

# Harnessing Technology Review 2007:

Progress and impact of technology in education







## PREFACE

Welcome to the *Harnessing Technology Review 2007*, a strategy-level review of what current research and evidence tells us about harnessing technology for the benefit of learners. This publication builds on the *Becta Reviews* of 2005 and 2006, focusing discussion closely on the ambitions of the government's e-strategy, *Harnessing Technology*.

This year we have divided the *Review* into two parts:

- A high-level summary which identifies the main messages from the evidence and offers an analysis of strategic issues and challenges
- An evidence review providing a detailed outline and discussion of the evidence and its implications, which is available at <http://publications.becta.org.uk/display.cfm?resID=33979>

There is now a strong evidence base to underpin the leadership of technology in education at national and local level. This review offers some clear steers which are discussed in the final section.

There are many encouraging signs of progress and a growing evidence base demonstrating positive impact of technology and educational 'e-maturity' on a range of outcomes. Clearly, however, the challenge of delivering greater value from technology and realising significant benefits for learners is a continuing one.

As you will read in the evidence review, we are now better able to understand and describe technology-related strategies which deliver benefits. The evidence helps chart and illustrate them in ways that will meet the needs of our key stakeholders. Through Becta's discussions with stakeholders and with national organisations supporting change in education and skills sector, we intend to ensure that the use of technology supports the development of an education and skills system which is fit for the 21st century.

**Stephen Crowne**  
*Chief Executive, Becta*



## INTRODUCTION

March 2005 saw the publication of the Government's e-strategy, *Harnessing Technology*, which sets out a system-wide approach to the application of ICT in education, skills and children's services. It sought to apply technology to transform the way in which educational institutions operate and are managed, and the way they connect with each other and enable interaction, for the benefit of learners, parents and carers. Technology should fulfil its potential as a critical enabler of educational change, directly supporting and connected with other government strategies, including the DfES's (now DCSF/DIUS) five-year strategy and the personalisation agenda.

The last 12 months have seen the translation of the e-strategy into a single delivery plan (Becta 2006). This clarified the desired outcomes of the strategy, grouping them in a 'scorecard' under the themes of:

- Fit-for-purpose technology, systems and resources
- Capability and capacity of the workforce, providers and learners
- Efficiency, effectiveness and value for money across the system
- Improving learner and system performance.

This review gauges the extent to which there has been progress in meeting the outcomes described by the *Harnessing Technology* scorecard in schools and the FE and skills sector in England. Where comparative data is available, it is provided for the UK, from work carried out by the Organisation for Economic Co-operation and Development (OECD) and the European Commission.

The analysis presented in this review has been informed by recent surveys and research studies, including:

- national statistics and large-scale and national level surveys
- national and large-scale research studies of ICT implementation and use

Figure1: The strategic outcomes of the Harnessing Technology strategy

<p><b>Capability and capacity of the workforce, providers and learners</b></p> <ol style="list-style-type: none"> <li>1.1 Leaders have the knowledge and skills to ensure technology for learning can be harnessed for the benefit of learners</li> <li>1.2 Institutions and providers plan and manage technology for learning effectively and sustainably</li> <li>1.3 Practitioners exploit technology consistently to offer engaging and effective learning experiences</li> <li>1.4 Practitioners, parents and learners can share and use information and data effectively for the benefit of learners</li> <li>1.5 Improved learner capability in using technology to support their learning</li> </ol>	<p><b>Outcomes and benefits for learners and children</b></p> <ol style="list-style-type: none"> <li>3.1 There is greater choice in learning opportunities and modes for all learners</li> <li>3.2 Learners have increased motivation for engagement in learning</li> <li>3.3 Fewer learners under-perform or fail to succeed in education</li> <li>3.4 An improvement in the quality of learning provision is accelerated</li> <li>3.5 There is improved child safety and child protection</li> </ol>
<p><b>Fit for purpose technology and systems</b></p> <ol style="list-style-type: none"> <li>2.1 All learners and practitioners have access to the appropriate technology and digital resources they need for learning</li> <li>2.2 Every learner has a personalised learning space to enable them to learn when and where they choose</li> <li>2.3 Technology-enabled learning environments are secure, supported and interoperable</li> <li>2.4 There is a dynamic, vibrant and responsive technology for learning market that can meet the needs of the system</li> </ol>	<p><b>Efficiency, effectiveness and value for money across the system</b></p> <ol style="list-style-type: none"> <li>4.1 Learning providers collaborate and share information and resources</li> <li>4.2 The management and administration of learning and institutions is more efficient</li> <li>4.3 There is a greater level of effective, learner-focused, assessment for learning</li> <li>4.4 Practitioners collaborate and share good practice and learning resources</li> <li>4.5 There is good use of information to support learner transitions between institutions and sectors</li> </ol>

- projects to evaluate national ICT programmes
- inspection data and reports from Ofsted
- systematic reviews of literature relating to ICT in education.

The final section charts overall progress and the issues and challenges arising from this review in the context of the e-strategy and the Government's wider ambitions for the education and skills sectors.



## FIT-FOR-PURPOSE TECHNOLOGY, SYSTEMS AND RESOURCES

Continuing investment has produced improvements in the technology infrastructure in schools, with the greatest improvement in the pupil:computer ratio in secondary schools (see figure 2). There has been particular growth in the availability of laptops, with the increase often linked to the availability of wireless networks.

The UK performs well in comparison to international benchmarks for access to technology in schools. For example, it ranks fourth in the European Union (EU) in terms of pupil access to internet-connected computers (see table 1).

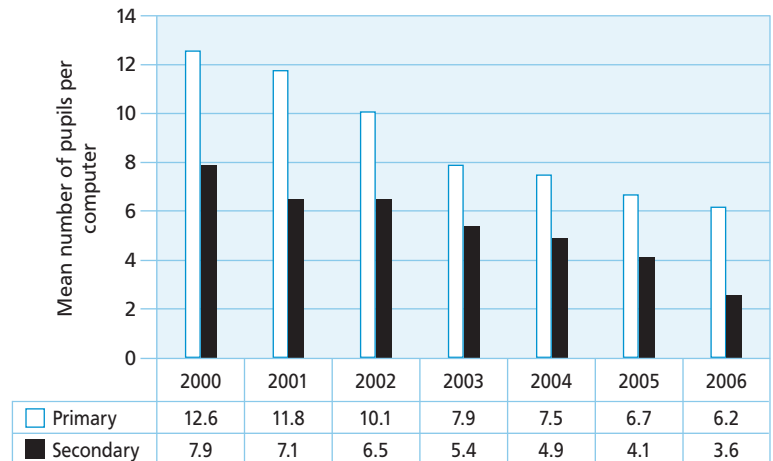
In the FE and skills sector, while in the past colleges have had a particular challenge in maintaining the currency of their infrastructure and have faced demands created by increasing student numbers, the number of full-time equivalent (FTE) students stabilised in 2006, and the student:computer ratio remained largely the same (see figure 3).

In colleges, around three quarters of computers are sited in classrooms, constraining when they may be used to those times when classes are scheduled. While open-access provision allows some use out of class time, this provision has remained relatively constant over the last few years.

There have been improvements in connectivity and access to the internet in schools and colleges (see figure 4), with improved reliability of connections giving practitioners increased confidence to use the technology live in the classroom. There is still a need to develop practice to gain full value from broadband use in classrooms.

Schools still have a way to go in achieving full integration of their curriculum and administration systems. The integration of

Figure 2: Number of pupils per computer used for learning and teaching 2000–2006



Source: ICT in schools survey 2004 (Prior and Hall, 2004), and Computer:Pupil Ratio from Pupil Level Annual School Census 2005 and 2006

Table 1: Number of computers per 100 pupils in European Schools 2006 \*

Country	Number of internet-connected computers	Number of computers	Overall rank for number of computers
Denmark	26.8	27.3	1
Norway	22.7	24.2	2
Netherlands	20.0	21.0	3
<b>United Kingdom</b>	<b>18.5</b>	<b>19.8</b>	<b>4</b>
Luxembourg	18.3	19.6	5
Sweden	16.6	17.4	6
Finland	16.2	16.8	7
Austria	14.2	16.2	8
Iceland	14.8	15.8	9
France	8.9	12.6	10
<b>EU25 average</b>	<b>9.9</b>	<b>11.3</b>	
<b>EU15 average</b>	<b>10.8</b>	<b>12.1</b>	

\* Only includes computers at schools available to students for educational purposes.

Source: Benchmarking Access and Use of ICT in European Schools (Head teacher Survey), Commission Services, European Commission (2006)

learning platforms with management systems remains an issue in both schools and FE and skills sectors.

The rapid growth in interactive whiteboards has continued in all sectors, with the most marked increase being in secondary schools (see figure 5). Interactive whiteboards continue to be a focus for future spending and growth in schools, and their numbers do not appear to have reached a plateau yet.



Learning platform availability continues to increase. However, overall levels of adoption remain relatively low, with learning platforms still more prevalent in secondary than primary schools. In colleges, although virtual learning environment (VLE) use is growing, college networks and intranets still serve as the predominant platforms.

While technical support remains an ongoing issue for schools, there is evidence that institutions are developing effective models for addressing the issue and see it as a high priority in future ICT spending. Where effective technical support is provided, ICT confidence among staff is improved.

## CAPABILITY AND CAPACITY OF THE WORKFORCE, PROVIDERS AND LEARNERS

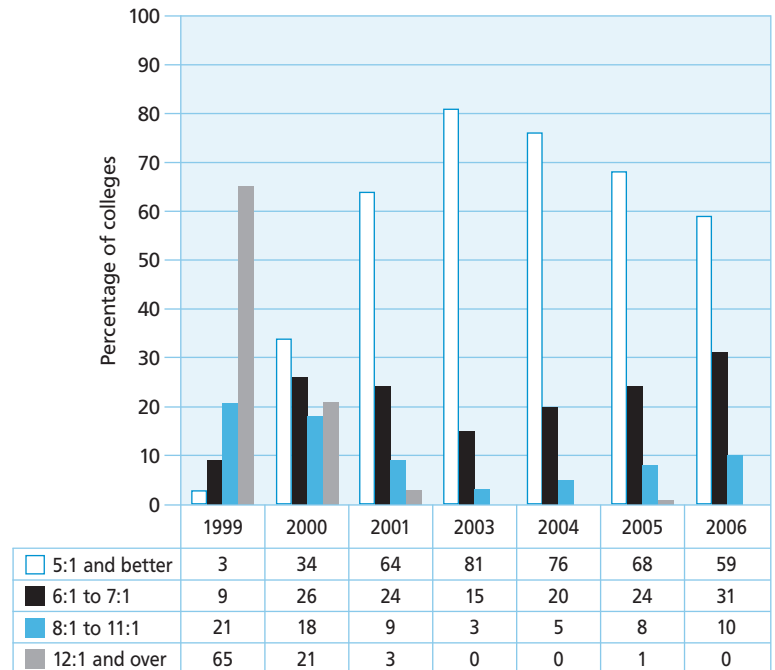
Organisational 'e-maturity' can be defined as the integration of technology-based applications and processes into all key aspects of organisational practice and operation. Butt and Cebulla (2006) state that e-maturity:

*...indicates the extent to which schools and their teachers make the use of ICT integral to their teaching and planning of teaching activities and provide students access to ICT inside and outside the classroom.*

Butt and Cebulla (2006) developed an index of e-maturity in primary and secondary schools using similar indicators to previous work by PwC. This index is composed of three dimensions combining measures of attitudinal and 'hard' data on availability and use of resources. These dimensions are:

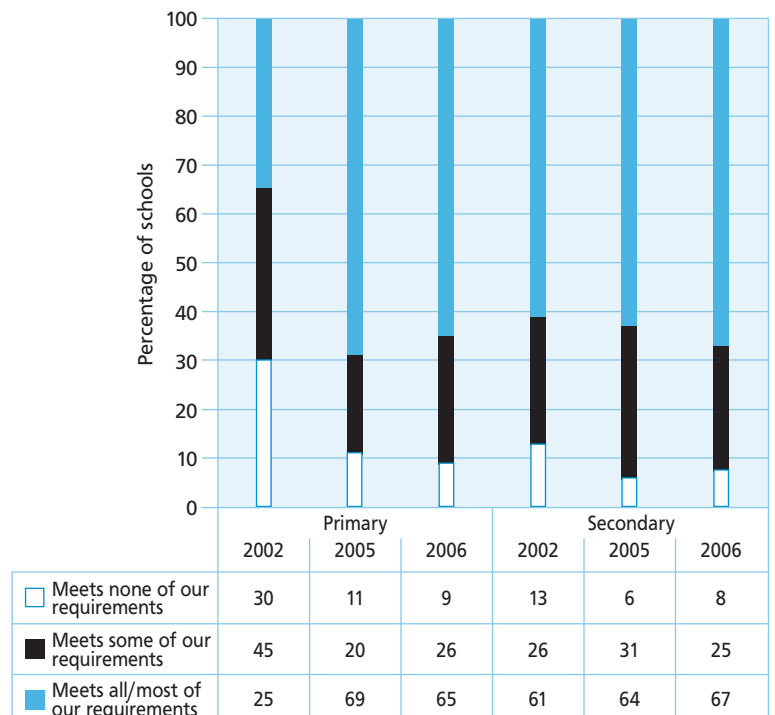
- ICT infrastructure and resources
- organisational co-ordination of ICT resources
- engagement with learners – the use of ICT in a school.

Figure 3: FE college ratio of FTE students to all computers



Source: *ICT and e-learning in Further Education: management, learning and improvement (Becta, 2006f)*

Figure 4: Speed of internet connections in schools 2002–2005



Source: *Harnessing Technology in Schools survey (Kitchen, Finch and Sinclair, 2007)*



Using this index there were modest but statistically significant increases in mean scores for overall e-maturity on a scale from 12 to 36 between 2002 and 2005 (see tables 2 and 3).

Although there is evidence of improved levels of institutional e-maturity in recent years, this improvement has not been rapid, and wide variations remain in the extent to which use of technology is embedded. For example, not all schools improved their e-maturity between 2002 and 2005, with 8 per cent of primary and 15 per cent of secondary schools showing a decline in overall scores over the three-year period. A key challenge is to ensure that all elements of an institution's ICT strategy work together for the benefit of learners.

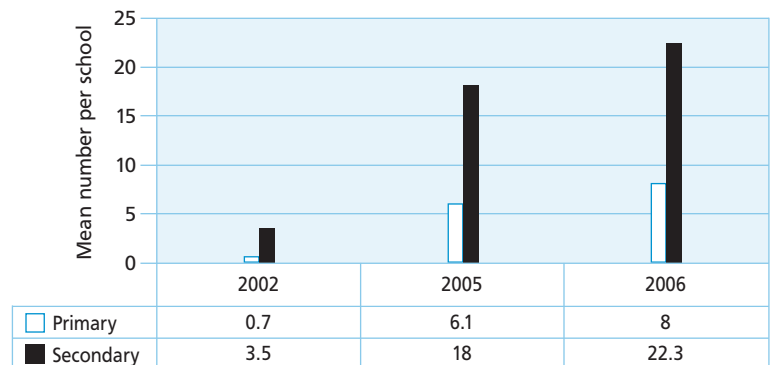
However, levels of use in schools of ICT resources in lessons has risen sharply since 2002, driven mainly by the adoption and use of interactive whiteboards and whole-class display technologies (see figure 6).

European indicators of embedding of technology in education show the UK performing well in terms of the percentage of practitioners reporting that they have the access, competence and motivation to use ICT in learning and teaching (see table 4). However, 40 per cent still do not report all three, suggesting that the UK's performance reflects a relative lack of maturity across EU member states rather than good UK performance. Lack of motivation and lack of access account for most of the 40 per cent.

Primary and secondary schools have taken different paths towards achieving improved levels of e-maturity. Promoting awareness and models of maturity in the use of ICT is central to helping to increase the number of educational organisations making effective use of ICT. Courses on using ICT in teaching are among the top three continuing professional development choices for all but the most recently qualified teachers (see figure 7).

Ofsted considers greater clarity is needed for schools in terms of expectations of embedding

**Figure 5: Number of interactive whiteboards per school (2002–2006)**



Source: *Harnessing Technology in Schools survey* (Kitchen, Finch and Sinclair, 2007)

**Table 2: Summary of e-maturity mean scores in primary schools**

Indicators (mean scores)	2002	2003	2005	Change 2002-05
Overall e-maturity	20.4	22.1	24.8	4.4*
Infrastructure	7.2	7.9	8.4	1.2*
Organisational/co-ordination	6.4	7.1	8.2	1.8*
Engaging the learner	6.7	7.2	8.1	1.4*
Base	271	202	182	

\* statistically significant difference 2002-2005 at 5 per cent level.

**Table 3: Summary of e-maturity mean scores in secondary schools**

Indicators (mean scores)	2002	2003	2005	Change 2002-05
Overall e-maturity	22.3	23.0	24.9	2.6*
Infrastructure	8.4	8.7	8.9	0.5*
Organisational/co-ordination	6.6	6.9	7.7	1.1*
Engaging the learner	7.2	7.4	8.3	1.1*
Base	265	172	154	

\* statistically significant difference 2002-2005 at 5 per cent level.

Source: *E-maturity and school performance – A secondary analysis of COL evaluation data* (Butt and Cebulla, 2006)

ICT in teaching and learning across the curriculum. The best provision offers a good balance between ICT as a discrete subject and its use within other subjects.

In secondary schools, there is evidence of good application of ICT across a few subjects, but subject departments continue to play a key role in the levels of ICT use. Ofsted has reported that on average only two in six departments in a secondary school make



effective use of ICT, with little ICT use in the rest.

Indicators of developing capability in FE colleges suggest continued improvement, with 25 per cent of providers now 'e-enabled', based on a framework capturing data on learner access, resource management, workforce skills, use in learning and teaching, and leadership/management (see figure 8). Twenty five per cent of colleges remain either 'ambivalent' or 'late adopters'.

The idea of using ICT, at least in some part of the teaching and learning process, is now commonplace in most colleges. Lecturers prepare lessons using ICT, exploit presentation software and word processing, and may expect students to access and use online resources and course documents.

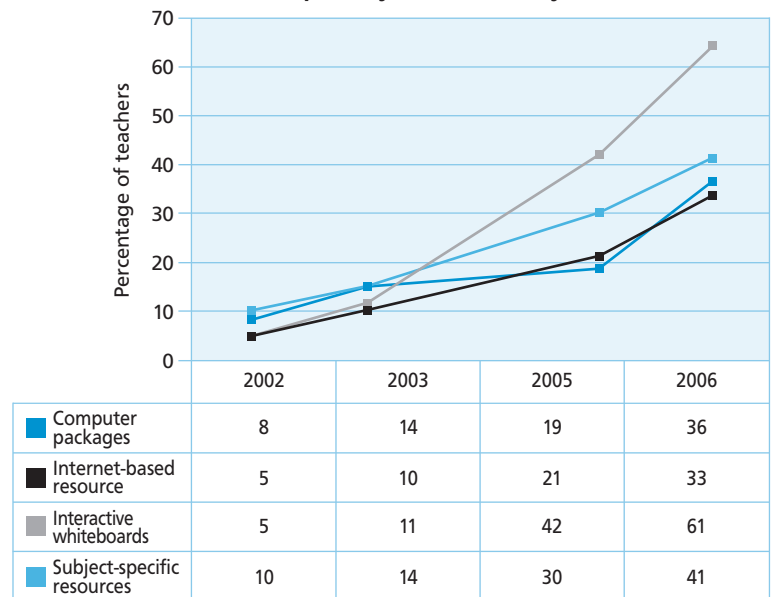
However, few practitioners across both the school and FE sectors fully exploit the possibilities for learning and teaching offered by technology. Relatively few teachers, for example, use technology to support learning in a range of ways (see tables 5 and 6), with fairly limited numbers of teachers using ICT in lessons to support creativity and collaboration.

## EFFICIENCY, EFFECTIVENESS AND VALUE FOR MONEY ACROSS THE SYSTEM

Schools have in place a range of technologies to facilitate access to shared ICT resources, but the amount of resource sharing and collaboration within schools and at local and regional level is generally limited (see table 7).

Learning platforms and VLEs are increasingly a key vehicle for sharing and collaboration, currently performing the role of learning content repositories. Effective implementation to meet local needs is a challenge. A number of issues, including current cultures of professional

Figure 6: Teachers' use of ICT resources in lessons: primary and secondary



Source: *Harnessing Technology in Schools Survey* (Kitchen, Finch and Sinclair, 2007)

Table 4: European comparisons of embedding of ICT

Country	VIII No access, competence & motivation	VII Access but no competence & motivation	VI Competence but no access & motivation	V Motivation but no access & competence	IV Access & competence but no motivation	III Access & motivation but no competence	II Competence, motivation but no access	I Access, competence & motivation	Score*
United Kingdom	0.7	1.2	5.6	1.8	11.0	2.7	16.8	60.2	250
Netherlands	1.1	2.6	7.3	1.5	17.3	2.9	11.7	54.7	241
Slovakia	2.0	4.7	4.2	2.4	10.0	9.2	15.2	52.2	237
Denmark	1.6	1.2	7.0	1.7	19.3	2.2	18.5	48.6	235
Portugal	1.9	2.6	3.1	6.9	5.4	7.4	22.9	49.9	234
Norway	2.6	2.6	7.6	1.5	14.2	2.2	20.2	49.1	232
NMS10**	3.2	4.0	5.6	6.4	9.2	7.2	22.6	42.0	220
Malta	2.7	1.1	6.6	2.6	6.0	2.0	44.5	34.4	219
Slovakia	3.1	1.7	6.6	6.0	9.3	4.9	32.3	36.0	215
Germany	4.8	5.5	8.4	3.5	14.1	4.6	18.1	41.0	214
Estonia	3.9	4.2	6.3	5.9	10.0	7.8	23.5	38.3	214
Czech Republic	4.3	3.9	9.7	4.9	13.7	4.8	20.7	38.0	211
EU 25	4.3	3.9	9.7	5.0	13.7	4.8	20.7	37.9	211
EU 25+2	2.7	2.6	11.0	3.9	14.3	5.2	26.9	33.4	211
Cyprus	3.7	1.8	8.1	6.9	6.2	3.9	35.6	33.8	210
EU15	4.6	3.9	10.6	4.7	14.7	4.3	20.3	37.0	209

\* Score = 3\*I + 2\* (II + III + IV) + V + VI + VII

\*\* New member states

Source: *Empirica (2006), Benchmarking Access and Use of ICT in European Schools 2006*





practice, hold back the use of technology for sharing and collaborative activities.

Successful cross-sector collaboration projects are those with a clear purpose, an ethos of sharing, well defined roles and responsibilities across the various partnerships, and effective stakeholder engagement with the planning process, supported by initial leadership.

In contrast to the situation in schools, there is greater evidence of collaboration in the learning and skills sector, often encouraged by the tradition of in-house resource development and a contrasting and restricted market for commercial software (see figure 9).

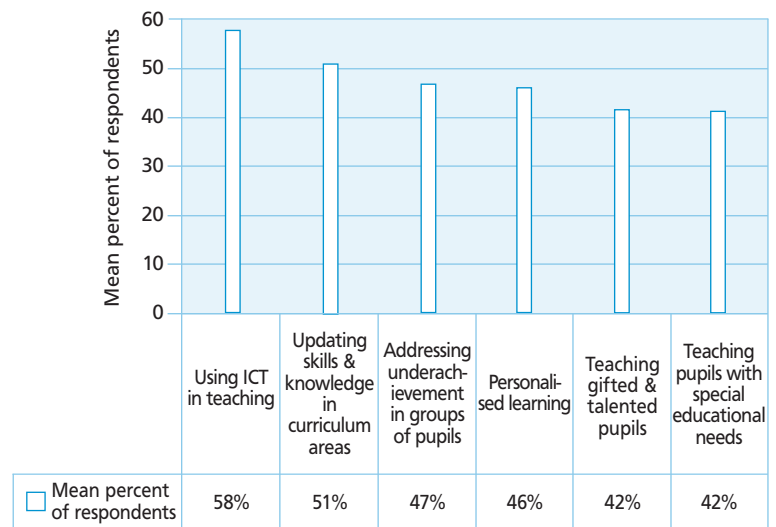
The use of ICT for administration and management has developed considerably in both schools and FE & skills sectors. Schools in particular have begun to appreciate the improved effectiveness and reduced costs that can result from centralised systems.

The use of electronic attendance and registration systems is growing rapidly in schools (see figure 10) and there is evidence that they reduce both the number of unauthorised absences and administrative time. They also provide mechanisms for efficient parental notification. However, nearly half of primary schools still use paper systems, suggesting that there is still a need for further development in this area, and around half of secondary schools do not have fully integrated systems.

Interoperability issues still prevent further improvements in the use of technology, with schools and colleges continuing to face challenges to effectively integrating management and learning systems.

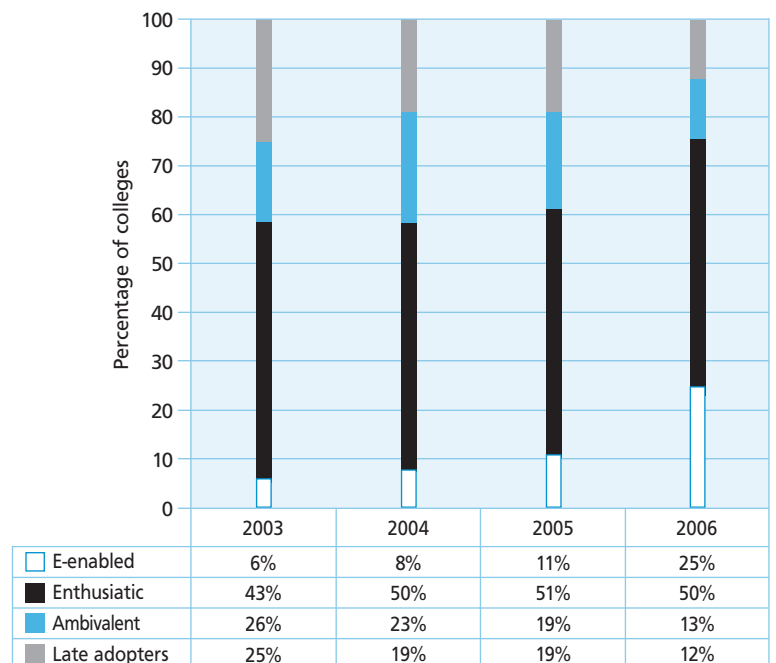
Technology enables the achievement of productive time efficiencies most where it is embedded effectively across the institution. Teachers report time savings using technology in lesson planning and lesson delivery (see figure 11). However, overall, evidence suggests that efficiencies from technology relate mainly to quality improvement for the same resource input and improved use of practitioner time,

**Figure 7: Mean frequencies of respondents' training needs per CPD topic calculated over two years 2005-2006**



Source: General Teaching Council for England Survey of Teachers 2004-06. Report on trend data (Ashby, 2007)

**Figure 8: Spectrum of e-enablement**



Source: ICT and e-learning in Further Education: management, learning and improvement (Becta, 2006f)



rather than significant time savings.

Further productivity gains are possible by using ICT to support lesson planning and preparation, information management and assessment.

There has been an increase in data transfer between schools, and greater use of ICT to support communication between colleges and employers. However, there is still little evidence of student-focused information transfer.

## IMPROVING LEARNER AND SYSTEM PERFORMANCE

ICT is currently used more frequently for whole-class activities in schools than by small groups or pupils working on their own. Developments in the use of technology to support more personalised learning are evident, but are at an early stage (see figure 12).

Schools are beginning to provide access to their networks from remote locations for staff and pupils. Communications technologies provide obvious opportunities for collaboration and sharing, but practice is at an early stage. Schools have yet to make significant use of Web 2.0 technologies, such as social networking websites, to support learning.

Learning platforms in secondary schools give practitioners and learners access to repositories of digital resources, increasing the range and quality of materials available. However, technology is most often used to 'push out' resources, and the opportunity for learners to choose their own pathways through the resources is rarely offered.

There is increasing evidence that the use of ICT can help raise educational standards, though this is influenced by the context in which the technology is used. Links between e-maturity and school performance have been demonstrated both through analysis of national data and the evaluation of the ICT Test

**Table 5: Primary teachers' use of ICT in lessons for helping pupils learn in different ways**

	Gathering information (%)	Analysing information (%)	Being creative (%)	Problem solving (%)	Working with others (%)
All or most lessons	2	*	0	1	*
More than half of lessons	6	2	2	4	2
Around half of lessons	19	8	8	12	3
Less than half of lessons	56	60	46	54	19
Rarely/Never	17	29	44	30	75
Base: all primary teachers answering	612	612	610	607	605

**Table 6: Secondary teachers' use of ICT in lessons for helping pupils learn in different ways**

	Gathering information (%)	Analysing information (%)	Being creative (%)	Problem solving (%)	Working with others (%)
All or most lessons	1	*	1	*	*
More than half of lessons	3	2	3	1	1
Around half of lessons	8	4	4	5	2
Less than half of lessons	58	39	24	25	13
Rarely/Never	31	55	68	69	84
Base: all secondary teachers answering	1192	1190	1190	1185	1186

\* Indicates the percentage value of less than 0.5 per cent

Source: *Harnessing Technology in Schools Survey 2006* (Kitchen, Finch and Sinclair, 2007)

Bed project. The latter found a strong improvement in the attainment of pupils (see figure 13), particularly at Key Stage 2.

Schools have technical solutions and policies in place to ensure the safety of staff and pupils. Breaches of e-safety tend to be among older pupils. Educating learners about acceptable and safe use of the internet can help reduce these breaches. Technology integration can support child protection through effective information sharing and exchange. However, this is still at an early



stage of development in most schools and local authorities.

Teachers and pupils are highly positive about the impact that using technology can have on motivation and engagement (see tables 8 and 9). This is especially true of the impact of interactive whiteboards. The impact on attainment relates to the precise nature or amount of use and the extent of embedding into learning and teaching practices.

There is little statistical evidence to link technology use in the FE sector with objective measures of improved progression and achievement. This is partly due to the complexities of measuring the impact in this sector. However, the ICT Test Bed project found improvements in the learning experience and learning outcomes between 2002 and 2006:

- Student satisfaction with learning rose considerably (up from 50 to 99 per cent).
- A greater number of teaching staff in colleges reported that the use of ICT would help them manage their workloads (up from 50 to 81 per cent).
- Learners engaged more actively in their learning – for example, by learners being involved in setting their own learning goals (up from 16 to 47 per cent of tutors reporting this).

The use of technology to support flexible learning is growing in the FE sector. There is a noticeable increase in remote access to learning, which suggests a trend to allow learners access to their programmes at a time and in a place to suit them. However, learning platforms are still used to ‘push’ resources to learners, rather than to allow learners to use them flexibly.

## STRATEGIC ISSUES AND CHALLENGES

### Summary

A growing body of evidence demonstrates links between e-maturity and educational

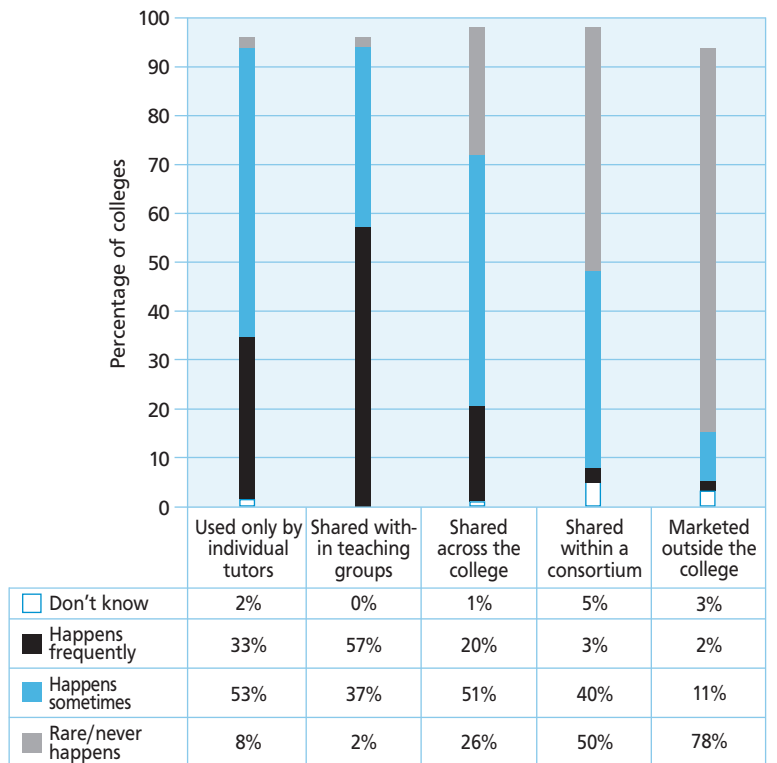
**Table 7: Secondary schools’ use of technology for collaboration**

	Joint curriculum and resource development (%)	Joint learning and teaching activities (%)	Continuing professional development (%)
With schools	46	34	31
With FE colleges	8	5	9
With Local Authority/RBC	29	10	25
With professional organisations	10	3	20

Base: all secondary school leaders (183)

Source: *Harnessing Technology in Schools Survey 2007* (Kitchen, Finch and Sinclair, 2007)

**Figure 9: Sharing of e-learning materials in FE**



Source: *ICT and e-learning in Further Education: management, learning and improvement* (Becta, 2006f)

improvement. Building e-maturity continues to be a challenge, however, both to schools and the FE and skills sector, and there is wide variation in its development. Achieving the benefits of learning platforms, and their integration with management information systems, is still some way off for the majority of schools and colleges, and they require ongoing support in recognising and realising these benefits.



### Technology issues

Technical support continues to be an issue, particularly in primary schools, and the experience of broadband is still inadequate in many schools. Linkage between learning platforms and management information systems remains a problem.

### Teaching and learning

Three quarters of teachers rarely or never use technology to support learners working together.

Use of technology needs to become secondary to a larger learning and teaching agenda in which learners develop a wider range of skills and gain access to a more personalised curriculum. Increased use of a range of technologies calls for new approaches to learner support and management, and with them, new approaches to professional development. The challenge is therefore that of developing the use of technology from enhancing and enriching learning to also extending and empowering it, developing a broader repertoire of practitioner skills.

### Continuity of learning

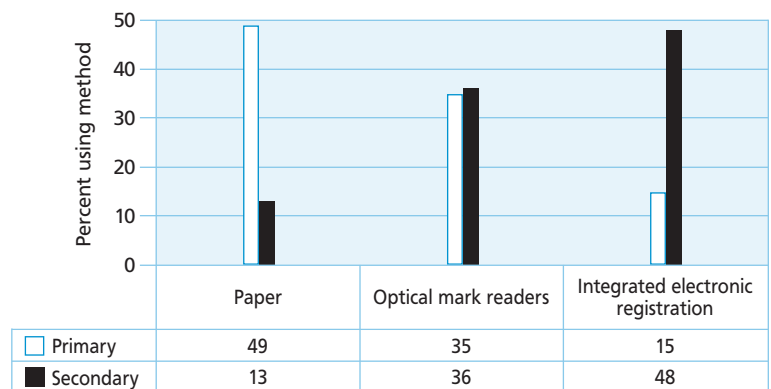
Use of technology to support effective continuity of learning is still at an early stage, particularly in the school sector. Issues of home access still need to be addressed, and both schools and colleges have some way to go in making educational information and resources accessible to learners (and their families) at times and in locations that suit their learning preferences and choices.

Developing awareness and understanding of what technology-supported continuity of learning looks like for different learner groups and sectors is essential.

### Partnerships

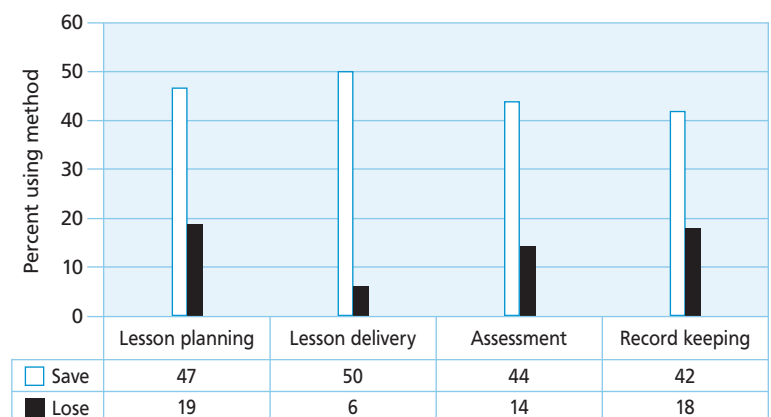
Continued investment in technology now enables schools, colleges, work-related learning and local agencies to share information and resources and to gain better value for money in procurement. However, partnership working is still in its infancy and requires significant changes in working practices in order for the benefits to be realised.

**Figure 10: Percentage of schools using different methods of recording pupil attendance**



Source: *Harnessing Technology in Schools Survey* (Kitchen, Finch and Sinclair, 2007)

**Figure 11: Percentage of teachers reporting time saved/lost through use of technology across activities**



Source: *Harnessing Technology in Schools survey* (Kitchen, Finch and Sinclair, 2007)

## Overall access and provision

This review has confirmed that learners' access to technology in terms of computer:learner ratios is improving at a slower rate than in previous years, and is reaching a plateau in some sectors. However, there is strong growth in the adoption of laptops and other portable devices, indicating potential for greater flexibility of use, which may lead to improvements to learners' experiences of access to technology. There are also indications of continuing improvements to connectivity, and the UK compares well with other EU countries in terms of a range of indicators of access.

Educational leaders report that they are planning further investment in technology infrastructure. Continued investment is necessary in the context of current needs and priorities. For



example, the 2006 Leitch report suggests that colleges will need to respond flexibly not only to increasing numbers of students but also to the requirement to provide access to learning at a time and in a place to suit each learner. The 2006 '2020 Vision' highlighted the need for greater personalisation of learning across education, supported by technology.

*Continued investment is necessary in the context of current needs and priorities*

Furthermore, developments in technology continually reveal opportunities for enhancement and enrichment of the learning experience.

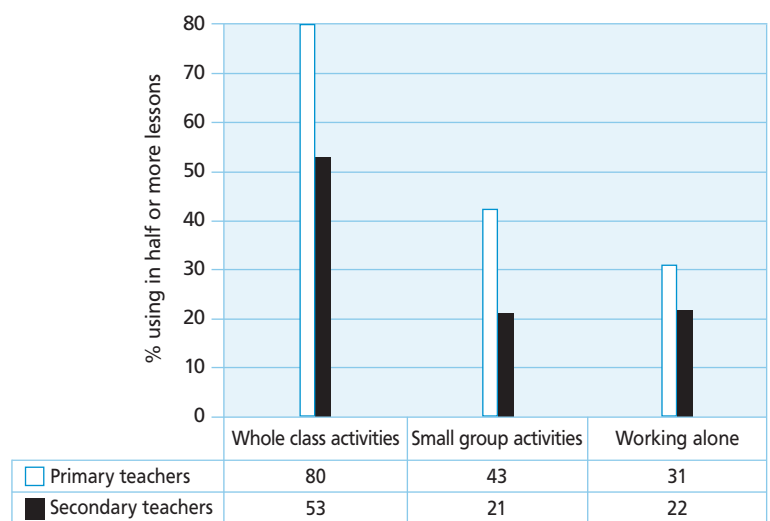
It is difficult within a rapidly changing context to predict the future technology investment needs of learning providers, something made more complex by a rapidly developing domestic technology market that is increasingly important in supporting formal learning. There are now greater opportunities for technology to support links between formal and informal learning, home and educational environments and other approaches including remote and online learning. The focus for infrastructure and technology investment is likely to develop rapidly in this context, requiring fresh thinking by education providers and those who support them, and increased agility to respond to developing opportunities and needs.

### Rapid adoption of technology and practice in some areas

The use of ICT resources in lessons by teachers has continued to grow in schools and FE colleges. For example, over 40 per cent of teachers now report using subject-specific software regularly in lessons, up from 10 per cent in 2002. Similarly, regular use of the internet in lessons has risen from 5 per cent of teachers to nearly a third.

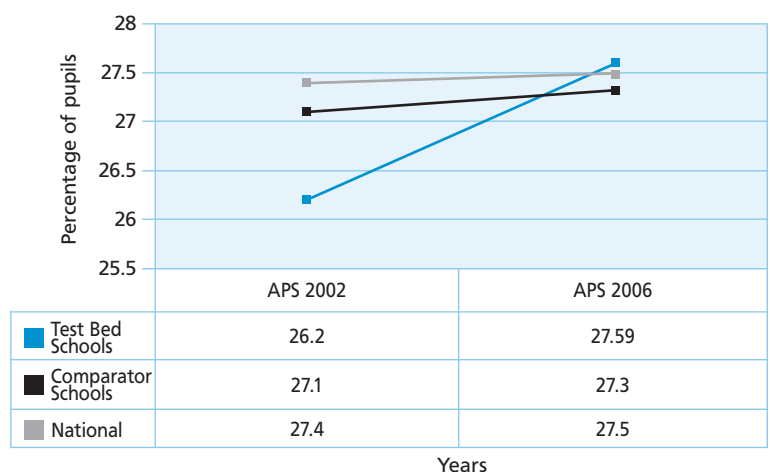
This sharp rise in the use of ICT resources in the curriculum has been driven to a large extent by the adoption of interactive whiteboards and related technologies. Interactive whiteboards

**Figure 12: Teachers' use of ICT in lessons for different activities (proportions using in half or more lessons)**



Base: all teachers answering (Primary: 609-613, Secondary: 1188-1192)  
Source: *Harnessing Technology in Schools Survey 2006* (Kitchen, Finch and Sinclair, 2007)

**Figure 13: Comparison of Test Bed schools with the national picture and comparator schools in core subjects**



Source: *Evaluation of the ICT Test Bed Project Final Report (2007)* (Somekh, Underwood et al., 2007)

are a popular technology, in heavy demand by schools and practitioners. There is strong growth where technologies offer transparent benefits to learning and teaching. That is, it is easy for institutions and teachers to recognise how interactive whiteboards enrich and enhance learning and teaching – something which may



not always be so immediately transparent to practitioners in the case of other technologies.

An example of similarly led change is the adoption of integrated registration systems, which, again, offer transparent benefits in terms of efficiencies and greater effectiveness in attendance recording, reporting and alerting. What characterises these technologies is that they link closely to, and support, current educational practice.

Adoption of technologies which enable educational practice to develop and change follows a very different pattern, requiring culture change and focused local leadership and management to drive adoption and embedded use. Delivering change to ensure that technology supports the extension and empowering of learning, as well as enhancing and enriching it, is challenging. For this reason, demonstrating transparent benefits from related technologies, and bridging the 'natural' use of technologies that support current practice with use that challenges current practice, are likely to be important strategies to deliver change.

### Slow adoption of technology and practice in other areas

Adoption and use of learning platforms is relatively slow in the school sector. And, while FE colleges are more likely to use learning platforms, use of a VLE as the main platform is the case in a minority of colleges. It is interesting also to note that while 46 per cent of secondary schools report having a learning platform, only 24 per cent of teachers report using one.

Relatively slow adoption can also be seen with other technologies, such as video conferencing, the use of data loggers (for example in science), and the use of creative and collaborative web-based technologies. All these bring potential benefits, but link less easily to established practice than, for example, interactive whiteboards.

While specialist technologies such as video conferencing could be utilised more widely, they do not represent as much cause for concern as

**Table 8: Primary teachers' views of impact of ICT (percentage agreeing ICT can have a positive impact on the groups listed)**

	Motivation		Attainment		Base (all primary teachers answering)
	Agree Strongly %	Agree %	Agree Strongly %	Agree %	
Key Stage 1 pupils	49	45	26	48	539/535
Key Stage 2 pupils	56	42	27	52	559/552
Girls	43	53	24	53	594/580
Boys	59	39	29	50	595/580
Able or gifted & talented pupils	53	42	29	49	598/586
Pupils with special educational needs	58	39	32	51	600/586

Source: *Harnessing Technology in Schools survey 2006* (Kitchen, Finch and Sinclair, 2007)

**Table 9: Secondary teachers' views of impact of ICT (percentage agreeing ICT can have a positive impact on the groups listed)**

	Motivation		Attainment		Base (all primary teachers answering)
	Agree Strongly %	Agree %	Agree Strongly %	Agree %	
Key Stage 3 pupils	42	49	20	47	1184/1174
Key Stage 4 pupils	38	51	23	47	1162/1150
Girls	30	52	19	47	1167/1156
Boys	47	45	23	48	1153/1143
Able or gifted & talented pupils	39	47	23	45	1179/1173
Pupils with special educational needs	45	46	26	47	1173/1163

Source: *Harnessing Technology in Schools survey 2006* (Kitchen, Finch and Sinclair, 2007)

learning platforms, which are a central enabling technology linked to a range of technology-supported processes. Learning platforms are central to providing a range of benefits and functions not easily attained without the use of technology.

These include enabling learners, parents and carers to access educational information and resources on demand, supporting practitioners in sharing lesson and learning resources, and streamlining a range of educational management processes, including assessment and reporting.

Even where adopted, the main pattern of current use of learning platforms across all sectors is as repositories for lesson and learning resources. It is likely that progress in more fully embedding technology to support learning will be limited without



stronger progress in the adoption of learning platforms and broader use of their functionality.

Educational institutions are likely to require ongoing support in recognising and realising the benefits of learning platforms, and practitioners will require support and time to develop a related repertoire of skills. If adoption and use are to grow at a stronger pace, it is also likely that other levers are needed to stimulate demand for their use. A need to provide more information to parents is one pressing example.

## Outcomes for learners – good evidence of benefit

Where technology is used to support learning, even if utilised purely to enhance existing practice, we can now be confident there is a positive general impact on learning outcomes. Since the 2003 ImpaCT2 study, statistical links between the use of technology and learning outcomes have been identified in an increasing body of evidence, ranging from studies of home use of ICT by learners, to studies of the impact of specific technologies (for example, interactive whiteboards) on learning, and analysis of the relationship between the development of school e-maturity and school improvement. In the FE and skills sector, robust evidence of impact on outcomes is limited.

However, the ICT Test Bed evaluation identified strong improvement through the project to FE learners' reports of engagement in and satisfaction with learning, which improved as the use of technology to support learning increased. A positive impact is by no means guaranteed though – technology does not deliver automatic benefits. In the school sector, for example, there is strong evidence of a link between embedded use of interactive whiteboards and learner outcomes, but less evidence of a link between use *per se* and an improvement in learning. Benefits identified in the recent primary interactive whiteboard evaluation were stronger in the teachers' second cohorts than the first – that is, beyond the first year of using the technology, after a period during which practitioners' confidence and expertise can develop.

Becta evidence also indicates that institutional or provider-level change and related leadership are critical in realising benefits for learners. That is, a learner may benefit to a degree from enhanced learning through technology, but if this experience is 'joined-up' across the institution, there is far more chance of benefit to learning outcomes. The impact is greatest where ICT is an integral and embedded part of the day-to-day learning experience.

### *Institutional or provider-level change and related leadership are critical in realising benefits for learners*

The body of evidence of the impact of ICT continues to grow, and we have a clearer view of the factors that influence how ICT can be an effective tool in raising standards. Studies relating institutional e-maturity to attainment and other performance measures show that results have improved faster than those of similar schools in core subjects. Evidence of an impact generally remains weakest in the FE and skills sector and often is heavily reliant on case study and individual institution evaluations.

## Efficiency and effectiveness

The use of technology to support educational business processes, and to enable practitioners to deliver learning and teaching, is already delivering greater efficiency and effectiveness in education.

We know, for example, that the increased use of electronic registration systems is beginning to show reductions in unauthorised absences, particularly from individual lessons in the secondary sector. Other evidence demonstrates that electronic registration saves time for schools and practitioners in recording and reporting on attendance.

We also know that, where used, digital resources in lesson planning, preparation and delivery offer significant value, enabling the development of higher quality learning and teaching resources and giving greater scope to share these with others, both within and beyond the institution. It therefore seems that, currently, we are seeing most value gained where technology can automate or enhance existing practice.

However, while there are clearly some easy wins in terms of efficiency and effectiveness resulting from greater use of technology, adoption and use is variable, so not all practitioners and institutions are gaining this value.

In addition, in other areas where there is apparent potential for delivering greater efficiency (in terms of greater value for the same effort or resource applied) there is very little progress at present. There is little progress, for example, in using technology to deliver shared learning provision. In addition, the potential for technology



to enable learning providers to collaborate and share resources, deliver a greater level of assessment for learning, and support the use of information across and between institutions and sectors is relatively untapped.

Sharing data, learning resources or whole courses, whether within a local authority, between institutions, or through regional consortia, is still at an early stage. This kind of value, based as it is in transforming practices and models of educational delivery, is particularly challenging to realise. However, where it is delivered, there is evidence of real and long-term benefit in terms of efficiency and effectiveness. In many cases, technology implementation in itself does not represent a significant barrier to progress. What is required is wider acceptance of the planned transformation, co-ordination and planning, development time, training and other resources to enable these sometimes complex projects to become a reality.

Co-ordination between educational institutions, whether schools, FE providers or both, is best achieved where there is clear mutual benefit. Current 14–19 partnerships between FE providers and schools represent one example of an opportunity for delivering education provision in different ways to enable efficiencies and improved effectiveness. This may be via, for example, common platforms and administrative systems or shared resources and tools for learners. What is required at this early stage is effective promotion of lesson learnt from projects of this kind, so that informed development can take place across the system.

## Technical barriers

This review tells us that, despite significant progress in the adoption and use of technology to support learning over recent years, schools and providers are still struggling with a range of technical and technology-related challenges. Primary schools, for example, face continuing issues in ensuring adequate technical support, with a member of teaching staff providing the main technical support in 27 per cent of cases. In addition, despite good broadband links to schools, the evidence tells us that the broadband

experience in the classroom and elsewhere is not always perfect, with 33 per cent of schools reporting that their internet connections do not meet all their requirements.

*Schools and providers are still struggling with a range of technical and technology-related challenges.*

In addition, and as reported in previous reviews, linkage between learning platforms and management information systems remains a problem. Very few schools with learning platforms link them to the school's management information system, and numbers are also low (33 per cent) for FE colleges. This does not necessarily reflect problems with interoperability of data. Though this is often the case, interoperability issues are increasingly addressed by common supplier standards and specifications. It is likely that the failure to link these systems is due to relatively poor technical planning and support, coupled with network limitations and senior managers being unaware of the potential benefits afforded by these systems.

These issues, where they exist, represent barriers to further embedding of technology to support learning, although none of them are particularly difficult to address. However, the planning, capability and capacity to address them are not always in place. Smaller institutions, especially, require ongoing support and help to recognise and address technical and technology-related issues. There is a strong argument for promoting more 'wraparound' services to schools, possibly linked to local partnerships and/or contractual arrangements with the commercial ICT sector. These should not only aim to lift the burden of technology implementation and support from institutions or providers with limited capacity, but also integrate technology planning with more general business and improvement planning.

## Institution and provider e-maturity

A key issue for the education system in realising the value of technology investment in education, also identified in the 2005 and 2007 reviews, is that of developing institutional or provider-level e-maturity. This is the capability of institutions to resource, lead and manage technology-related change and to develop a workforce to utilise technology effectively to deliver technology-supported learning across the curriculum.

While there has been progress, the large majority of schools are not yet e-mature. Overall, change at this level is proving difficult, far more so than that based on simple adoption of specific technology, such as interactive whiteboards, by practitioners. In the learning and skills sector, some 25 per cent of colleges are now e-mature. However, much of the change that is happening in the FE sector is still enthusiast-led rather than based in mainstream leadership and management.





There are many sources of support in this area for leaders and managers, including advice, support tools such as Becta's self-review framework, and training through the programmes of the National College of School Leadership (NCSL), including, now, aspects of the mandatory National Professional Qualification for Headship (NPQH). In the FE and skills sector, the new leadership standards and qualification developed by Lifelong Learning UK (LLUK) include effective use of new and emerging technologies. The qualification will be mandatory for all new principals from September 2007 and, taken together with the eQuIP e-learning quality improvement programme for senior managers, will have the potential to encourage ICT strategy development and to support the wider embedding agenda in colleges.

However, support and guidance, while important, represents just one strategy for delivering change in the education system. Public policy needs to develop further strategies to drive the required change. Many education leaders recognise the need for technology to support learning more effectively in order to deliver the ambitions of the education and skills system, and at a system level there are compelling reasons to modernise educational delivery for the benefit of learners entering a rapidly changing knowledge economy. But institutions and providers have few compelling reasons to invest resources and effort in delivering the change.

There are good reasons for change, but because of the genuine challenge of delivering change at this level, new incentives and levers, for example new accountabilities for schools, may be required to drive it.

## Pedagogical change

Though there is evidence of significant integration of technology across curriculum delivery, the type of use remains fairly limited, focused in schools primarily on whole-class technologies and the use of office tools and internet search tools by learners. For example, 75 per cent of primary teachers and 80 per cent of secondary teachers report they rarely or never use technology to support learners working together.

Practice in using technology with learners for analysing information, problem solving, collaboration and creativity is also more limited than in the primary sector. This may be constrained by secondary school timetables, which commonly limit the time spent focusing on a particular subject. This type of use may also be limited by the demands of the curriculum or the skills and confidence of teachers.

Whatever the reasons, the use of technology to support curriculum-based learning in schools often gives learners a passive role, representing a very different position from learners' use of technology outside education. The pedagogical approach most commonly adopted is unlikely to encourage the range of competencies increasingly demanded by employers and the economy more generally. It also potentially presents a risk of further dislocation between learners' informal experiences at home and those in education, possibly at the expense of learners' enthusiasm for educational experiences. This is at a time when personalisation debates increasingly recognise the need for closer links between formal and informal learning.

Clearly there is a significant pedagogical agenda to pursue if uses of technology are to be developed effectively. In terms of advice and other support to the front line, the focus needs to be on the development and transformation of learning and teaching for the 21st century. Technology must become secondary to a larger learning and teaching agenda.

## Professional development

In recognising that practitioners' uses of technology to support learning are relatively immature, there necessarily follows a discussion of the challenge of supporting effective professional development. Professional development of teaching practitioners is a complex area, and effective approaches for enabling practitioners to develop the repertoire of skills and approaches required are likely to be equally complex.

Currently much practitioner professional development is supported by institutions and learning providers, but its timing and format often fail to fulfil expectations. When institutions plan technology developments, practitioners' skills and competencies should be developed as part of the overall strategy, but frequently they are not. Particularly in the case of teachers, strong professional affiliations and identities exist which influence professional development. These extend across institutional boundaries, for example at the level of sector or subject specialism.

We also need to develop a more sophisticated understanding of the ways in which teachers develop their professional practices, to better meet the challenges of workforce development. Training, though playing a role, is not necessarily the answer to current



professional development needs, which require a profound change in cultures of practice. There is a paradox that both headteachers and teachers consider that teachers have adequate skills to use technology in teaching and learning, but teachers' most often expressed continuing professional development need is exactly this. It indicates both a confidence in the context of current practice and an awareness of the continuing need for development. This suggests there is a need to raise the debate about the repertoire of skills and approaches required by the education workforce in a modern education system.

Personalised learning requires new pedagogical approaches and new approaches to learner support and management. Clarifying the vision and the implications of personalised learning and discussing exemplars of practice in relevant professional forums will be critical to developing the right culture to support improved professional development.

## Continuity of learning

One of the weakest areas of progress is in the use of technology to support continuity of learning, especially in the school sector. Technology offers opportunities, for example, for parents and carers to participate more fully in children's learning – a key factor in educational success – and for young people to access learning resources and tools to support learning at home and to enable collaboration with their peers. Access to and use of learning platforms enables this, but delivering this access in an effective way is a challenge. Effective access to learning goes beyond simply providing information and learning resources online, to include support, advice, and collaborative and constructive tools.

Use of technology to support effective continuity of learning is clearly at an early stage. It is most likely to be seen in HE and FE contexts and in work-based sectors where learners lead and direct much of their learning, and where remote learning is a necessity in many cases

A key issue still, despite statistics demonstrating generally high levels of access to the internet by young people, is ensuring that all learners have

access to technology-based learning resources and tools at home. There are still many young people who lack internet access, and, as the ICT Test Bed has demonstrated, developing sustainable models for ensuring that all young people have access to the internet, and to relevant tools and resources, is difficult for schools and local authorities for a range of reasons. These include software licensing constraints, administrative burdens and lack of phone line access in some homes. The current ministerial home access taskforce is currently considering approaches for achieving access, bringing together industry, educators and other relevant organisations to address this problem.

*Understanding what continuity of learning, supported by technology, looks like for different learner groups and sectors is essential.*

But the main issue, as noted above, is change to current educational practice. This is something which is challenging and which requires a change to professional cultures, as well as leadership, resourcing and management. Understanding what continuity of learning, supported by technology, looks like for different learner groups and sectors is essential. Developing greater intelligence on related models and approaches to implementation is also essential, and is a key role for organisations like Becta that have a role in supporting change.

## Partnerships for business efficiency and effectiveness

Many of the issues and challenges discussed in this section represent challenges because there are inevitable limits to what educational institutions and providers are able to achieve in their own right. There may be limitations, for example, in relation to purchasing the right technologies and resources at the right price, managing technical support services, providing access for learners and practitioners to online resources and assets, delivering efficient educational services, such as a broad curriculum suited to the needs of different learners, or providing extended support for learners in the context of increased 'any time, anywhere' learning.

Clearly, increased partnership working at local, regional or national level is an important factor in delivering technology-related benefits and realising greater value from technology assets which are currently in place. There are examples of partnership working already, including local and regional learning platforms, resource repositories and portals, aggregated local purchasing of technology infrastructure and services, and centrally-provided online learning support procured by local authorities (for example, for children of travellers).

As with the challenge of supporting greater continuity of learning, national-level action in this area must include promoting



exemplars and models of effective and efficient educational delivery supported by technology. Offering incentives and refining accountabilities for delivering business efficiencies with the support of technology is also important. But it is also important to recognise that local needs have local solutions and that, though there may be effective general approaches identified as part of this process, there should not be an assumption that 'one size fits all'.

## CONCLUSION: MEETING THE CHALLENGE OF CHANGE

The *Harnessing Technology Review 2007* reports the progress and the impact of that progress in many aspects of the development of the role of technology in the school, FE and skills sectors. Though the previous section mainly focuses on strategic challenges, this is not to underplay the significant technology-related change already being delivered by educational institutions and providers and the educational workforce for the benefit of learners.

However, the main concluding message from this review is the continuing need to find effective ways to deliver the change that is clearly required in order to realise the full benefits of technology for the education system. This review tells us something about the complexity of that change, including the factors and barriers and roles and actions required to deliver it effectively.

The agenda is challenging and can only be delivered in partnership across the education and skills system. The need for continued clarity and coherence of vision and leadership at all levels in the system, from institutional to local and national level, is essential. Becta will continue to play a central leadership and co-ordination role, linking up partners and providing strategic co-ordination and guidance for all.

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