also indicated that the programme was having a positive effect (PwC, 2004a). Ofsted recommended that the programme is extended to include middle managers (including ICT co-ordinators), LEA personnel and national strategy consultants (Ofsted, 2004).

### Administration, management and planning

Though the use of ICT for administration is widespread, the most recent survey data identified that a significant minority of teachers were not yet using ICT for tasks such as administration and record-keeping.

Somekh et al (2002) suggested that teachers in both primary and secondary schools needed more encouragement and support to use ICT for administration, stating:

*Current approaches to the use of information will need to be changed to make use of the facilities made available by computer-based systems, while at the same time paper-based systems will need to be phased out. At present few teachers will see the need to change or any potential advantages.* (Somekh et al, 2002, p. 5)

As with other aspects of institutional development, we are reliant on indirect indicators of progress in effective linking of curriculum delivery, learner management and business planning. Evidence tells us, however,

**Table 4.2:**

| School reports of teachers' use of ICT to reduce workload | | | |
|---|---|---|---|
| | Substantial (%) | Some (%) | None (%) |
| **Primary** | | | |
| Preparation/planning/ assessment or record-keeping | 14 | 67 | 19 |
| Routine, administrative and clerical tasks | 13 | 63 | 24 |
| **Secondary** | | | |
| Preparation/planning/ assessment or record-keeping | 11 | 70 | 19 |
| Routine, administrative and clerical tasks | 17 | 66 | 17 |
| **Special** | | | |
| Preparation/planning/ assessment or record-keeping | 14 | 62 | 24 |
| Routine, administrative and clerical tasks | 15 | 60 | 26 |

Source: *The Stationery Office - Survey of ICT in Schools 2003*

that a minority of schools are not yet using MIS for basic information handling, such as attendance recording and key stage entry (The Stationery Office, 2003). Overall, most MIS use is currently focused on data entry and collation, rather than on data transfer or analysis to support planning (Visscher et al, 2001 and North et al, 2000).

### ICT and teacher workload

The PwC study of ICT and teacher workload (PwC, 2004b) concluded that ICT has helped to address workloads for teachers, but this was only achieved when they were confident in using ICT. Benefits reported included better management, storage and maintenance of work. In cases where ICT saved time, this was reinvested in other tasks such as lesson preparation, which teachers considered resulted in higher quality teaching and learning.

Other evidence supports the role of ICT in achieving efficiencies. The broadband evaluation (Underwood et al, 2004) found that in many schools the advent of broadband enabled changes to ICT provision which allowed them to streamline administration, offering, for example, integration of curriculum and administration, bringing together student tracking, registers, individual education plans (IEPs), online work and assessment, and the launching of an MLE. There was evidence of greater use of intranets for sharing information and resources in case study schools.

But there is not a consistent picture of workload savings. Some increases have been reported. PwC (2004b) noted that in cases where teachers reported that ICT increased workloads, this was likely to be a result of:

- lack of confidence or lack of ICT skills
- an ICT strategy which lacked a focus on addressing workload
- ineffective technical networks, or a lack of appropriate training or technical support
- how far the ICT strategy had advanced.

The report noted that an upfront investment of time was needed before workload savings could be realised. ICT was more likely to reduce workloads if schools could harness growing confidence in ICT use by realising further benefits from better sharing, management, access to and storage of teaching-related resources.

### Continuity of learning/home–institution links

There is an increasing body of evidence that shows the growing availability of ICT in the home. In 2002, 81 per cent of pupils had access to a personal or laptop computer in the home (Hayward et al, 2003). An average of three-quarters of young people reported using computers at home, while nearly half (49 per cent) reported using them elsewhere including in other people's homes rather than in public places. In some instances, this is related to homework but increasingly it involved accessing learning resources and materials online and via a VLE. However, access to and use of ICT at home varies with socio-economic group. Lower socio-economic are groups currently relatively disadvantaged.

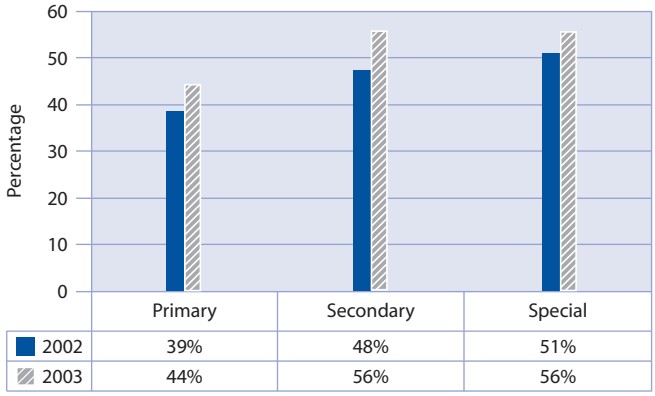
In terms of realising the potential for ICT to facilitate home-institution links, the ICT in Schools Survey 2004 found that 29 per cent of secondary schools and 12 per cent of primary schools operated networks that were accessible beyond the school premises. This appears a fairly low base. However, this provision is largely related to school size – 42 per cent of large secondary schools, for example, provided remote access to the school network. It is likely that larger institutions are more likely than smaller ones to have the technical capability to deliver this.

In relation to differential access by pupils to home computers, an increasing number of schools offer pupils and staff arrangements to loan computers.

The 2004 survey includes specific data on loans to pupils; 20 per cent of secondary schools and 6 per cent of primary schools had this arrangement.

Ofsted reports that in most schools, pupils can use ICT equipment before and after school and during the lunch hour. The ICT in Schools Survey indicates that over 90 per cent of secondary schools offer pupils access to

**Figure 4.1: Percentage of schools with arrangements to loan computers to pupils and/or staff 2002-03**




Source: *The Stationery Office - Survey of ICT in Schools 2003*

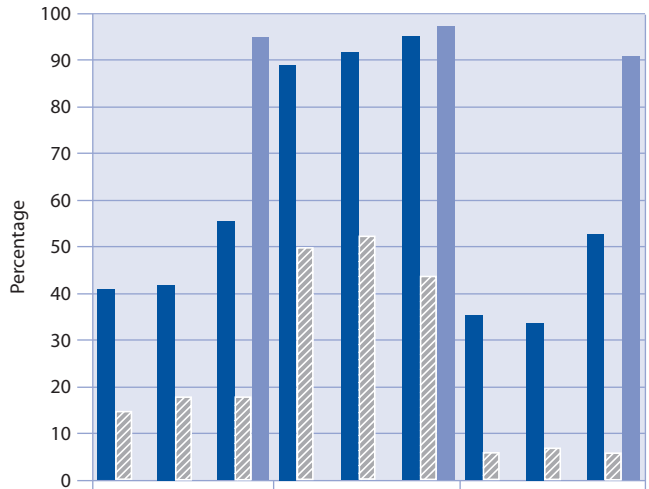
school computers outside school hours, but access to computers outside school hours in primary schools is more limited, although it has increased noticeably in the last year, as has this provision in special schools.

Email accounts funded by the LEA or school are common across all school types. In secondary schools, more than half of all pupils are provided with such an account.

In terms of practice, the proportion of secondary school teachers setting homework requiring the use of a computer 'very' or 'quite' often is rising fairly rapidly – from 19 per cent in 2003 to 23 per cent in 2004 according to the Curriculum Online evaluation survey. The setting of homework involving use of the internet rose from 15 to 19 per cent in this period (Kitchen and Finch, 2004).

School websites have the potential to support the process of extending learning opportunities beyond the school. Underwood et al (2004) found that websites were used initially as an information board, but in some cases as a conduit and shared data area for staff, pupils and parents. Ofsted (2004) states that school websites are used mainly as a vehicle for publicising the school and its activities.

**Figure 4.2: ICT facilities available out of school hours**




| | Primary schools | | | Secondary schools | | | Special schools | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2004 | 2002 | 2003 | 2004 | 2002 | 2003 | 2004 |
| Pupils | 41% | 42% | 55% | 89% | 92% | 94% | 35% | 33% | 52% |
| Local community | 15% | 18% | 17% | 50% | 53% | 42% | 6% | 7% | 6% |
| Staff | | | 94% | | | 97% | | | 91% |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

**Table 4.3:**

| Provision of personal email account funded by LEA or pupils (personal or shared) | | | |
|---|---|---|---|
| | Primary schools | Secondary schools | Special schools |
| All pupils | 38% | 60% | 33% |
| Some pupils | 21% | 11% | 20% |
| Few or none | 41% | 30% | 46% |
| Base (schools) | 1079 | 893 | 458 |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

## DEVELOPMENTS IN THE LEARNING AND SKILLS SECTOR

### Overall effectiveness

Ofsted and Adult Learning Inspectorate (ALI) inspections of post-16 institutions do not include separate quality assessments of institutional ICT provision, unlike the schools sector.

The recent NLN evaluation (LSDA/NLN, 2004) researched staff and student perspectives on ICT and e-learning provision, including their judgements on overall levels of quality. Case study interviewees, when asked about ICT developments in their institutions, reported that the infrastructure and resources were not yet fully in place to allow e-learning to be integrated as a simple option by staff. Even when the facilities, materials and support were present, teaching staff were often not themselves ready to make full use of e-learning.

Data relating to the MIT scale of technology maturity (see Annex) was collected as part of Becta's 2004 ICT and e-learning survey of FE institutions. A quarter reported their institution as innovators, nearly half (49 per cent) as early followers and a quarter as cautious adopters. Just 1 per cent claimed that ICT was peripheral in their colleges. The model of diffusion of innovation developed by Everett Rogers suggests that innovators would normally represent just 2.5 per cent of a population, and early adopters some 13 per cent (Rogers 1995). 'Laggards' would normally represent 16 per cent. It appears that colleges view themselves positively in relation to ICT.

It is difficult to assess the reasons for this, but this may be due to low expectations or a lack of understanding of technological potential.

Research findings on ICT maturity from PwC (2004a) appear in the school section on 'Leadership of ICT and e-learning' (see above). Related figures for FE colleges are presented in Table 4.4.

The report notes that in over one-seventh of colleges there was a view that ICT was embedded substantially in the delivery of teaching and learning, and around half indicated that there was a significant willingness to move towards embedded e-learning. The researchers stated that the lower levels of embedding in colleges should not be taken to suggest that less use is made of e-learning in colleges compared to schools. Staff and managers in FE colleges were less ready to regard the use of ICT to support learning and teaching as 'e-learning,' than school-based colleagues.

### Leadership of ICT and e-learning

There are no indicators of the quality of ICT leadership across FE although the PwC report (PwC, 2004a) provides some sector-wide data on ICT leadership. The survey found that nine out of ten institutions had an ICT strategy, either formal (more likely in larger institutions) or informal. However, only between one-tenth and one-fifth had an ICT strategy which linked to the overall teaching and learning strategy.

The 2004 Becta ICT and e-learning survey found that the use of electronic resources was directed by a college-wide plan in only 14 per cent of FE colleges, and by a plan at department or course level in a quarter. Nearly a third (32 per cent) of colleges set formal targets for the use of ICT and e-learning across all programmes. A further 44 per cent set targets where they felt they were appropriate and 22 per cent of FE institutions did not set targets for ICT and e-learning at all.

PwC found an important factor in successfully embedding ICT in FE colleges was the appointment of a senior manager with e-learning as his or her responsibility, to ensure senior management 'buy-in' (PwC, 2004a). The most effective e-learning strategies were developed when all staff were fully 'bought in' to the overall vision for learning and associated strategies for the use of ICT. In addition, phased approaches to the implementation of e-learning and ICT were recommended in order to take account of the pace at which staff could accommodate change.

**Table 4.4:**

| Spectrum of e-enablement for FE colleges | | | | | |
|---|---|---|---|---|---|
| | Late adopters | Ambivalent | Enthusiastic | e-enabled | Sample size (N) |
| FE colleges | 20% | 23% | 49% | 8% | 99 |
| All schools and colleges | 13% | 36% | 40% | 11% | 345 |

Source: *Moving Towards e-Learning in Schools and FE Colleges (PWC, 2004a)*

### Administration, management and planning

The LSDA/NLN evaluation (LSDA/NLN, 2004) found that the most commonly or constantly used administrative applications used by staff were for communicating with colleagues, for record-keeping, and for tracking student progress. However, as with schools, there is a challenge to link learner management to curriculum delivery – only 33 per cent of institutions reported this was easy, compared to 36 per cent who reported this was not possible (Becta, 2004c).

Electronic student portfolios or records of achievement were maintained in nearly a quarter (24 per cent) of colleges in 2004. In the FE sector, levels of use of electronic information to support learning are increasing slowly, and have not improved since the 2003 survey.

The tracking of learners through a programme of study and linking it to the college MIS was reported as problematic for many colleges. The survey investigated ease of operation across the three main college learning platforms and found that these activities appeared to be easier for those who use a VLE. However, when it came to tracking learners through any programme of study and linking this to the MIS, it was only marginally easier for VLE users. This finding seems to reinforce the point made earlier

**Table 4.5:**

| Ease of use of main college learning platform | | | |
|---|---|---|---|
| | Upload materials | Track learner activity | Link to college MIS |
| Easily | 83% | 37% | 33% |
| With difficulty | 14% | 26% | 27% |
| Not at all | 1% | 31% | 36% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

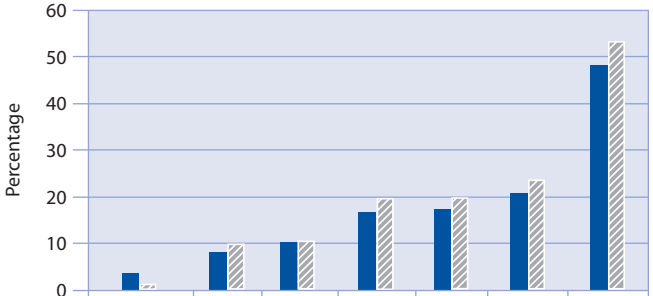
in the 'Infrastructure' section of the report that institutions find it difficult to link together curriculum/learning and management/administrative systems.

### Continuity of learning/home–institution links

In the learning and skills sector, there is a stronger tradition of distance learning than in schools. Links to other locations, such as the workplace, play an increasingly important role in developing ICT and e-learning which is focused on delivering the objectives of the DfES Skills Strategy. The best indications of how colleges are using ICT in this respect can be seen from Figure 4.3. Levels of remote access were low at 10 per cent, reporting they used ICT in this way in all or most programmes. Remote learning is currently dominated by learndirect, with two-thirds of colleges reporting delivering learndirect courses.

The LSDA/NLN evaluation found that almost three-quarters of students had internet access at home or in the workplace. Half of these had broadband, while a third accessed VLEs and college intranets remotely. In terms of specific uses of communications technology, fewer than one in ten students made daily use of email comments from teachers and two-thirds never used them. This rose to three-quarters for email for assessment feedback. Video conferencing was rarely used in teaching. At the moment, ICT use to support continuity of learning is not a significant feature of learning and teaching in colleges.

**Figure 4.3: The use of ICT in all or most mainstream college programmes**




| | Individualised programme | Remote access | Learners' own pace | Learners' own time | Part of blended learning | Traditional classroom | To support learning |
|---|---|---|---|---|---|---|---|
| 2003 | 4% | 8% | 10% | 17% | 18% | 21% | 48% |
| 2004 | 1% | 10% | 11% | 20% | 20% | 24% | 53% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

# 5 LEARNING AND TEACHING


**Summary**

Levels of workforce confidence and competence with technology have improved and overall use of ICT has risen sharply since 2002. Teachers' and lecturers' personal access to and ownership of ICT is likely to account for much of the rise in use.

There is variation in levels of use of ICT in teaching based on subject area in both schools and FE, with highest levels of use found generally in core subjects.

There is a general pattern across key stages for pupils to spend more time using computers at home than at school. Overall, use of computers in subject learning increases with age.

Quality of use of ICT in schools, as judged by Ofsted, is rising. However, Ofsted observed that there is unmet potential to achieve a positive impact on pupil learning.

There is a growing body of evidence relating to the positive impact of ICT on learner attainment and other outcomes, but we need to develop further our understanding of effective ICT pedagogies and how they can be supported. Factors which account for whether there is positive impact on learning include subject tradition with ICT, use across the curriculum, and quality of leadership and teaching.

In colleges, staff are enthusiastic about the use of technology in learning and teaching, but the picture at the moment is one of under-utilisation of the potential of ICT and an over-reliance on generic uses.

Little comprehensive national data is available about the use of ICT to support assessment in schools and colleges.


## DEVELOPMENTS IN SCHOOLS

### Defining 'effective'

As with many areas within this review, there are limitations in the data available – in this case on the quality of teachers' use of ICT. Ofsted's judgements offer evidence but ideally these should be triangulated with evidence from research, especially studies relating ICT use to learning and attainment.

Similarly, though there is some valuable time series data on levels of use of ICT in learning and teaching, this comes from schools rather than teachers. Teachers' reports of levels of use are below the estimates of schools (based on comparisons of ICT in Schools survey data and the Curriculum Online evaluation).

### ICT training for teachers

The ICT in Schools Survey 2004 shows that the vast majority of teachers had received training in the use of ICT by 2003, with most of them receiving updated training within the preceding two years. The NOF (National Opportunities Fund) accounted for a large proportion of this.

Though training levels were reported as high, there are issues with the nature and effectiveness of ICT training. Ofsted has concluded that a majority of NOF training was insufficiently differentiated to meet such varied needs. The approach adopted by many schemes used electronic communications and distance learning with limited face-to-face training, which proved frustrating to teachers:

*They wanted opportunities to discuss practical software problems or pedagogical issues arising from their use of ICT. Many became disillusioned when they found the bulk of the NOF training was self-study to be undertaken in their own time.* (Ofsted, 2004, p.22)

However, the training did stimulate higher levels of ICT competence among staff and raised the profile of ICT training, giving it a whole-school focus for the first time. NOF was successful where teachers collaborated and schools planned their professional development, providing useful lessons for future training and CPD programmes. Overall, teachers' satisfaction with training appears higher when provided internally – possibly linked to greater tailoring and differentiation, as Table 5.1 indicates.

Personal access to computers is high among teachers. This has considerably improved teacher confidence, knowledge and skills with ICT, and familiarity

with software packages, as demonstrated in evaluation studies of the DfES Laptops for Teachers programme (Cunningham, 2003; Kington, 2003).

Despite a trend towards increasing confidence and competence, however, very few teachers have a comprehensive knowledge of the range of ICT resources now available (Cox, 2003b). Scrimshaw (2004) suggests that peers play a key role in addressing this barrier, disseminating ICT resources and applications and demonstrating benefits which technology can bring to the delivery and management of learning in particular areas. In addition, the ICT in Schools Survey 2004 found that over 90 per cent of primary and secondary school teachers considered that their main source of ICT-related professional advice and support was fellow colleagues, followed by LEA advisers.

Teaching assistants and other support staff have not had the same amount of training as teachers. School leaders were less likely than teachers to have received professional development in ICT-related basic skills or practice.

### Workforce skills

Skills and confidence of staff to use ICT in subject teaching have risen in the last five years. This is one of the most marked areas of ICT-related improvement over this period. However, 2004 saw the first drop in levels of staff confidence to use ICT in subject teaching, as reported by schools. The drop was not statistically significant, but could be indicative of a levelling off (see Figure 5.1).

It may be that schools are increasingly aware of continually changing skill demands, or it may be that a hard core of teachers cannot be reached and there are some intractable barriers in achieving 100 per cent confidence.

### Levels of ICT use in schools

DfES ICT surveys over the last three years show schools reporting that an increasing number of teachers are using computers for teaching and administration. At the same time, the figures for primary and secondary schools making little or no use of ICT have declined. Again, this is an area of marked improvement over the last five years.

Teaching staff are the most active users of ICT, with schools reporting in 2004 that 98 per cent of primary

**Table 5.1:**

| Amount and quality of ICT training available | | |
|---|---|---|
| | Primary *(% very/quite good)* | Secondary *(% very/quite good)* |
| Amount of training | 63 | 52 |
| Quality of internal training | 73 | 64 |
| Quality of external training | 47 | 31 |
| Base: All teachers | 1,038 | 1,741 |

Source: *Evaluation of Curriculum Online: Report of the Baseline Survey of Schools (Kitchen & Finch 2003)*

**Table 5.2:**

| Staff training 2004 | | | | | |
|---|---|---|---|---|---|
| | School leaders | Teachers | Teaching assistants | Other support staff | None of these |
| **Primary schools** | | | | | |
| Percentage who have received appropriate levels of... | | | | | |
| Professional advice and support on ICT | 88 | 91 | 62 | 55 | 4 |
| Guidance on the use of ICT | 90 | 93 | 63 | 52 | 4 |
| Professional development in ICT-related basic skills | 83 | 88 | 68 | 52 | 3 |
| Professional development in ICT-related practice | 78 | 85 | 46 | 48 | 5 |
| **Secondary schools** | | | | | |
| Percentage who have received appropriate levels of... | | | | | |
| Professional advice and support on ICT | 82 | 87 | 51 | 53 | 5 |
| Guidance on the use of ICT | 83 | 91 | 58 | 57 | 5 |
| Professional development in ICT-related basic skills | 76 | 86 | 60 | 55 | 5 |
| Professional development in ICT-related practice | 64 | 73 | 36 | 39 | 7 |
| **Special schools** | | | | | |
| Percentage who have received appropriate levels of... | | | | | |
| Professional advice and support on ICT | 87 | 90 | 73 | 54 | 5 |
| Guidance on the use of ICT | 88 | 92 | 75 | 53 | 5 |
| Professional development in ICT-related basic skills | 81 | 89 | 74 | 46 | 5 |
| Professional development in ICT-related practice | 75 | 81 | 58 | 48 | 6 |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

teachers and 94 per cent of secondary teachers used a computer on a regular basis for teaching and learning, followed by leaders and support staff. More than three-quarters (77 per cent) of teachers regularly used a computer for management and administration, rising to 97 per cent and 96 per cent respectively of primary and secondary school leaders (Prior and Hall, 2004).

The Curriculum Online evaluation baseline study (Kitchen and Finch, 2003) found that a significant minority of teachers used ICT resources on a regular basis – 19 per cent of primary teachers, for example, reported they use subject-specific software in half or more of their lessons.

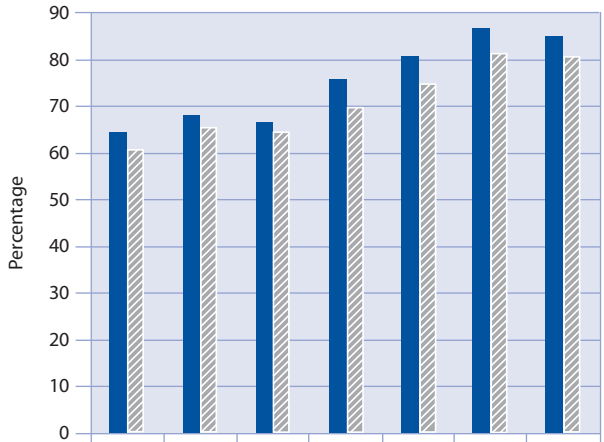
There is a clear trend for increasing numbers of teachers to make regular use of ICT in lessons (use in half or more lessons). When comparing 2003 figures with those from 2004, in most cases, there is an increase. In secondary schools, the regular use of internet-based resources in lessons has doubled (from 5 per cent to 10 per cent), and the regular use of interactive whiteboards is up from 5 per cent to 11 per cent.

The exception to this trend is in primary use of subject-specific software, where the figures declined by 1 per cent (see Table 5.3). This decline is not statistically significant, but nonetheless indicates that this may be an area of ICT use which requires specific attention.

Further progress is indicated by teachers' perceived importance of ICT at Key Stages 1 and 2. This increased substantially between 2003 and 2004, with, for example, more than three-quarters of primary school respondents rating ICT as 'very' or 'quite' important for Key Stage 1 English in 2004, compared to 65 per cent in 2003. Similar change can be observed for Key Stage 3.

This represents evidence of a cultural change in process. Teachers' beliefs about and attitudes towards ICT in learning and teaching are changing rapidly.

**Figure 5.1: Staff who feel confident to use ICT in their subject teaching**




| | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|
| Primary | 65% | 68% | 67% | 76% | 81% | 87% | 85% |
| Secondary | 61% | 66% | 65% | 70% | 75% | 82% | 81% |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

**Table 5.3:**

| Frequency of using ICT resources in lessons | | |
|---|---|---|
| **Resources** | Primary teacher *(% half or more lessons)* | Secondary teacher *(% half or more lessons)* |
| Computer packages<br>*Change since baseline* | 26<br>+4 | 14<br>+5* |
| Internet-based resources<br>*Change since baseline* | 14<br>+4* | 10<br>+5* |
| Interactive whiteboards<br>*Change since baseline* | 11<br>+5* | 11<br>+6* |
| Subject-specific software<br>*Change since baseline* | 18<br>-1 | 14<br>+4* |
| Base: All teachers | 733 | 1212 |

*statistically significant change
Source: *Evaluation of Curriculum Online: Report of the Follow-Up Survey of Schools (Kitchen & Finch 2004)*

### Curriculum use of ICT

Over the last three years, the DfES ICT in Schools survey asked schools about the extent to which ICT is used in a range of curriculum areas. The results show that levels of use vary considerably according to subject. For example, the 2004 ICT in Schools survey found that use was significantly higher in English, maths and science in primary schools, and in design and technology, science, maths and geography, in secondary schools, compared to other subjects. With the exception of design and technology, there appears to be a relationship between how 'core' a subject is and the level of use of ICT. For example, levels of use were low in primary schools in modern foreign languages, music, PSHE, PE and RE, and in secondary schools in citizenship, PSHE, PE and RE.

Less is known about variation in use within schools, particularly variation between teachers in the same subject areas. This would tell us something about the extent to which levels of use are institutionally driven, or based on teacher experience and preference.

Ofsted noted the role subject departments play in levels of ICT use in secondary schools. The typical picture is for a handful of departments to be working well with ICT, and others less well. Ofsted concluded that the Government's aim for ICT to become embedded across the work of schools is a reality in a minority of schools at the moment, stating:

*More typical is a picture in which pupils' ICT experiences across the curriculum are sporadic and dependent on teachers; in many schools, opportunities to exploit the technology are lost on a daily basis.* (Ofsted, 2004, p.6)

However, Ofsted observes that in schools that are furthest ahead, ICT is starting to have a beneficial effect in teaching and learning in all subjects.

### Pupils' use of ICT in learning

As with teachers' use, the trend data we have on pupils' use of ICT (DfES, Young People and ICT Surveys, 2002 and 2003) suggests an upward trend in all aspects of pupil use – both at home and in school. There seems to be a sharp rise in some areas. One of the most striking results of the 2002 Young People and ICT survey was the very substantial increase in the proportion of children in Key Stage 2 reporting that they do homework on a computer, from 7 per cent in 2001 to 40 per cent in 2002.

In 2002 there was a general pattern across key stages for pupils to spend more time using computers at home than at school. At Key Stage 3, for example, it was double the time spent using computers at school. About one-third of use at home was game playing, which accounted for most of the difference between boys and girls in time spent using computers at home (Hayward et al, 2003).

Overall use, and use of computers in subject learning, increases with pupils' age. However, 2002 data indicates that levels of pupils' subject use drop at Key Stage 4, indicating a possible negative impact on ICT use as a result of GCSE assessment.

**Table 5.4:**

| Use of ICT in areas of the curriculum _ Primary schools | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2002 | | | 2003 | | | 2004 | | |
| | Substantial | Some | Little/ none | Substantial | Some | Little/ none | Substantial | Some | Little/ none |
| Art & design | 9% | 74% | 17% | 12% | 68% | 20% | 14% | 68% | 18% |
| Design & technology | 4% | 45% | 50% | 3% | 57% | 39% | 7% | 60% | 34% |
| English | 59% | 41% | 1% | 60% | 40% | - | 63% | 36% | 1% |
| Geography | 8% | 70% | 22% | 14% | 75% | 12% | 23% | 66% | 11% |
| History | 11% | 71% | 18% | 18% | 72% | 10% | 29% | 63% | 8% |
| ICT | 90% | 9% | 1% | 91% | 9% | 1% | 84% | 14% | 1% |
| Mathematics | 40% | 56% | 4% | 47% | 51% | 2% | 56% | 42% | 3% |
| MFL | 1% | 4% | 96% | 1% | 4% | 95% | 1% | 11% | 89% |
| Music | 2% | 34% | 64% | 2% | 45% | 52% | 4% | 46% | 50% |
| Physical education | - | 3% | 97% | - | 4% | 96% | * | 14% | 86% |
| Religious education | 1% | 36% | 63% | 3% | 49% | 48% | 6% | 59% | 35% |
| Science | 17% | 75% | 8% | 24% | 71% | 5% | 37% | 59% | 4% |

* Equals less than 0.5% but greater than 0

**Table 5.5:**

| Use of ICT in areas of the curriculum _ Secondary schools | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2002 | | | 2003 | | | 2004 | | |
| | Substantial | Some | Little/ none | Substantial | Some | Little/ none | Substantial | Some | Little/ none |
| Art & design | 13% | 60% | 27% | 17% | 63% | 20% | 26% | 62% | 12% |
| Citizenship | n/a | n/a | n/a | 4% | 50% | 46% | 8% | 52% | 41% |
| Design & technology | 54% | 42% | 3% | 62% | 35% | 3% | 66% | 30% | 3% |
| English | 16% | 64% | 19% | 19% | 69% | 12% | 24% | 63% | 14% |
| Geography | 20% | 65% | 15% | 22% | 66% | 12% | 30% | 61% | 9% |
| History | 11% | 61% | 28% | 15% | 65% | 20% | 21% | 63% | 16% |
| ICT | 98% | 1% | 1% | 99% | 1% | - | 99% | - | 1% |
| Mathematics | 24% | 59% | 17% | 31% | 57% | 11% | 41% | 51% | 8% |
| MFL | 17% | 57% | 26% | 20% | 60% | 20% | 28% | 55% | 17% |
| Music | 23% | 48% | 29% | 24% | 51% | 25% | 29% | 49% | 22% |
| PSHE | n/a | n/a | n/a | n/a | n/a | n/a | 7% | 50% | 44% |
| Physical education | 2% | 31% | 67% | 3% | 38% | 59% | 7% | 45% | 48% |
| Religious education | 5% | 50% | 45% | 6% | 55% | 38% | 11% | 53% | 36% |
| Science | 33% | 61% | 6% | 41% | 54% | 4% | 49% | 46% | 5% |

Source: *ICT in Schools Survey 2004 (Prior & Hall 2004)*

### Quality of use in the classroom

Ofsted inspections offer evidence of continued improvements to the quality of use of ICT in learning and teaching (Ofsted, 2004). Good teaching was observed in 60 per cent of all lessons which used ICT in primary schools, a rise of 6 per cent from its previous survey 2 years before, and 6 per cent higher than those rated good across all lessons in primary schools.

Ofsted also reported that the impact of ICT on teaching was rated as good or better in 53 per cent of primary schools, a rise of 7 per cent. Ofsted singled out the primary sector as demonstrating particular progress – there was a strong upward trend for good use of ICT in the three core subjects in primary schools.

However, Ofsted also noted variation in the quality of use of ICT in learning and teaching between institutions.

Ofsted suggests that developing the effective use of ICT in learning and teaching in special schools represents a particular challenge. It argues that the potential of ICT to raise pupils' achievements across the curriculum has not been fully realised. Reasons given are that the selection of specific software is limited and ICT merely provides additional work rather than challenging pupils and extending their achievement.

The Communications Aids Project (CAP) project provides technology for pupils with significant communication difficulties, with the aim of making the curriculum accessible, assisting interaction with others, and supporting the transition to post-school provision. A recent evaluation found that children reported positive changes in areas such as functional abilities and their quality of life, including reporting a decrease in feelings of embarrassment, frustration and being treated 'like a baby'. The positive impact of equipment on children's participation in learning experiences was also cited. (Wright et al, 2004).

### ICT and assessment

There appears to be little or no comprehensive data that provide a national picture about the way in which ICT is being used to support assessment in schools, or help learners demonstrate and record their achievement. Studies have demonstrated the potential for ICT to support different types of assessment and deliver associated benefits. NFER (2004) provides a guide to computer-based assessment drawing on national and international research, and Ridgeway et al (2004) assess the role of e-assessment in shaping educational practice. Studies on the use of VLEs (for example, North 2004) also mention the potential for formative assessment in colleges.

### Impact on learning

There is a growing body of evidence relating to the positive impact of ICT on learner attainment and other outcomes. Informal evidence from studies such as the recent case study data in the PwC e-learning report (PwC, 2004a) indicates that pupil attainment has improved as a result of embedding e-learning into the curriculum. However, participants were unable to quantify the extent of the improvement or demonstrate causal links between ICT use and outcomes. Though literature from small-scale studies draws mixed conclusions, systematic reviews of these confirm the conclusion that, where used effectively, ICT does contribute to pupil and student learning.

The study of ICT and motivation by Passey et al (2003) found that the motivational impact of ICT was positive. This was accounted for in various ways, including presentational features, the potential for ICT to support pupil-centred learning and access to a range of resources to support learning tasks. The circumstances and ways in which ICT was used determined outcomes for the learner.

ImpaCT2 and Becta's statistical analysis of national data (SAND) (Becta, 2003a and 2003b), also tell us that ICT policy has had a positive impact on standards on a national scale, at least for schools and in certain subject areas. ImpaCT2, the first large-scale study on the impact of ICT on individual pupil attainment in national tests and GCSEs, found:

- at Key Stage 2, a statistically positive association between pupil ICT use and national tests for English and a positive association for mathematics, although not as striking and not statistically significant
- at Key Stage 3, a statistically significant positive association between pupil ICT use and national tests for science
- at Key Stage 4, a statistically significant positive association between pupil ICT use and GCSE science and GCSE design and technology.

There is no direct link between the fact of use of ICT and attainment gains, though there is some evidence that where there is a solid tradition of subject-related ICT use, levels of use do relate positively to attainment gains. However, clearly in these cases, the types of use which have been developed and disseminated are those which are more proven and effective.

The original data for this study is some years old now. It is likely that the picture has changed since then. Findings from a more recent review of the literature on ICT and attainment (Cox et al, 2003a) concluded that:

- there are positive effects of specific uses of ICT on attainment in almost all National Curriculum subjects

- the most substantial evidence is in core subjects of English, maths and science at all key stages
- there is evidence to identify the contribution that specific applications of ICT can make in subjects such as science, maths and English.

But there is a continuing challenge to 'get underneath' the statistics to understand better the processes, factors and specific uses of ICT which consistently relate to positive impact on pupil learning/institutional standards and which add most value. The challenge here is not simply to explain positive outcomes, but also to understand what can be transferred to other contexts.

We have a growing understanding of the factors associated with positive impact on standards:

- Subject ICT traditions are key mediators of impact. We know from various sources that impact varies between subjects. As Cox et al (2003b) argue:

  *The positive effect on attainment is greatest for those ICT resources which have been integrated in teachers' practices. Up to the present time there have been more subject-specific ICT resources available to teachers in English, mathematics, science and ICT than in other subjects, more use is made of such resources in these subjects than in others, and there is a greater body of knowledge about educational practices with ICT in these areas (p.3).*

- Pupil use across the curriculum – ImpaCT2 (Harrison et al, 2002) confirms this is important, combined with the use of both generic and specific resources at subject level. That is to say, a single subject teacher is unlikely to drive attainment gains unless institutional conditions are right and pupils are exposed to a range of ICT uses.
- Institutional enablers – 'SAND' reports (Becta, 2003a, 2003b) identified five key institutional enablers which account for the link between ICT resourcing and school standards. The extent of good ICT learning opportunities within a school is a key factor, and this is enabled by good teaching, good overall leadership (particularly at primary level), good ICT leadership and good ICT teaching (the latter particularly at secondary level).
- Teachers' understandings – of their subject and how to teach it, and their understanding of the potential role of ICT in supporting it – are critical. There are big differences between teachers in this respect and there is evidence that at the moment only a minority of leading-edge teachers have practical understanding of the full range of potential uses of ICT in their subject.

We also know something about pupil-related mediating factors. ICT use has a positive impact on pupils' motivation to learn. This is more the case with boys than girls, but true of both. This is not a 'novelty effect' based purely on the intrinsic interest of ICT, rather, a range of characteristics of ICT contribute to this. At higher levels, pupils' ability to search a range of resources appears to be particularly motivating if underpinned by clear task orientation.

Related to this, ICT contributes to pupils' perceived efficacy in learning by providing tools which enable pupils with different needs to achieve success. All this, of course, is dependent on teachers' understandings of the potential of ICT to support different learners, and on teachers' developing approaches to differentiate the learning experience. We need to know more about the skills and practical understanding of teachers who deliver a differentiated learning experience using ICT – that is, we must develop further our understanding of effective ICT pedagogies and how they can be supported.

## DEVELOPMENTS IN THE LEARNING AND SKILLS SECTOR

### Workforce skills

The 2004 Becta ICT and e-learning survey shows a continuing, upward trend in reported levels of teaching staff IT and e-learning competence. Colleges overall considered that 56 per cent of staff had reached the level of 'competent' and 'advanced' in e-learning skills. Though there has been rapid progress, however, there is clearly a continuing challenge here.

The survey asked colleges to distinguish between IT skills and e-learning skills. IT skills involved the personal use of IT for administration, lesson preparation or record-keeping; e-learning skills refer to the application of ICT knowledge and skills to use in the classroom and with students to support and encourage learning.

On average, three-quarters of staff were regarded as competent or advanced in their personal use of IT, compared with 67 per cent in 2000. The figures also indicate that the gap between the two sets of skills appears to be narrowing, although the report notes that:

*…the lack of a commonly agreed and well-understood set of definitions of e-learning competences, combined with the uncertainty about what contitutes good practice and effective pedagogy for e-learning, may have led many respondents to overstate the e-learning skill level of staff.* (Becta, 2004c, p.23)

This broad distinction is reflected in the LSDA/NLN evaluation (LSDA/NLN, 2004), which found ICT was most commonly or constantly used by staff for communicating with colleagues, for record-keeping, and for tracking student progress. The survey also asked how often staff currently used ICT in teaching. It found that 24 per cent used ICT constantly and 17 per cent reported they never used ICT in teaching.

The report concluded that when ICT was used in a teaching context, it most commonly supported traditional teaching methodologies by aiding delivery. Aspects of ICT use which offered the chance for a radical new pedagogy, such as feedback and communication with learners or distance and online learning, were less used (see Figure 5.3).

In terms of sources of ICT training and continuing professional development (CPD), the 2004 Becta survey found that the Ferl Practitioner Programme (FPP) was cited by 14 per cent of respondents, while 3 per cent mentioned the European Computer Driving Licence. (ECDL). It appears that the source of most training and CPD for college practitioners is in-house.

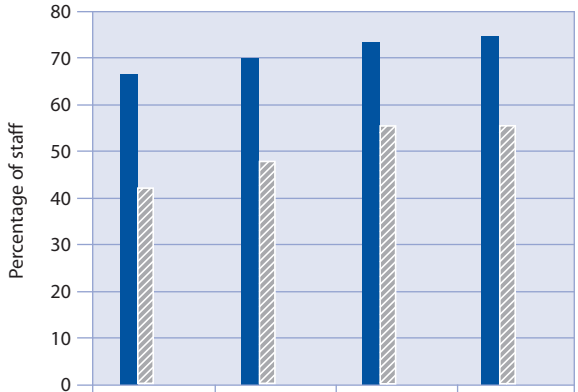
The pilot phase of FPP was launched in October 2002 and involved 108 English colleges and eight from Northern Ireland. The programme aimed to equip the teaching, learning resources, learning support and technical staff in colleges with the skills essential for harnessing the potential of ILT and e-learning. The evaluation of the programme (Becta 2003c) made recommendations for improvements to the materials and programme modules, but did not assess impact on staff ICT confidence and competence. An evaluation to consider these issues is being conducted in 2005.

### Levels of use

The LSDA/NLN evaluation report looked in detail at learning and teaching issues, sampling both learners and lecturing staff. The study found that students' reported use of networked PCs in college was fairly high overall – over 70 per cent reported using these at least weekly.

The majority of staff were enthusiastic about the use of technology in learning and teaching, and a significant minority felt that increased use of ICT/online learning would lead to better grades.

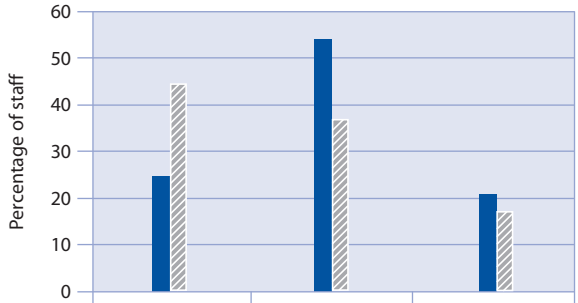
**Figure 5.2: College estimates of staff competent and advanced at IT/e-learning**




| | 2000 | 2001 | 2003 | 2004 |
|---|---|---|---|---|
| IT skills | 67% | 70% | 73% | 75% |
| e-learning skills | 42% | 48% | 56% | 56% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

**Figure 5.3: Teaching staff IT and e-learning competence**




| | Beginner | Competent | Advanced |
|---|---|---|---|
| IT skills | 25% | 54% | 21% |
| e-learning skills | 45% | 38% | 18% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

Staff saw technology as essential in their work. Clearly, ICT is very important in the day-to-day activities in colleges.

Both FE staff and students were prepared for greater use of ILT/e-learning, but reported that barriers held them back. Reported barriers included lack of staff time, insufficient equipment, ill-equipped rooms, and lack of support and guidance. Lack of electronic content, unreliable networks and poor software/learning materials were also inhibiting factors, but these were reported to a lesser degree than other factors.

Though small in the sample, part-time learners appeared to have less access to ICT while being taught (that is, in college and in class) than full-time learners. Similarly, students at higher levels reported better access to ICT than did others. This included access to data projectors and interactive whiteboards in the classroom.

Three-quarters of the learner sample reported having access to the internet outside college, and 34 per cent reported accessing a VLE or college intranet from outside the college.

Students reported that, when used, a VLE was useful, including the use of self-assessment and online tests (quizzes). The main benefit of using a VLE was reported as the ability to work in their own time.

### ICT and assessment

Data from the Becta ICT and e-learning survey (Becta, 2004c) describes the extent to which colleges used ICT to track students' academic progress. Tracking against assignments and assessments was the most widespread aspect of tracking, taking place in some 47 per cent of colleges (see Table 5.6).

Some 35 per cent of colleges commonly use electronic information to assist personal tutorials. Only 24 per cent maintained electronic student portfolios or records of achievement, which was little changed from the previous year. This appears an area of relatively slow progress (Becta, 2004c).

Online assessment, in the context of each college's whole programme, was limited to individual enthusiasts in half of the colleges surveyed, and was only reported as widespread in 2 per cent of colleges (Becta, 2004c).

### Impact on learning

The learning and skills sector does not have the same tradition of investigation into the impact of ICT on attainment as the schools sector. FE evidence about the impact of ICT on learning is currently limited. That is, it is local and small scale at present.

Drawing on perceptions data in the NLN evaluation (LSDA/NLN, 2004), many students and staff were positive about the outcomes of ICT use. Staff reported that ICT use had most impact in relation to students' employability. There was perceived potential for ICT to lead to higher grades and have a positive effect on staying-on rates, but there were mixed views about this. Only just over two-fifths of those surveyed thought ICT could lead to improvements in these areas. Full-time staff were most likely to believe that ICT would have a positive impact on attendance, retention, motivation, grades and employability.

Further work is required in order to investigate the impact of ICT on such factors as retention rates and attainment or achievement rates. This is currently being commissioned by the DfES.

**Table 5.6:**

| Use of ICT to track progress | | |
|---|---|---|
| | 2003 | 2004 |
| Scheme of work | 12% | 16% |
| Whole programme | 21% | 17% |
| Assignments | 42% | 47% |
| Completion of an element of the programme | 27% | 27% |
| Tutorials | 18% | 15% |

Source: *ICT and e-learning in Further Education (Becta 2004c)*

# 6 PROGRESS, ISSUES AND CHALLENGES

In assessing 'how far have we got?' and articulating the challenges in making further progress, we will now consider progress in relation to impact on:

- **Learners** – in terms of the outcomes of ICT supporting personalised learning, collaboration between learners as well as individual interaction and engagement, allowing greater inclusion and access to learning and helping to raise standards.
- **The educational workforce** – in terms of the development of a more effective workforce, using ICT for learning and teaching and for administration, supported by continuing professional development, including access to communities of professional practice, and extending roles, support and resources beyond institutional boundaries.
- **Educational institutions** – in terms of support for localised delivery, increased innovation and improved accountability, and the creation of effective, engaged and extended institutions.
- **The educational system as a whole** – in terms of improved communication and coherence, whereby innovation occurs and effective practice permeates across the system.

## LEARNERS

### Learners' experience

Over the last few years learners have experienced an increasing use of ICT in learning and teaching, and clearly rapid progress has been made recently. There has also been an upward trend in the number of institutions judged to be making effective use of ICT – again, there has been some real progress in this area in recent years. There are now good examples of subject-specific software packages and related tools to support learning and teaching, and, partly because of the large central investment in this area via the NLN in post-16 education and Curriculum Online for schools, learners are experiencing increased opportunities to use these in their learning.

The evidence presented in this review tells us, however, that the experience for learners is a highly variable one in terms of level and quality of ICT access, indicating a fair distance to travel in terms of enhancing and personalising all learners' experiences. In fact, there are profound differences in the ICT-based learning opportunities available for pupils and students, and this is true both in the schools and post-16 sectors.

Though there has been rapid progress in levels of access to and use of ICT, some aspects of use which are important to personalisation, such as ICT-based assessment for learning, are rare across both sectors at the moment. The research literature cites positive examples of the use of ICT for these kinds of purposes, but these represent pockets of innovation at the moment. Embedding effective innovation across the system is a key challenge which entails drivers for progress being put in place, such as the QCA's intentions to develop increased online assessment.

However, Becta's 2003 LANs survey tells us that only a quarter of schools were equipped with the minimum specification in terms of ICT infrastructure to deliver the QCA's online ICT assessment. Overall, smaller institutions in particular are struggling to develop and sustain an accessible and reliable ICT infrastructure to support learning and teaching, and this is a key barrier to realising the vision of ICT supporting a more effective and personalised experience for learners.

There is no national data available on learners' use of collaborative learning technologies, though Ofsted notes that the use of email by older pupils to discuss ongoing work with other students is becoming more common. We know that small-scale studies have identified examples of effective collaborative activity using VLEs and other tools, but do not know the extent or quality of use across the system. However, given that teachers' and (probably) lecturers' understanding of the range of uses of ICT is limited overall, it is likely that further work is needed to embed this aspect of practice.

### Mediators of learner experience

Key factors which influence the level and quality of ICT use in learning and teaching include:

- institutional differences based on local leadership, related decisions about deployment and use, overall decisions about ICT spending, and barriers such as the design of school buildings. These factors have a direct impact on the logistics of using ICT in learning and teaching and can, in some cases, prevent

teachers and lecturers from using ICT when they have the commitment and experience to do so.
- teacher/lecturer knowledge, commitment and time for integrating ICT into learning and teaching, particularly in terms of the use of tools, and content to support curriculum learning and assessment.
- learner circumstance – notably in relation to ready access to a home internet-connected computer to enable access to learning resources via the internet or the institutional intranet or VLE, if applicable.
- the subject under study; for example, post-16 learners studying trade-related subjects are far less likely to use e-learning than other students, and generally core and ICT-specific subjects in school demonstrate higher levels of use and impact than other subjects.

Generally, the evidence tells us that learners are developing increasingly sophisticated ICT skills. They are also more likely to use ICT at home than in their institution and be motivated in their learning when ICT is used. This is especially true of older school pupils and learners studying at higher levels in FE colleges. Similarly, there are indications of general demand for the use of ICT resources among FE students and a perception that ICT is currently being under-utilised in learning and teaching.

Learners are ready to embrace higher levels of use of ICT and are increasingly coming to expect it as a routine aspect of learning and teaching.

The progress made in meeting expectations in those institutions delivering well on the use of ICT in learning and teaching is best accounted for in terms of 'fertile ground' – effective leadership and a knowledgeable workforce, representing an institutional capability to anticipate and work through the challenges of implementing ICT effectively. The public policy challenge now is to develop strategies for delivering change in institutions in different circumstances – those developing from a lower base in terms of ICT leadership and overall teacher/lecturer expertise.

### Impact on attainment

It is difficult, for methodological and other reasons, to study the causal relationship between the use of ICT in learning and teaching and attainment gains, as measured by performance in national tests. However, we know with a degree of certainty, from the ImpaCT2 study and recent follow-up (Harrison et al, 2004), from Becta's analysis of inspection and attainment data, and the review by Cox et al (2003a) of ICT and attainment that ICT resourcing and use is positively associated with attainment gains in some subjects and key stages in the school sector. Less is known about the impact of ICT in post-16 education. A DfES study is currently under way in this area.

In addition, the study by Passey et al (2003) of ICT and motivation was important in confirming that ICT use has positive impacts on pupils' motivation to learn. However, ICT was motivating only if underpinned by clear task orientation.

Impact, of course, is dependent on teachers' understandings of the potential of ICT to support different learners, and on teachers developing approaches to differentiate the learning experience. We have a growing understanding of factors associated with positive impact on standards, some of which overlap with factors in learners' experience of ICT. Important in this is the extent of the ICT tradition within a subject, the use of ICT across the institution and curriculum, and teachers' more general understanding of their subject and how to teach it. One of the key enablers of impact on learning is teachers' understanding of how to integrate ICT to support subject pedagogies. Clearly, continuing professional development in this area needs to focus on developing this understanding and on developing communities of subject ICT practice.

### What we don't know

In understanding how ICT supports learning, there is a continuing challenge to 'get underneath' statistics to understand better the processes, factors and specific uses of ICT which consistently relate to positive impact on pupils' learning and institutional standards, and to understand which of these add most value.

This represents a major evidence challenge. In the context of continually developing educational thinking and innovation in ICT provision and use, studies focusing purely on statistical impact are limited in providing useful outcomes for taking forward ICT policy and practice.

Evidence is currently limited as to the extent and nature of ICT use in different subject areas and the link with teachers' pedagogy and effective practice. In particular:

- the range, nature and amount of ICT use in particular subjects and sectors from the perspective of both the teacher/lecturer and the student. Currently, much of what we know is based on evidence from institutions and does not specify the particular uses to which ICT may be used in a given subject.
- the links between technological developments and educational practice, in particular, the innovative pedagogical approaches which are supported by new and emerging technologies
- the effectiveness of ICT resources, especially software resources, in practice – to develop an evidence base which informs both practitioners and developers, and tracks content quality in terms of impact on learning outcomes
- the actions of the teacher, teaching strategies and pedagogical reasoning which are associated with effective use, including differentiation of learner experience.

We know that there are currently technical and infrastructure barriers to progress, but evidence is limited on:

- factors determining poor ICT provision
- user perspectives on, and preferences in relation to, infrastructure provision.

# THE EDUCATIONAL WORKFORCE

### ICT and e-learning capability

Just as the provision and use of ICT in education has improved hugely over the last few years, schools also report that teachers' competence and confidence in using ICT in their subject teaching has improved. This seems to have been driven primarily by teachers' personal access to and ownership of ICT, as indicated by the evaluations of the Computers for Teachers and Laptops for Teachers schemes, but also by the delivery of training and CPD. Personal access is also likely to account for colleges' reporting of increased staff skills in both the use of ICT and in e-learning. These are lower than those reported in schools, though it is difficult to make direct comparisons, as expectations are likely to be different in each sector.

There are some positive messages about a developing ICT capability in the educational workforce. However, exceptions to this include support staff, particularly teaching assistants. In addition, teachers' and lecturers' skills in e-learning (use in learning and teaching as opposed to ICT skills per se) are still limited.

However, we have seen that the trend reported by schools for increased teaching staff confidence in using ICT as part of their job has not risen in the latest DfES figures. While this may partly be a consequence of a slight change to the survey method, it may also be an indicator of increased expectations and a realisation that achieving capability is more challenging that previously thought. Similarly, figures for the amount and nature of advice, guidance and professional development with respect to ICT relate to schools' and individuals' perceptions of 'appropriate' levels, which may reflect limited expectations in the context of low use in some schools. As we know from other research, very few teachers have a comprehensive knowledge of the range of ICT resources available, and it may be that increased use of ICT in learning and teaching exposes practitioners to the gaps in their understanding.

There are also indications from Ofsted and other sources that the quality of technical support to institutions is very varied and that this has a negative impact on teachers' confidence in using ICT in the classroom. This may be partly based on variations in technical staff expertise – Ofsted identifies the need for a national structure of accredited training programmes for school-based technicians as one of their recommendations for action at a national level (Ofsted, 2004, p.9).

### Professional practice

There is a clear message for the need for continuing professional development in both sectors in relation to the use of ICT in learning and teaching. However, a precursor to this is defining the expertise required to gain value for learners from the use of ICT, that is, to develop greater understanding of the ICT and e-learning pedagogies required to develop a more learner-focused and enhanced learning experience.

Decisions about ICT deployment and use need to be driven by educational need, and informed by pedagogical considerations. This is not just about applying ICT knowledge and skill. Practitioners, including managers, will be increasingly required to make decisions about how to improve the learner experience within particular contexts using ICT. There are unlikely to be universal answers, so practitioners need to be supported as theorists, informed by the possibilities of ICT along with an understanding of what's afforded and required within their particular organisational and learner context.

The current ambitions for education also entail that practitioners' understandings of ICT go beyond learning and teaching to link with effective learner management and administration. We know that a significant minority of practitioners are still not using ICT for tasks such as administration and record-keeping, despite a growth in this area of use. We do not know the extent to which low use reflects institutional or practitioner-level factors – it is likely to reflect a mixture of the two – but we do know that institutions and institutional leaders are the most likely to drive change in this area.

### Spreading effective practice

Peers play an important role in disseminating what ICT resources and applications there are and demonstrating the benefits which technology can bring to the delivery and management of learning in particular areas. Practitioners are willing to learn and take advice from their peers in similar circumstances (Cox, 2003b; Scrimshaw, 2004). Professional and other networks and associations, therefore, have a key role to play in developing professional practice with ICT. Given that we know that ICT pedagogies are closely linked to subject pedagogies, especially at school level, practitioner subject networks have a particular role to play in defining, developing and spreading effective ICT pedagogies.

ICT can also play a key role in supporting geographically spread networks of practitioners and in developing communities of professional practice. The NOF evaluation found that practitioners reported the need for dialogue and interaction with other practitioners to support and develop their understanding. There are some good examples of online forums which enable this, and evidence that, in the right circumstances, practitioners engage in sustained ways with these forums.

We have evidence relating to what makes for successful online communities but the extent of impact and influence of such forums nationally is still unclear. In addition, Ofsted notes that not everyone engages with such approaches to professional development, and clearly a reliance solely on online approaches at the expense of face-to-face approaches is a mistake.

Arguably, evaluations of the impact of large-scale online forums, such as Teachers Online, the SENCO forum and NCSL's Talk to Learn, have the potential to tell us more about the overall effectiveness of forums like these in developing or adding value to communities of practice. It is important that such evaluation addresses the tools and types of interaction which particularly support accelerated development of professional understanding.

### What we don't know

Overall, evidence is limited as to how to develop and spread effective ICT practice in the educational workforce. Specifically:

- the individual competencies which underpin effective ICT practice, including effective ICT pedagogies. This relates to practitioners' roles as local decision-makers in the achievement of educational change within particular contexts.
- how ICT adds particular value to developing and spreading effective practice – notably how communities of professional practice are built and supported.

## EDUCATIONAL INSTITUTIONS

### Overall effectiveness

Our analysis informs us that institutions and institutional choices and decisions are key mediators of the experience of ICT in learning and teaching. Therefore, it is critical to support leaders in understanding how ICT can be implemented effectively and sustainably in both learning and teaching and in institutional management. Some key aspects of effectiveness have been considered already in this review, such as the ICT skills, confidence and competence of the workforce – both those of practitioners and institutional leaders – and related training and professional development issues.

In addition, institutions will need to be innovative and consider ways of using ICT to extend learning beyond the traditional boundaries of their organisation. Importantly, institutions need to orient themselves to supporting practitioners in delivering a more learner-focused educational experience. This entails providing the right information systems and data analysis, where appropriate, and supporting practitioners in delivering a personalised experience.

As with the learner and practitioner experience, the institutional benefits of ICT are currently held back in many cases, especially in smaller institutions, by limitations in the deployment and reliability of ICT infrastructure. This means that a considerable minority of schools are not using management information systems (MIS) for basic information handling, such as attendance recording and key stage entry. For those that are, a substantial minority do not have a joint learning and administration network (see Section 2). Similarly, many FE colleges report that they are struggling to develop systems which track learners' progress through a programme of study. Institutions need to be supported in addressing these infrastructure barriers to enable them to develop and fully embed the use of ICT to support learning and teaching and learner management. Arguably, achieving ICT sustainability and technical reliability is proving a distraction for many educational institutions from delivering core educational business.

### Learning beyond the institution

There is evidence that schools and colleges are beginning to use ICT to facilitate links between the institution and elsewhere, notably the home and workplace. There is a good basis for taking this forward. Levels of young people's use of, and access to, personal computers at home are high compared to the population as a whole. A majority of schools provide pupils with access to their computers outside school hours. In addition, teachers have high levels of access to personal home computers, and many institutions now have intranets and websites (though these are not always linked), which have the potential to support the process of extending learning opportunities beyond the institution.

However, again, and especially in small institutions, there is a real technical and pedagogical challenge in developing intranet or VLE provision to support learning beyond the institution. Until the use of ICT becomes a natural platform for providing learning materials and support within the institution, the benefits of providing this externally are unlikely to outweigh the costs of delivery in terms of time and other resources. At present, school and college websites are used more as a vehicle for publicising the school, and there is a need to spread the expertise and practice of those leading-edge institutions which are using them to provide learners with access to learning, revision and assessment materials from a distance.

A key issue to address in enabling learners to access information and support for learning beyond the institution is the significant minority of learners who do not have home access to an internet computer. These are

more likely to be learners from lower socio-economic groups and older learners, who will be disadvantaged in relative terms by developments in this area. Institutions need to be sensitive to local context in their ICT-resourcing decisions, and may need to resource home access as well as institutional provision in some cases. This is not a simple challenge to meet and can involve procuring internet services, developing security systems and processes, and dealing with issues of learners' safety.

### ICT, workload and productivity

We know from the recent DfES study of ICT and teacher workloads (PwC, 2004b) that ICT has great potential to free practitioners from mundane tasks so they can focus more on developing the quality of learning and teaching. The study found good examples of this being achieved. The challenges in ensuring this happens throughout the system are significant. Making a difference in this respect requires that institutions and practitioners have a clear understanding of how the deployment and use of technology can realise efficiencies. Less ICT-skilled practitioners were more likely to report an increase in workload arising from using ICT, for example. It appears that ICT realises workload savings only where it is properly planned and deployed to do so.

A critical question is whether institutions, especially smaller ones, have the in-house capacity and capability to deliver the ICT changes necessary to make real improvements in this area. This is unlikely to be the case and there is a clear need to develop frameworks for guidance and support to institutions in order to achieve this, as well as enabling learning about what works to be transferred between institutions.

### Institutional ICT maturity

A recent study has offered us a picture of the levels of 'e-enabled' institutions (PwC, 2004a). A fairly small minority of institutions have successfully embedded ICT, a further small minority have not made any significant progress, and a large core in the middle are endeavouring to make progress but are struggling to deal with issues of sustainability and effectiveness.

There are some indications presented in this review that the gap between the leading-edge and late adopters may be increasing. This is likely to be due to that fact that those institutions which are best served at the moment are now driving their own development and becoming less reliant on direct government funding and support. These institutions are clearly prioritising and continually improving their own use of ICT. Meanwhile, late adopter institutions are struggling to move forward.

It is likely that to achieve progress across the board, interventions are required which are tailored to institutions at different stages of maturity.

### What we don't know

Robust evidence is currently limited as to effective ways of providing real value to institutions in supporting institutional processes, including facilitating continuity between institutionally-based learning and learning elsewhere and achieving efficiencies in educational and management processes. This includes:

- effective and efficient strategies for linking learning inside and outside the institution using ICT
- the issues and challenges in achieving efficiencies in teaching preparation, including cultural, organisational and technical issues using ICT
- the impact of ICT on productivity and efficiency, where it is used effectively in order to understand the relationship between costs of implementation and benefits accrued.

We now have good baseline measures of institutional ICT maturity against which to track progress – but follow-up studies are needed, to assess the distance travelled.

We do not currently have a baseline against which to measure progress in the achievement of efficiencies using ICT, or to measure the extent to which practitioner time is freed up using ICT.

## THE EDUCATIONAL SYSTEM AS A WHOLE

The prime reason for seeking a more unified (not uniform) educational system is to better serve the needs of individual learners. For example, in future, learner programmes of study and learning journeys may involve engaging with different institutions at the same time. The management of learners will become something that happens between, rather than purely within, institutions.

The evidence tells us that there are technological developments and pilots to support these processes, for example, increased use of learner records of achievement and learner portfolios which can be accessed online. But, as with many of these developments, they are restricted currently to leading institutions and localities.

Networking between institutions is important in facilitating the spread of innovation in practice. Where it happens at the moment, innovation tends to be isolated and, though there are some networks and mechanisms in place for sharing practice, it is unlikely, owing to limited embedding of ICT,

that online networks and services currently have a real impact on other institutions.

Overall, the evidence suggests we have an ICT system which is not yet capable of facilitating a fully networked learning community which adds value for learners. Key issues which need addressing are:

- **Ubiquitous access** – currently, the use of technology is not ubiquitous enough. There are still some areas of particularly low access to ICT.
- **Reliability** – lack of reliability is proving a barrier to practitioners' sustained use of and, importantly, their competence and confidence in using networked ICT routinely.
- **The use of ICT to fully support a range of educational processes** – uses of ICT within institutions are not yet joined up. This not only restricts efficiencies, but is also a barrier to developing embedded use.
- **Workforce expertise** – as we have seen, it is likely that practitioners' and managers' knowledge of the potential for ICT is limited in many cases. There is also a gap in skills and confidence, despite progress.
- **National ICT system** – use across educational processes is a significant challenge and is likely to demand central intervention to facilitate the development of an appropriate national ICT 'architecture' which supports both the provision of learning opportunities and data management across the system.

### What we don't know

Evidence is limited as to effective approaches to joining up educational provision, how ICT adds particular value to this, plus how learning and educational business can be conducted effectively between institutions and between the centre and the locality.

There are good examples of isolated development studies at the moment, but no systematic or robust evidence to inform technology developments which support coherence in the education system.

## CONCLUSIONS

Among the most evident improvements over the last few years are those to learners' access to ICT and to overall institutional provision. These indicators suggest good progress within the larger international picture. There has also been a sharp rise in levels of teacher/lecturer confidence – in terms of both general confidence and the use of ICT in learning and teaching.

It might be argued on the basis of this progress that ICT embedding will in time take care of itself, but this is unlikely. The evidence tells us that there are some critical barriers to making significant progress in relation to the four areas outlined at the beginning of this section. The limits to progress are most starkly represented in recent research into levels of institutional ICT maturity in schools and FE colleges, which found that many institutions, especially smaller ones, are struggling to embed the use of ICT to serve their educational goals. As a result, learners' ICT experience varies considerably and institutions and the educational workforce do not gain the full benefits of effective ICT deployment and use.

Barriers to progress include limitations in infrastructure access and reliability, and limitations to professional expertise in the workforce. These are clearly areas for public policy advice, support and intervention.

Overall this review suggests that the time is ripe for a unified strategy for ICT in education to meet the ambitions of the DfES *Five Year Strategy*. In the current context, change of the kind and order proposed is unlikely to happen without co-ordinated intervention and support – to promote systemic change, and to ensure joining-up across the system.

The review also tells us that in taking this work forward we need to be realistic about the existing capabilities of the workforce, the institution and the system. Any strategies for further progress certainly need to recognise the importance of promoting organisational and cultural change within institutions, and also address the capabilities of the workforce in using ICT effectively in learning and teaching.

There is a clear need to support institutions whose overall capabilities in this area are limited or developing. It is likely, in fact, that support and intervention will be most effective if targeted specifically at institutions' differing stages of development. There is also a need to lift unnecessary burdens and barriers relating to ICT where desirable and possible – including, for example, unnecessary technical burdens.

Finally, as yet there is no definitive roadmap for ensuring that technology implementation will deliver desired change. Though we know much about what is currently effective, given the extensive ambitions for technology within the *Five Year Strategy*, innovation is critical in developing future practice with technology at different levels in the system. We need to ensure that there are mechanisms for supporting and diffusing proven innovation, such that leaders in the field can influence the development of others.

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# ANNEX

| MIT/Becta five-level transformation scale | | | |
|---|---|---|---|
| **Impact indicator** | ILT strategy | ILT management | Staff development |
| Localised | An ILT strategy is not developed but some staff/departments are integrating ILT in their work | ILT takes place mainly in isolation, little co-ordination by management across the institution | Staff development: individual training on an *ad hoc* basis |
| Co-ordinated | There is a draft strategy in place and the extent of use is measured, resources are inventoried | Central IT management function identified. Management involved in curriculum development to co-ordinate ILT practice across the institution | There is a draft strategy in place and the extent of use is measured, resources are inventoried |
| Transformative | Staff actively contribute to the process of updating and expanding the strategy and its implementation in the curriculum | Management acts as a catalyst for change and takes account of current application of ILT in education | There is curriculum and information systems training for most staff, recognition of new skills needed to facilitate changing learning and teaching styles |
| Embedded | The ILT strategy takes account of teaching and learning styles arising from the potential of ILT exploitation | Management monitors and supports ILT integration across the college and advises on models of good practice and innovation | ILT staff development and training is intuitively integrated in all areas of a college's work |
| Innovative | Significant strategic commitment at management level to the use of ILT in teaching and learning | Significant strategic commitment at management level to the use of ILT in teaching and learning | Staff are trained in tutoring and there is timely intervention to support and use ILT |

**The five-point scale was developed by Massachusetts Institute of Technology to measure the impact of IT on businesses and adapted by Becta as a model which may be applicable to the adoption of ILT by colleges. [http://www.becta.org.uk/research/research.cfm?section=3&id=55] Currently Becta is refining this model further.*

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