

The impact of ICT



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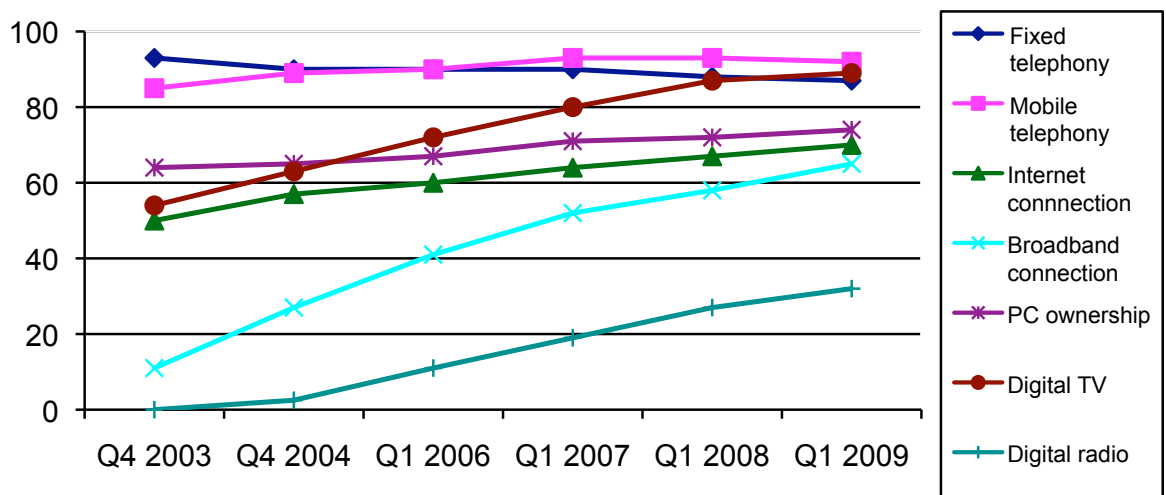
What is the situation in 2009¹

The information revolution is the phenomenon of our times, affecting work, life and society as profoundly as the industrial revolution did in the 1800s. The availability and use of communications technology is constantly evolving but the last five years show some clear trends emerging, as Figure 1 shows.

More households now use mobiles than have a landline – although using landlines to access broadband has helped keep the level of fixed connections high. Broadband access has surged with two-thirds of households now using the service (although a significant number of households are still relying on dial-up internet access). The advent of Freeview means that access to multi-channel digital TV is now as commonplace as a fixed telephone connection. High-definition TV is starting to make inroads into the market. Behind these headlines lie a number of other key trends:

- Growth in messaging – More adults use messaging than the internet. The volume has trebled since 2002 and on average each person sends over 80 (mostly text) messages per month.
- Mobile broadband – The arrival of ‘USB dongles’ and the growth of 3G (nearly 20 per cent of all mobile connections) is driving a fast expansion of mobile broadband, with around one in eight households using it.
- Convergence – We are seeing a variety of functions coming together in one piece of technology. Two-thirds of 14-24 year-olds have access to a games console, with a significant proportion also using it for watching DVDs and/or listening to CDs. Mobiles, digital TV sets and PCs provide access to an increasing range of functions. Over 40 per cent of mobile users, for example, use their handset to take photographs.
- Broadband – Speeds are getting faster and averaging around six megabits per second (Mbps), with super-fast broadband available for those who can afford it.
- TV – The nature of viewing habits is changing fast as over half of all homes have access to a digital TV recorder, such as Sky Plus, and all the main channels offer iPlayer style services. The main networks are losing market share to the multiplicity of other digital channels.

Figure 1: Trends in using communications technology



Note 1: The Q1 2006 figure for PCT ownership is based on Q4 2005 data.

Note 2: The Q4 2004 and 2004 data for Digital TV are based respectively on data for Q1 in 2004 and 2005.

Source: Ofcom data

- Video – The internet is increasingly being used for watching video clips and webcasts. Over half of 15-24 year-olds use these functions.
- Digital radio – A third of adults now own a digital radio and nearly four million people are listening to podcasts at least once a week. Although the overall number of radio listeners has risen, the average number of hours they listen is declining slowly (more quickly among young people).
- Newspapers – Circulation is decreasing, at quite a dramatic rate for some papers. This in turn is affecting advertising revenues, though the effect is being partially offset by newspapers giving away more complimentary copies, the growth of free papers (*Metro* now has a bigger circulation than *The Mirror*²) and the development of online newspaper sites. In February 2009 *The Sun* and *News of the World* recorded over 27 million unique users visiting their site³.

As significant as the trends, is how we use all this communications technology. Two in five consumers use their mobiles while watching TV. Young people aged 16-19 are the group most likely to create and share content using the web. Children are more likely to use the internet for instant messaging than email. Older people spend more time watching TV. Fewer of them have mobiles or an internet connection – but those that do spend 30 minutes longer online than the UK average.

There is also a digital divide which is not related to ability to pay but to level of education. Those who have a degree are much more likely to use the internet than those with no qualifications⁴.

What do future trends look like?

It would be foolhardy to speculate how ICT will have developed by 2020. The information revolution keeps taking off in ways that were not predicted and are unpredictable. The most we can sensibly do is look at current developments within the pipeline and examine their potential impact on society and the education system. Becta has identified ten trends that are potentially significant for learning over the next five years (see Figure 2 on page 10) and has assessed the extent to which these are already having an impact on society in general and schools in particular.

What does this mean for future policy? ⁵

The government sees effective exploitation of digital technology as vital to the success of the UK's economy. The digital economy accounts for £1 in every £10 that the whole economy produces each year and has helped the UK close the productivity gap on its leading European competitors. By 2012 £1 of every £5 of new commerce will be online.

However, such is the pace of change that the UK cannot take for granted its relatively strong position in this arena. France, the USA and a host of Asian countries will provide fierce competition. The government has accordingly identified five areas which it is prioritising.

- Upgrading and modernising digital networks – wired, wireless and broadcast. This involves: creating the right financial incentives for internet providers to invest in 'next generation' broadband which provides speeds of 50 Mbps or more; making it easier for companies to access BT's ducts so that they can lay fibre optic cables to homes; and paving the way for 4G mobile by clearing radio spectrum currently used by analogue TV. The move to digital TV will be completed by 2012 and it is hoped to achieve a digital radio switchover by the end of 2015.
- Creating a climate that makes the UK a good base for investing in digital content, applications and services. Radio and TV programmes, films, music, software, computer games and electronic publishing are part of a valuable and growing creative industry sector, accounting for over £2 billion worth of exports a year. Securing intellectual property and copyright is seen as one way the government can maintain the UK's position as an attractive place in which to develop creative products and services.
- Ensuring that UK citizens have access to high quality digital content. The government is keen that we continue to have access to a range of sources of impartial news, comment and analysis. As advertising revenue is spread over more media outlets, there is recognition that traditional terrestrial commercial TV channels (ITV, Channel 4 and Channel 5) are not viable in the long term in their current form and so the government is exploring

options for a new public service broadcaster in addition to the BBC.

- Providing fair and universal access to digital services and developing digital literacy in all citizens. The government is committed to every household having access to a two Mbps broadband service by 2012 and to 90 per cent of homes and businesses being able to have superfast 'next generation' broadband by 2017. This will be funded in part by a 50 pence per month levy on fixed phone rentals. The Rose Review of the primary curriculum, which aims to embed the development of digital skills across all aspects of learning, is seen as the template for developing digital literacy across all aspects of primary, secondary, vocational, further, higher and professional education. The government has also established a £300 million Home Access scheme for low income families supported by a Digital Inclusion Team and Champion. It is also expecting the BBC to use its role to promote the use of broadband.
- Developing widespread take-up of online public services. Already just under 90 per cent of public services are available online, compared to around 70 per cent in France and Germany. However, the UK take-up of e-government by individual citizens is only slightly above the European Union (EU) average and take-up by businesses is below that average. The government is planning a digital switchover of many public services, under which online access would become the primary means of accessing services rather than being one among many – though there would be a safety net for those unable to use services online. School registration is listed as one of the candidates for this switchover.

What does this mean for school and college leaders? ⁶

Progress

Schools, like the rest of society, have travelled an enormous way since the early 1980s when the Sinclair Spectrum and the BBC Model B were the main means of schools accessing new technology:

- The computer – pupil ratio in schools is now 1 to 6.25 for primary and 1 to 3.6 for secondary schools. In 1998 when Becta

first started measuring this it was 1 to 18 for primary and 1 to 9 in secondary.

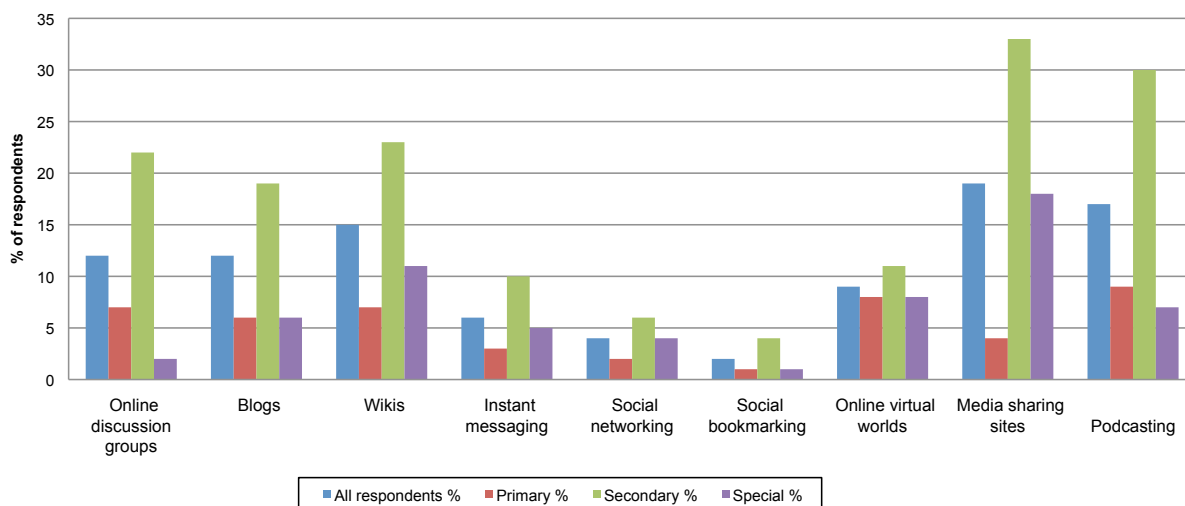
- All schools had broadband by 2005. Just seven years earlier the majority of schools (83 per cent) did not have an internet connection at all. Moreover, most schools now have good broadband (eight megabits or more) and around 95 per cent of classrooms have internet access, whereas fewer than 10 per cent had it in 1998.
- Over half of classrooms have interactive whiteboards and the vast majority of the rest have access to data projection facilities.
- Nine out of ten teachers and full-time FE practitioners say they are confident in using technology as part of their job.
- Just under two-thirds of schools and just over three-quarters of FE colleges have a learning platform and the proportion of schools and FE colleges that are assessed as being fully e-mature has grown since 2003 to around a quarter.
- Leadership of ICT has been improving with leaders "providing a vision for the place of ICT in learning and... investing significantly in infrastructure, resources and staff training".⁷

Challenges

However, despite this very positive picture, the secondary and FE sectors still face very considerable challenges in relation to ICT. For example, fewer than 15 per cent of schools use technology for communicating student progress to parents. Most school and college ICT infrastructures do not support good mobile and remote access to the network. Community access to ICT facilities in schools and colleges is relatively low, though just under half of secondary schools do offer access for adult learning or evening classes.

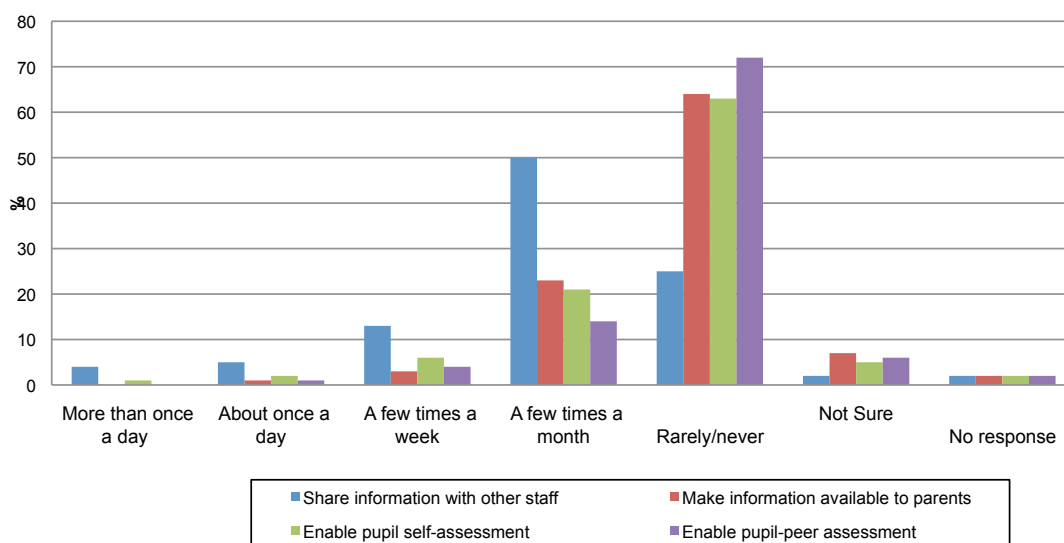
More significantly there are limitations in how ICT is being used in teaching and learning. Students, with increasingly powerful devices of their own, are used to digital technology dominating their lives outside learning. However they are not yet being empowered and facilitated to bring their everyday Web 2.0 expertise in social software into the learning environment (see Figure 3).

Figure 3: The extent to which pupils are encouraged to use the following applications to support learning, to a great extent or to some extent



Source: Becta 2008 Harnessing Technology survey

Figure 4: Frequency with which teachers use electronic pupil assessment information for selected pupil assessment related tasks



Source: Becta 2008 Harnessing Technology survey

Teachers are also a long way from exploiting the full potential of ICT in assessing and reporting on students' progress, as Figure 4 illustrates. In addition, other data from Becta indicates that less than a third of secondary school teachers use ICT 'often' in lessons to assist them with assessment for learning. And Ofsted's study of ICT in schools found that assessment was the weakest aspect of ICT teaching and was inadequate in one school in five⁸. It was rare for schools to measure students' attainment in the subject on joining secondary school, track their progress, or assess the use of it in other subjects, so ICT teachers had little idea about how well they applied their skills elsewhere.

Schools and colleges will also face major challenges managing the ICT developments identified in the previous section that are coming down the line, particularly as some schools are not achieving value for money when it comes to implementing the principles of best value in evaluating, planning, procuring and using ICT provision⁹.

E-safety will be a major issue. It will be more than just a technical issue of secure access, filters, firewalls and rules on website access – important though these will be. Technology is blurring the boundary between home and school for students and teachers. Already there have been instances of students being accused of cyber-bullying of other students and teachers. And teachers and school leaders have been criticised for the content of their Facebook pages.

However the biggest challenges are even more fundamental and relate to the nature of teaching and learning in 2020.

Today's students have grown up with digital media in a way that makes it almost as natural as breathing. As adults we may email constantly, rely on our handheld organiser, go online to research, organise holidays, shop online and download our music onto our MP3 player, but Net Generation students are different. Don Tapscott, the author of *Grown Up Digital*, describes how the digital world pervades the whole of young people's lives:

"They use their mobile phones differently. You talk on the phone and check your email; to them email is old school. They use the phone to text incessantly, surf the web, find directions, take pictures and make videos

*and collaborate. They seem to be on Facebook every chance they get...You consume content on the web, but they seem to be constantly creating or changing online content. You visit YouTube to check out a video you've heard about; they go to YouTube throughout the day to find out what's new. You buy a gadget and get out the manual. They buy a gadget and just use it. You talk to other passengers in the car, but the kids in the back are texting each other."*¹⁰

It's not just about young people using instant messaging, Twitter, Flickr, Skype and virtual world games or juggling a range of devices at the same time. It's also about how they learn.¹¹

"Their learning styles are influenced by the immediacy and visual richness of the environment they have grown up in, particularly television and the internet. Net Generation students expect to be engaged by their environment, with participatory, sensor-rich, experiential activities (either physical or virtual) and opportunities for input. They are more oriented to visual media than previous generations and prefer to learn by doing rather than by telling or reading. 'Don't just tell us – let us discover'".

Web 2.0 tools also foster personalised learning and increased creativity. They enable students to deconstruct and remix digital applications and create their own music, video, blog, art, game or combination of all these, in what is often referred to as a 'mash-up'.

Pedagogy, curriculum and assessment

This means that future curriculum and pedagogy will need to be centred more on actively engaging students. It will require greater reliance on using visualisation and virtual worlds, collaborative discovery, creating shared web content, providing and discussing feedback online, letting students engage in peer review and having more open questioning and discussion – among students themselves, with their teacher and, via the web, with a wider audience. And this will have to be achieved with the context of recognising students' digital contributions in e-portfolios and ensuring e-safety.

Learning will have to balance using technology to help understand and address a student's personal learning needs while also harnessing its power to support collaborative learning.

One of the constraints on making the changes needed could be politicians' refusal to countenance reform of assessment. It has been said that we have 21st-century students being taught by a 20th-century trained workforce working to an exam and assessment system designed in the 19th century.

CISCO, Intel and Microsoft – three of the biggest commercial players in the ICT world – argue that major reforms of assessment are needed if schools are to meet the future needs of society and students. Memorising facts and implementing simple procedures will, in tomorrow's digital world be less important than "the ability to respond flexibly to complex problems, to communicate effectively, to manage information, to work in teams, to use technology, and to produce new knowledge"¹². These capabilities, they believe, are rarely taught in schools or measured in typical assessments:

*"Existing models of assessment typically fail to measure the skills, knowledge, attitudes and characteristics of self directed and collaborative learning that are increasingly important for our global economy and fast changing world. New assessments are required that measure these skills and provide information needed by students, teachers, parents, administrators, and policymakers to improve learning and support systemic education reform."*¹³

Over the next decade, ICT developments will increase the pressure to reform assessment so

that it focuses on students' proficiency with technological tools and digital resources, and on their ability to apply this proficiency both to subject knowledge and everyday tasks and to create new ideas, content and knowledge.

Mobile devices

Increasingly schools are using e-Readers and i-Touch devices to maximise digital access and usage. But some commentators are suggesting that the revolution in students' digital usage, and the need to link learning inside and outside an institution, will mean that schools and colleges will have to switch to basing their ICT strategy on students' own mobile devices.

This would mean a school's role in ICT development would move away from procuring, deploying and managing networks and to supporting student access to networks via the range of tasks described in Figure 5. Under this scenario, schools may spend less on devices but may need to spend more on other infrastructure and technical support.

Mobile devices may not be suitable for all kinds of learning and the design of schools will need to be flexible enough to provide large spaces for presentation and performance while including a host of smaller places for formal, informal, collaborative or project-based team working, individual study and pastoral care. Digital or wireless access will need to be available throughout an institution.

Figure 5: Implications of a school/college ICT strategy based on students' mobile devices

● Evaluating and preparing for new devices, interfaces, contents and applications.
● Training teachers and lecturers and advising them on the choice, purchase and use of their own devices.
● Ensuring all learners have connectivity and security, ensuring equity and access for all learners and liaising with local suppliers and vendors to ensure suitable choices for learners.
● Configuring learner devices, installing and supporting standard applications and software, training learners and ensuring back-up, power supplies and synchronisation facilities.
● Organising and updating local and external content for all devices.
● Liaising with libraries and publishers over licences and Internet Protocol.
● Exploiting freeware and popular applications such as games.
● Monitoring traffic and content, enforcing acceptable-use policy and ensuring learner safety.

Source: Adapted from Traxler (2008)¹⁴

The future role of teachers

The learner-centred approach required to meet the needs of Net Generation students does not mean that teachers and lecturers are redundant! In many respects the nature of what it means to be an effective leader of learning will remain the same but the context for the teacher's role will be different. In the future, the teacher's role seems likely to focus on¹⁵:

- creating the right social and learning environment where students feel secure and encouraged to learn
- empowering students to demonstrate and teach new ways of using technologies – since they are likely to be at least one step ahead of most teachers
- enabling all students to have good technology skills and ensuring that students whose out-of-school environment does not include a high level of digital engagement are not left behind or disadvantaged
- ensuring that students have the literacy, mathematical and scientific competencies and background subject knowledge (for example, if they were studying a particular period of history then knowledge of time lines, cultural values and political structures might be necessary) to be able to make sense of, and contextualise, the information they are discovering and sharing via the web
- being creative in the use of technology to communicate ideas and impart knowledge by being open to using virtual worlds and visualisation
- assisting students to develop in-depth research skills. The Net Generation may be very digitally literate but they are often not 'net-savvy'. The challenge is to move students beyond 'cut and paste' and relying on the easiest available source of data to more sophisticated searching, comparing and contrasting different theories and interpretations
- developing critical thinking skills to evaluate what they are finding given that a huge

variety of views, instant opinions and misleading information finds its way on to the web

- providing opportunities for students to learn by doing, and creating and sharing their own solutions
- building a practice and discipline of collaborative working and peer review
- breaking down the boundaries between formal and informal learning and enabling students to use their out-of-school expertise within the curriculum
- helping students to understand and practise respect for intellectual property and responsible, safe use of the internet
- using assessment for learning including monitoring the progress of each student and identifying the personal support that will help them realise their full potential

Teachers and lecturers will need support and development to make the most of this agenda. The generation of teachers currently entering the profession, or who have joined during the last decade, is made up of 'digital natives'; they have grown up as part of the Net Generation. The challenge is to ensure that their Initial Teacher Training (ITT) and leadership development encourages and equips them to integrate their natural familiarity with digital technology into effective teaching and learning. The new Masters in Teaching and Learning may provide one avenue to help embed technology in effective pedagogical approaches to teaching early in a teacher's career.

The development needs of more established teachers are different¹⁶. Becta's Harnessing Technology surveys show that teachers have become more technologically confident in recent years. And, as most of us now do, they are usually using digital technology in a growing number of ways in their personal lives. However, the Becta surveys also reveal that three-quarters of teachers say they need 'a little' or 'a lot' of development in the use of particular software packages. And Ofsted has identified specific weaknesses in terms of teachers using technology to underpin assessment for learning and being

proficient in data logging, manipulating data and programming¹⁷.

A results General Teaching Council survey, teachers most frequently identify 'using ICT in teaching' as the topic needing continuing professional development (CPD). Supporting teachers to relate and use technology in a way that better helps them to teach their subject is the big challenge in the coming years. Some schools are approaching this by pairing teachers so that technological skills and pedagogical experience and expertise are matched and they are able to maximise learning from each other.

E-safety and security

E-safety and security are likely to continue to be major issues. Young people need to be able to determine which websites or other sources of information are reliable and which are bogus; to understand the dividing line between 'fun' and 'inappropriate' behaviour; and to grasp the risks they take in posting the pictures or comments online which they may come to regret, if not now then as adults and job-seekers in the future. Schools and colleges are really the only place young people will learn these skills.

Funding

The prevalence of ICT in schools has been made possible by a substantial surge in spending. Between 2003/04 and 2007/08, for example, there was a 20 per cent increase over and above inflation in ICT resources for secondary schools in England¹⁸. With public spending constraints being the order of the day it is unlikely that investment will continue at that level. If they are to maintain their competitive advantage schools and colleges will need to work in partnership with others to procure and manage their ICT requirements in order to make the most of available funding.

References

- 1 Much of the material in this section is drawn from 2008 and 2009 editions of *The Communications Market*, published by Ofcom and *The Telecommunications Market Update for Quarter 3, 2008*, published by Ofcom in February 2009.
- 2 See official newspaper circulation figures audited by ABC as reported in the *Press Gazette* on 9 January 2009.

- 3 See official online newspaper circulation figures audited by ABCe as reported in *The Guardian* on 26 March 2009.
- 4 See *Focus on the Digital Age*, National Statistics, 2007.
- 5 This section is based on *Digital Britain, interim and final reports*, published respectively by the Department for Culture, Media and Sport and the Department for Business, Enterprise and Regulatory Reform in January 2009 and June 2009.
- 6 The sources for the material in this section are taken from Becta briefings and reports unless otherwise stated.
- 7 *The importance of ICT: Information and communication technology in primary and secondary schools*, Ofsted, March 2009.
- 8 Ofsted, *Op cit*.
- 9 Ofsted, *Op cit*.
- 10 *Grown up digital* – Don Tapscott, McGraw Hill, 2009.
- 11 *Growing up with Google: what it means to education* – Diana G Oblinger, Becta research report, March 2008.
- 12 *Assessment Call for Action: Transforming Education: Assessing and Teaching 21st Century Skills* – Cisco, Intel, Microsoft, 2009
- 13 Cisco, Intel, Microsoft, *Op cit*
- 14 *Learners: should we leave them to their own devices?* – John Traxler, Becta, November 2008.
- 15 This list draws on thinking to be found in Oblinger, *Op cit* and *Future issues in socio-technical change for UK education* – Cliff et al, *Beyond Current Horizons*.
- 16 This paragraph draws on an internal Becta briefing paper on: *What do we know about the ICT skills, competencies and e maturity of teachers?*
- 17 Ofsted, *Op cit*.
- 18 *Valuable lessons: Improving Economy and Efficiency in Schools* – Audit Commission, June 2009.

Figure 2: Ten technology trends and their potential future impact on education *

* Timelines are intended to be indicative only. Most of the trends listed are not technology specific, and encompass a wide range of different technologies that will mature at different rates. There could be disruptive trends/technologies not addressed here and new technologies can also have unintended consequences/unexpected outcomes. More details on each of the trends can be found at: http://emergingtechnologies.Becta.org.uk/index.php?section=etr&filter=ArtTec_003

Trend	What is it and how is it evolving?
New approaches to delivering IT	<p>The increasing complexity of IT provision is leading to new approaches to delivery. For example:</p> <ul style="list-style-type: none"> ● 'cloud' computing whereby programmes are accessed and data is stored and retrieved via the internet. Organisations buy the services they need rather than procuring and maintaining their own infrastructure. ● service orientated architecture (SOA) separates software into a series of functions or tasks that are interoperable – that is they can talk to and function with each other. A programmer then fits the different parts together to meet the organisation's specific requirements.
Web 2.0 and social software	<p>The explosion in applications and services online has resulted in users moving from passive downloaders of web content, to active participants in creating and sharing content via social networking sites, blogs, online reviews, Twitter, wikis, video and podcasting and web 'mash-ups'.</p> <p>Web 2.0 functions are increasingly being mainstreamed and integrated into other systems, such as learning platforms.</p>
Context aware computing	<p>This is about systems that can understand context and intelligently adapt their behaviour to suit. Systems could respond to who you are (your role, preferences and previous actions), your location, what device you are using (and other devices and services you have access to), your environment, what you are doing and even your emotional state.</p> <p>Stand-alone applications of context aware computing technologies are already with us – the iPhone that automatically changes from landscape to portrait depending on how you hold it or Google's latitude service that can advise you when a friend is nearby.</p>
Pervasive computing (or ubiquitous computing)	<p>A range of technologies can be embedded into a multitude of everyday objects. Rather than computing being a desktop experience it would pervade every aspect of our lives.</p> <p>Pervasive computing works through four main technologies: identification (via radio frequency identification tags and two-dimensional barcodes), location (GPS), sensors and wireless connectivity (via WiMAX, Wi-Fi and Bluetooth). These technologies are being added to an increasing range of goods and services.</p>

Source: Adapted from Becta

Definition of 'emerging' In research labs; potentially some trials; possibly commercialisation of specific technologies or first generation products.	Definition of 'early adoption' Use by those interested in new technology, or specific products more widely adopted. Technology still developing and impact not fully understood. Innovative use, but effective implementation models/uses still being developed.	Definition of 'tipping point' Significant adoption/ early mainstream. Benefits understood. Economies of scale bring prices down.	Definition of 'Mainstream' Mature market. Widely adopted/ integrated. Development slows but technology continues to evolve.
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Why is it significant?	0-2 years	2-5 years	5-10 years	10+ years
<p>May offer more efficient, reliable and flexible delivery of IT services to education. They could help reduce operating costs during an era when public spending is much tighter while providing more accessible services.</p> <p>An increasing number of schools, for example, are using Google Apps Education Edition – a bundled package of web-based email, calendar and office software originally tailored for business but now being offered free to schools.</p>	Early adoption	Tipping point	Mainstream	
<p>Web 2.0 is revolutionising how we think about generating knowledge, what it means to be an active citizen, how government works and how we behave as consumers.</p> <p>In education, Web 2.0 allows learners to take more control of their learning through customising the information, resources and tools they use; provides new ways to be creative; and facilitates collaborative learning.</p>	Tipping point	Mainstream		
<p>Context aware computing might, for example, warn us when buying a product if we are about to break our overdraft limit, adjust our home heating based on how hot or cold we are as measured by personal biometric sensors, or schedule a health check-up when our blood pressure or other symptoms trigger a concern.</p> <p>Context aware computing could also help deliver the 'smart' classroom by automatically facilitating student registration, downloading learning aims and materials on to learners' mobile devices, identifying key areas where students are struggling and recording student evaluations.</p>	Early adoption	Tipping point	Mainstream	
<p>Pervasive computing will potentially help us make better use of physical resources: managing collections, constantly monitoring a car's tyre pressure, regulating the flow of water and nutrients to crops or knowing when things in the fridge are going out of date.</p> <p>Pervasive computing could also open up new avenues for learning. For example, Semapedia is a collaborative project that enables users to tag physical items with a barcode that can be read by mobile phones. The barcode provides a link via Wikipedia to previously uploaded information on the object.</p>	Emerging	Early adoption	Tipping point	Mainstream

Trend	What is it and how is it evolving?
Increasing mobility	<p>The performance and affordability of mobile devices such as notebooks, tablets, smartphones, media players and games consoles are growing all the time.</p> <p>The capacity of mobile devices will increase as the constraints of low battery life, small displays and poor interfaces are overcome.</p> <p>The improved availability and quality of wireless technology, along with a gradual move to 4G from around 2012, will bring much faster and more reliable broadband access.</p> <p>Growing competition between providers will bring down the cost of tariffs and drive innovation.</p>
Low-cost mobile computers	<p>These are small, basic notebook computers (known as netbooks, mini-notebooks or ultra mobile devices) that run full operating systems and applications. They come with Wi-Fi connectivity or mobile broadband which means that, although they lack all the features of a PC, they can access applications online.</p>
Emerging display and interface technologies	<p>Our interaction with PCs has been dominated by the mouse, keyboard and LCD screens. But new developments such as voice, handwriting and gesture recognition and multi-touch touch displays will potentially transform these interactions. Electronic paper, 3D screens, 3D printing and projectors embedded in mobile devices are all on the horizon.</p>
Consumerisation of IT	<p>Computer technology has tended to be developed for business and government markets with hardware and software in due course filtering down to consumers. Increasingly technology innovations are aimed at the consumer market with entrepreneurial users adopting these for their work. Companies then develop equivalents for their business.</p>
Information handling	<p>Exponentially increasing amounts of digital data and content are becoming increasingly difficult to store, manage and use. This is leading to the development of more sophisticated and intelligent ways of storing, searching, analysing and presenting data.</p>
Green IT	<p>While ICT has lots of positive environmental potential – through facilitating more homeworking and use of video-conferencing to reduce travel – there are concerns about the energy consumption and carbon emissions generated by ICT usage.</p>

Why is it significant?	0-2 years	2-5 years	5-10 years	10+ years
<p>People will have access to a permanent 'info-cloud' that changes how they work and interact with the world about them. It will also:</p> <ul style="list-style-type: none"> ● bring increased learner autonomy and motivation as students own their own devices ● embed ICT in the 'classroom' through instant, individual broadband access and a wide range of tools for students to use individually or collaboratively ● facilitate flexible access in any part of a school or college and enable innovative uses on visits and trips ● improve home – school links and reduce the digital divide 	Tipping point	Mainstream		
<p>The significance of these devices to education lies in their low price, small size/weight and simplicity. They may well provide the means to give every student 1:1 computer access.</p>	Mainstream			
<p>These new technologies could allow for better collaborative interaction in classrooms. By providing more natural and human-centred ways of interacting with computers they could also allow learners to concentrate on the content of the task and not the technology.</p>	Emerging	Early adoption	Tipping point	Mainstream
<p>Traditionally school and college IT managers have – for understandable reasons – tightly controlled their systems. However, this could reduce innovation and make education IT seem something separate and less relevant to students. The challenge will be for education providers to support innovation while still providing a secure and robust infrastructure.</p>	Tipping point	Mainstream		
<p>These developments could help with areas such as assessment for learning, just-in-time testing and recoding/tracking progress. They could also help learners to retrieve the right information and interpret data through, for example, using visualisation of facts and findings.</p>	Early adoption	Tipping point	Mainstream	
<p>ICT is an increasingly important dimension of energy efficiency. Businesses and public agencies, including schools and colleges, will have a growing incentive to minimise their ICT energy footprint as the Carbon Reduction Commitment takes effect. (See separate ASCL briefing on climate change).</p>	Tipping point	Mainstream		



THE IMPACT OF ICT

This briefing is one of eight developed as part of the ASCL 2020 Future project, which aims to stimulate a debate for school and college leaders about developments in wider society that are likely to affect what it means to be an education leader in 2020. The research is being carried out by consultant Robert Hill with generous support from Becta and EdisonLearning. For more information go to www.ascl.org.uk/home/publications/2020_future

Previously published

Briefing paper 1: The impact of a changing population

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