Analysis of emerging trends affecting the use of technology in education

Research to support the delivery and development of Harnessing Technology: Next Generation Learning 2008–14

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Introduction

In April 2008, Becta launched a major research programme to support the Harnessing Technology strategy.[1] The research covers the education and training system as a whole: children's services; schools; further education, skills and regeneration (FESR); and higher education (HE).

This publication is a consolidation of work carried out to identify and analyse the major trends relating to each area of the Harnessing Technology research programme. This report presents an overview of the trends identified, why these trends are important, and how they relate to the ongoing research work.

This report comes at the half-way point in the first year of research. Becta will publish further trends analyses at six-monthly periods throughout the three-year research programme. The focus of much of the research up to this point, apart from work on pedagogy and the curriculum, has been on the schools sector and young people. Later trends analysis will cover the whole education and training system.

Research related to the learner and the learner's context identified four emergent or potential future trends:

- Consumption of multiple technologies by young people
- Increased dependence of young people on mobile technologies for online social networking
- Increased parental encouragement of their primary age children's educational uses of computers in the home
- Increased use of TV-on-demand by young people in the home.

The research identified 24 core trends (listed in Appendix A) affecting the development of learning technology relating to pedagogy and the curriculum. From the core trends, six cross-cutting trends emerge, which are the:

- growing use of Web 2.0 technologies by young people
- development of mobile, ubiquitous and contextual computing
- impact of widespread capital building programmes
- demand for increasingly technological skills in the workplace
- economic, social and technological drivers transforming the character and organisation of education and training
- challenge to professional development of the teaching workforce.

The factors affecting pedagogy are not isolated from each other. There are inter-relationships between the factors, and they can have combined effects; for example,

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[1] See *Harnessing Technology: Next Generation Learning 2008–14.*

mobile computing can support new modes of social learning through Web 2.0 applications.

Research relating to trends, undertaken as part of the business processes for delivery, focused on resource access. We identified four trends that will have an impact on the education and training system:

- Online spending and access to services is accelerating in consumer purchasing, private sector business procurement and delivery, and public sector procurement, access to and consumption of resources.
- The school sector is in the midst of a migration from heavy dependence on traditional procurement channels to online procurement channels.
- Decision-makers in education and training increasingly favour free ICT resources over one-off purchases or subscription models.
- Peer-to-peer approaches are emerging as the preferred means of disseminating innovative ideas and practices relating to ICT.

Why these trends?

Research on the learner and the learner's context primarily raises questions about potential new trends in terms of young people's uses of technologies in the home and elsewhere away from school or college. These trends are potentially important for two main reasons:

- The trends were encountered in the secondary research but not so far in the primary data-gathering. The research team therefore needs to be alert to what may become more significant during the course of the project.
- The members of the research team perceive some signs of a growing trend in what they have heard from the young people in their primary research, and want to check this impression against evidence from other sources.

In the research on pedagogy and the curriculum, trends are defined as 'persistent patterns of changing practices in a domain'. The analysis of the trends takes account as far as possible of all factors that may have an impact on the Harnessing Technology strategy, whether they come from wider social trends, government policy, within specific educational developments, or behaviours afforded by technological innovation. The trends may be either drivers or inhibitors for the vision set out in the strategy.

Outside the education and training system, innovations in business processes and new technologies that support procurement have consistently signalled both the willingness and capability of organisations to move ahead with modernisation. In the research on business processes for delivery, it became apparent that procurement is central to the successful delivery of improved business processes through new technological innovations, particularly because it relates to access to resources.

Emerging trends and the Harnessing Technology strategy

The diagram below shows how the emerging trends will contribute to – or in some cases impede – the system outcomes identified in the Harnessing Technology strategy.[2]

	Harnessing Technology goals				
Trends	**Confident system leadership and innovation**	**Improved personalised learning experiences**	**Technology confident effective providers**	**Engaged and empowered learners**	**Enabling infrastructure and processes**
Consumption of multiple technologies by young people					
Increased dependence on mobile technologies for social networking					
Increased parental encouragement of primary children's educational uses of computers in the home					
Increasing use of TV-on-demand by young people in the home					
Young people's incorporation of Web 2.0 technologies into their lives					

[2] See page 48 of *Harnessing Technology: Next Generation Learning 2008–14*.

Trends	Harnessing Technology goals				
	Confident system leadership and innovation	Improved personalised learning experiences	Technology confident effective providers	Engaged and empowered learners	Enabling infrastructure and processes
The impact on curriculum and pedagogy of capital building programmes	■	■	■		■
Changing demands of workplace skills	■		■		
Economic, social and technological drivers transforming education	■	■	■	■	■
Challenges to teachers' pedagogical role and professional development	■		■		■
Development of mobile, ubiquitous and contextual computing	■	■	■	■	■
Growth in online spending and access to services					■
Preference for free ICT resources			■		■

	Harnessing Technology goals				
Trends	**Confident system leadership and innovation**	**Improved personalised learning experiences**	**Technology confident effective providers**	**Engaged and empowered learners**	**Enabling infrastructure and processes**
Preference for peer-to-peer approaches to disseminating innovative ICT practice	░░░		░░░		░░░

The trends in detail

Consumption of multiple technologies by young people

This trend for consumption of multiple technologies by young people was suggested by interviews with learners. The trend was further investigated to discover whether it signalled a more general trend within the UK and globally or a mainly localised phenomenon.

It appears to be increasingly the case that young people have a distinctly multi-tasking relationship with new technologies, and a 'multiple consumption' approach to owning them. The trend appears to be towards young people in their teens and younger possessing or aspiring to possess a substantial combination of the following technology items:

- Laptop computer
- Mobile phone (in some cases more than one)
- MP3 player
- Full-size games console
- Mobile games player.

It does not seem particularly remarkable to suggest that young people have a strong consumer relationship with new technologies. However, it is striking how widespread and how advanced this phenomenon appears to be. In investigating the existence of such a trend more widely, the research found confirmation and some degree of clarification.

The current growth of the general trend is backed in two recent reports: the Ofcom Communications Market Report of (Ofcom, 2008) and Trends in Media Use (Roberts and Foehr, 2008) in the USA. The Ofcom report gives the following indications of the situation in the UK:

- There has been an increase in the use of technologies within the 8–25 age group since 2005, including an increased popularity of mobile phones, MP3 players and computers. Some 50 per cent of children aged 9 own or use an MP3 player or a mobile phone. By the age of 15, 75 per cent of children own or use an MP3 player or mobile phone. Between the ages of 8 and 11 and again between 12 and 15, a significant increase occurs in the number of media activities carried out, particularly regarding use of the internet (26 per cent), mobile phones (39 per cent) and iPods or MP3 players (24 per cent).
- Since 2007, there has been a large increase in specific technological activities within the 15–24 age group, the highest of these being in the download of music, films or clips from the internet (52 per cent increase), playing games online (50 per cent increase), and watching video clips and webcasts (45 per cent increase).

- Games consoles are used less frequently as age increases: 60 per cent of 15–24-year-olds have access to games consoles, whereas only 33 per cent of people aged 45–64 do.
- A survey by Olswang and YouGov (Olswang, 2007) suggests that young people aged 16–24 are the most likely to download unauthorised music and films.
- Nearly seven in 10 individuals aged 16–19 claim to upload photos onto the internet, with six in 10 being part of a social networking community. Popular user-generated content includes blog updates, photos, videos and web pages.
- Young people are the most likely to multi-task with technology.

The combination of multiple ownership and use of technologies characterises this trend so that, for example, a young person uses a phone to take photos which he or she then uploads onto the internet (a consumer product in its own right) via a laptop computer. Even the illegal downloading of music constitutes an aspect of consumption, given that the music is then played on a laptop, a phone or an MP3 player.

The picture in the USA appears to be quite similar to that in the UK, as the following points from *Trends in Media Use* (Roberts and Foehr, 2008) demonstrate:

- Users aged 8–18 use two or more media together approximately 25 per cent of the time, although they do not appear to be using technologies for any longer period; as they grow older, they become adept at co-ordinating the use of media to save time.
- Concurrent multi-tasking depends on both opportunity and environment: the young person needs both to have access to items such as a computer, which promotes multi-tasking, and for the technology to be conveniently located for the use of another technology, for example to be next to the television.
- Time spent using media technologies increases to approximately eight hours a day when the young person is aged 11–12, and then gradually declines to seven hours a day during the onset of adolescence, in response to the growing importance of school-related and social activities.
- Audio media activities and computer use tend to correlate positively with age. Possible reasons for the growth of computer use with age include young people becoming more aware of their ability to multi-task on the computer and realising that they can fulfil more of their needs at a given time.

The trend for consumption of multiple technologies by young people raises two key issues:

- First is the need for in-depth understanding about the ways in which, and the extent to which, multi-tasking uses of technologies are woven into young people's daily routines; this understanding is required before any serious attempt can be made to harness these behaviours and technologies for their formal learning value. (To harness the value of these behaviours and technologies, we need to know how young people choose to use these consumer possessions.)
- Secondly, the rapid expansion of technology ownership that many young people are experiencing raises an increasingly stark prospect of a digital divide both within the UK and globally.

Research is also considering the issue of young people as consumers in terms of whether the way in which young people buy technologies constitutes an important part of their identity (Wilska and Pedrozo, 2007).

Increased dependence of young people on mobile technologies for social networking

The trend towards using mobile phones as a platform (in some cases, the primary platform) for social networking is not yet well advanced in the UK, but this situation is likely to change over the next few years. Given the evidence from the report below (Perey *et al.*, 2008), the commercially driven conditions for the rapid intensification of mobile phone use in the UK are now in place or being put in place. Slight evidence from interviews carried out with learners for this research suggests that young people of secondary school age and above are already using mobile phones for social networking, mainly in ways that are supplementary to the main access via PCs at home. An example from the research is accessing Bebo pages via a mobile phone. The key technology driver has been the arrival of 3G mobile connectivity: 3G has made the internet accessible (to varying degrees of quality) on mobile technologies, although still at a fairly high price in the UK.

The strongest evidence of the growth of the trend towards increased use of mobile technologies for social networking comes from Japan, where 3G mobile phones have been available for some time. In Japan, mobile phones are used for considerably wider purposes than in the UK, including buying train tickets, watching TV and sending emails (rather than SMS texting). Young Japanese users operate within highly formalised social groupings, as Takahashi (2008) demonstrates in an article that compares the kind of closed social interactions that young Japanese people have in Mixi (the leading Japanese social networking service (SNS) site) with the more open and often global ones they have in MySpace, all conducted via mobile phones as a matter of course. Several other sources support the picture outlined below.

- A growing trend among young Japanese children is to use their mobile phones for email as opposed to making and receiving phone calls. More than half of young people sent or received 10 messages a day. This 'keitai

mail' is used primarily to chat with 'friends in relatively close proximity' (Kamibeppu and Sugiura, 2005).

- While mobile phone email allows people to send emails to PC-based email accounts, the large proportion of emails are sent between mobile phones, particularly in the case of young people.

- A survey conducted by the Ministry of Public Management, Home Affairs, Posts and Telecommunications of young Japanese people aged between 13 and 19 showed that 90 per cent of adolescents are subscribed to mobile internet services, a much higher percentage than would be expected in the UK (Boase and Kobayashi, in press).

- Japanese mobile phone users are often considered as the most advanced due to their willingness to install new applications onto their phones to meet the technical requirements of mobile community platforms.

- Mixi had over 12 million subscribers in December 2007, with over 6 million of these users accessing Mixi via their mobile phones. The majority of mobile SNS users (58 per cent) were aged under 25. A lower number of users aged under 25 (43 per cent) used the computer-based Mixi. (Morrison, 2007.)

Interestingly, high levels of mobile social networking are found in other parts of the globe, as well as Japan:

- People in emerging economies such as the Middle East, Eastern Europe, India, South East Asian countries outside Korea and Taiwan, and China, have substantial numbers of SNS users (Perey, 2008).

- A small-scale pilot study surveying two low-income grade-11 classes at an urban school in the Western Cape, South Africa, recently found that students were intensively using mobile phones for social networking and communication, but made limited use of the internet via a landline. While the findings are at an early stage, the data suggest that school students are using the internet on mobile phones in ways that challenge the notion that poor people in Africa don't use the internet (Kreutzer, 2008).

The UK may not necessarily follow this trend for mobile social networking. Although the Japanese love of mobile phone email may have developed from a previous use of pagers, the USA did not follow suit (Boase and Kobayashi, in press). A report by Informa TM (Perey, 2008) suggests that the Web 2.0 application which supports social networking platforms on mobiles is at least two years behind Web 2.0 online in becoming mainstream. The UK user base for mobile internet is not only quite small, but social networking is also low among priorities for its use. A survey by Haddon (2008) found that:

- Within the UK market, only 24 per cent of mobile internet users access SNS with their mobiles, and only 7 per cent of these check these sites

every day. However, 20 per cent of heavy SNS users do not solely check their SNS via mobiles but also use computer-based internet access.

- Forty-one per cent of UK mobile internet users suggested they would use internet services more if the cost of the services were reduced, particularly with respect to using more email (74 per cent), websites (70 per cent), instant messaging (60 per cent) and social networking (34 per cent).

- While mobile users tend to check email at any time during the day and in the evenings, social network users check their websites more in the evenings (18 per cent) and at any time (16 per cent) as opposed to during the day (5 per cent).

Another trend within the UK is that mobile phone users appear to access SNS during 'social time' – the activity lacks importance within day-to-day life. Perey (2008a) suggests that mobile social networking is likely to grow over the next three to five years in terms of usage, number of users and revenue, depending on societal, market, economic and technological obstacles. The growing trend in using mobile SNS is a prominent feature within the under-21 age group. Perey *et al*. (2008a) suggest that:

- In three to five years, under-21s will invent new uses for existing SNS features and demand new capabilities from SNS. New uses will develop from users' years of experience with user-generated content and social networking facilities.

- Young people aged between 14 and 20 account for approximately 40 per cent of all mobile community participants globally. It is assumed that this age group makes up the greatest proportion of contributors to SNS and that 'their social lives pivot around their online community tools', for example that these young people browse news feeds and message friends.

As a supplementary report (Perey, 2008b) shows, a wide range of companies are in sharp competition with one another, and product development is a costly and lengthy process. Currently gearing up to attract the custom and revenue of young people in the UK, alongside Bebo Mobile, are offers from start-ups and established brands such as Flirtomatic, itsmy.com, Mobilelove, Facebook Mobile Web, Moko, MySpace on Mobile, Next2Friends, Piczo Mobile and SeeMeTV, all of which see the mobile phone platform as central to future development in the industry.

The question remains, what if anything does the growth in mobile social networking signify in terms of learning or educational opportunity, even if this is a major trend within the industry and in the leisure activities of young people? Much has been written about the importance of using mobile technologies to enable and motivate young learners to access school, further education (FE) or HE learning, but little has been achieved, perhaps because of slow take-up of the technology until now. The likely trend for learners to engage more in social networking activities via mobile

technologies might make them more likely to respond to the efforts of educational institutions and training providers to encourage 'any time, anywhere' learning, but there is as yet little evidence of this.

There is, however, some evidence to suggest that informal activities of certain kinds – collaboration over homework (for which there is some evidence in our findings from interviews with learners), and information-gathering – appear to be generated when young people use SNS sites, especially those relating to personal interests and activities. This is particularly evident in research by Takahashi (2008):

'Young people do not only seek and collect information but also exchange and share information with their uchi [closed social group] members all together by using SNS Mobile frequently.'

While there is not yet a great deal of evidence about learning that may occur from using social networks, some research does support the potential. For example, a study of undergraduates at Michigan State University by Ellison *et al.* (2007) indicated that the use of Facebook (but not internet use in general) is positively related to the maintenance and creation of social capital, in particular 'bridging social capital'. Utilising the work of Granovetter (1982), bridging social capital is defined as 'loose connections between individuals who may provide useful information or new perspectives for one another but typically not emotional support' (Ellison *et al.*, 2007). Social networks could have important implications for learning.

Despite the many uncertainties surrounding the trend towards increased mobile social networking, this trend merits close observation over the next few years.

Increased parental encouragement of their primary age children's educational uses of computers in the home

This trend – parental encouragement of primary age children's educational use of computers in the home – is presented perhaps rather more tentatively than the other three, but its provenance is fairly strong. It certainly constitutes a perspective that we will look at in later stages of fieldwork in the home. (The work will observe learners using the computer/internet *in situ* and talk to parents about their attitudes to learners' activities, where relevant.)

The evidence referred to below provides some indication that parents of primary-school-age children are spending more time with their children using their computers to support educational development. This is a potentially important breakthrough, because the same evidence suggests that parental encouragement has a large effect on the length of time spent on educational websites and the type of web pages encountered.

- A current review of the Effective Preschool and Primary Education 3–11 (EPPE 3–11) study suggests that a new trend is emerging. EPPE 3–11 extended a large longitudinal study investigating the effects of pre-school

education on children's development outcomes from the start of primary school until Key Stage 1 (Sylva *et al.*, 2004). EPPE 3–11 followed the developmental progress of more than 2,400 of the children who had taken part in the previous EPPE study between the end of Key Stage 1 and Key Stage 2. The amount of time parents spent using the computer with their children for educational activities increased between Key Stage 1 (7 years) and Key Stage 2 (11 years). For children aged 7 years, 65 per cent of parents typically spent time regularly on educational activities with the children at the computer. In comparison, 78 per cent of those same parents spent time educationally on the computer with their children when they were aged 11. This suggests that around 13 per cent of the parents chose to spend time with their children in encouraging an educational use of the computer as the children grew older.

- A further distinction can be made within the type of educational activities that the parent helps with. When considering the use of offline educational activities, including educational CD-ROMs, SATs and spelling practice, 73 per cent of the frequent computer user families encouraged this activity. In addition, 78 per cent of the frequent users encouraged educational activities using the internet, suggesting that the internet may be a preferred method for encouraging educational stimulation for older children (Talae, 2008).

- Parental encouragement of children aged 10–12 has a positive effect on the children's use of the internet. In Korea, the more time a parent spends on the internet with a child and recommending websites for the child to visit, the more time the child spends using the internet educationally (Lee and Chae, 2007).

These newly developing trends suggest that increased encouragement of educational uses of the internet at age 11 has a positive effect on the amount of time children spend on educational websites. This effect is potentially important in light of evidence from the EPPE study. The research will continue to monitor these emerging findings, because they may represent evidence of family learning taking place around the computer.

Increased use of TV-on-demand by young people in the home

An important trend developing within the UK is the increasing popularity of TV-on-demand services via broadband, in particular through BBC iPlayer and Channel 4's 4oD. This trend emerges with some force from interviews with learners, especially if the young people have computers in their bedrooms. In many cases, it appears that TV-on-demand allows young people to integrate into their time spent on the computer all their home-based activities: social networking or messaging on MSN, games playing, email, doing homework and watching TV when they choose.

The UK Association of Online Publishers recently reported that the TV-on-demand audience has doubled. The TV Trends 2008 study by Tiscali reported that 37 per

cent of the UK population regularly view on-demand programmes (up from 17 per cent in 2006) either via TV or computer; of this number, 38 per cent view on-demand programmes via their computers by using services such as iPlayer, 4oD, ITV.com and Sky Anytime. Some 86 per cent of those who were using such services in 2006 were still viewing as many or more on-demand programmes in 2008. The Ofcom Communications Market Report (Ofcom, 2008) states that:

- Seventeen per cent of those with broadband watch TV-on-demand; 37 per cent of iPlayer users are aged between 16 and 34.
- There has been an increased amalgamation of professional TV content into popular websites. While the BBC (through iPlayer) and other leading television channels host their own sets of on-demand programmes, other third-party sites have often been used to reach out to newer audiences. For example, E4 premiered the second series of Skins on MySpace and e4.com one week before its broadcast, and Bebo now hosts its Open Media Platform where users can distribute their favourite content from sites such as the BBC to other Bebo 'friends'.
- There has been an increase in viewers of user-generated videos such as on YouTube. YouTube's UK monthly audience has increased by 50 per cent over the year, standing at 9 million in April 2008.
- Almost 90 per cent of 15–24-year-olds watch user-generated content on TV programmes, internet news or video clips. This same age range is considered to be the most likely to download video clips and watch TV and webcasts online.

The results of a survey conducted by the Ericsson company Redback Networks into the use of on-demand TV and internet video by adults within the UK was released in 2008 (Redback Networks and YouGov, 2008). Some 7 per cent of UK residents watch around 10 hours of either on-demand TV or pre-recorded TV. Women are slightly more likely to watch on-demand TV than men (58 per cent of women; 55 per cent of men). The highest users of the service are over-55s and 18–24-year-olds at 60 per cent; 25–34-year-olds are the lowest users at 51 per cent. Out of all those polled, only 9 per cent use their PDA or mobile phone for internet TV or video viewing. This is markedly different from Japan, where the mobile phone is used a great deal more for TV viewing.

These somewhat disconnected data suggest that TV-on-demand is a rapidly growing industry. Owing to the ongoing amalgamation of professional TV content into popular websites that are accessible by young people, it is expected that increasing numbers of younger people will use these services. Young people are large viewers of user-generated media online, especially sites such as YouTube. Therefore it is reasonable to expect that young learners will devote an increasing proportion of their online time to the more passive activities of TV and video viewing, which runs somewhat counter to them gaining the presumed educational benefits of active and sometimes creative engagement in Web 2.0 applications and sites.

Young people's incorporation of Web 2.0 technologies into their lives

Web 2.0 technologies are developed outside education for commercial, leisure and networking purposes. However, as use of them becomes commonplace and an integral part of the lifestyles of many young people, learners are increasingly bringing the habits and behaviours based around their use of these technologies into their learning. Moreover, the availability of such applications opens up new opportunities for collaborative and participative modes of learning.

Web 2.0 tools provide particular opportunities for the personalisation of learning, because they enable activities such as the decoupling of applications and their recombination according to individual preference (the creation of what are often known as 'mash-ups'), and because they allow individuals to create their own resources, which also potentially enables increased creativity in the curriculum.

In schools, effective teaching consists of stimulating pupils to engage in conversations about the concepts being taught within the context of collaborating towards a shared goal (Mercer and Littleton, 2007) as stipulated in the National Curriculum. Consequently, the social networking enabled by Web 2.0 technologies, in which children converse online and make and remediate online content in their personal lives (Candy, 2006), offers a powerful new dimension to effective teaching.

Most teachers, however, do not use Web 2.0 technologies in the majority of their lessons, and many schools do not allow pupils' personal devices in classrooms due to fears of bullying (Hayes, 2008). Moreover, pupils tend to dislike their social networking technologies, such as Facebook, being co-opted for school learning (Hoare, 2007).

Personalised Web 2.0 technologies are transforming the business world (Kluth, 2006), and there is interest in how similar models might be imported into the education and training sector. For example, Amazon aggregates purchasing patterns and user rankings to present search results likely to be of interest to individual users. Such functionality is largely untapped by schools, and teachers generally access institutional resources by using traditional search methods (Oblinger, 2008).

Technology is anticipated to play a key role in transforming education and training towards supporting deeper, higher-order learning (Rogers, 2007). There is current interest in how connectivity can foster 'communities of inquiry' among school pupils (Garrison, 2007), consistent with the aims of the National Curriculum. An example of progress being made in this direction is offered by the Personal Inquiry project [http://www.pi-project.ac.uk], 'where children aged 11–14 investigate a science topic with classmates by carrying out explorations between their classroom, homes and discovery centres, guided by a personal computer'. It is essential that such efforts are not isolated examples of good innovation. Rigorous and pragmatic theoretical frameworks such as the 'conversational framework' (Laurillard, 2008) are required,

which enable designers and teachers to tailor the use of technologies to the needs of children as acquirers of knowledge.

In HE, there is a trend towards convergence of library information and IT services, with formal integration in some institutions. With library provision increasingly being online, there is a tendency towards a degree of overlap between the professions as well. More generally, HE institutions are increasingly responding to Web 2.0 developments by providing their own versions of blogs, social networking sites and the like (see, for example, Warwick blogs and community@brighton). Whether institutions should, instead, use tools that already exist outside education and training remains to be seen.

The impact on curriculum and pedagogy of capital building programmes

The major programme of capital investment, led by the Building Schools for the Future (BSF) funding for schools but also present in the primary and FE sectors, is leading to new approaches to technology – an outcome which is integral to the vision for this investment.

Local authorities and institutions are developing a range of responses as initiatives are rolled out. The implications of different approaches will need to be monitored and evaluated over the next few years; both the approaches to investing in technology infrastructure and the impact of different approaches to the design of physical learning spaces will need to be evaluated. New learning spaces can afford new modes of learning, including the integration of informal and formal learning, which is often mediated by technology. Although it is early days, and lessons from the pathfinder projects are still being learnt, there is concern that new builds are not sufficiently informed by modern pedagogy and opportunities for innovative forms of teaching and learning.

Investment in technology will lay the basis for new approaches to pedagogy and engagement. One vital issue to address is the support and resources available for training teachers and lecturers, and for continuing professional development (CPD) once the first step of establishing technical competence has been secured.

In FE, the reconfiguration of physical and virtual learning spaces is key to providing a 21st-century environment for learning. Building Colleges for the Future offers many of the same affordances and challenges as its equivalent schools-sector programme, BSF (DIUS, 2008). Building Colleges for the Future will raise the bar in terms of leaders' understanding of the potential of new technologies, and suppliers' understanding of educational contexts; both leaders and suppliers will be challenged to strategically plan and integrate the technologies identified as most appropriate to support the chosen curricula.

As yet, there is little evidence of cross-fertilisation between BSF and Building Colleges for the Future in terms of ICT provision, although this may happen

organically through common ICT suppliers. Equally, there is a risk of the proliferation of bad practice.

There have been some major unsuccessful initiatives in HE in the UK to construct new institutions around digital technology, such as the UKeU. Nevertheless, levels of activity around new technology remain high, although only some initiatives reflect institution-wide strategic leadership. The Open University has recently made a major investment in a new online learning platform, and the implementation of virtual learning environments (VLEs) is now commonplace.

The changing demands of workplace skills

As activities such as social networking become increasingly commonplace among new entrants to the workforce, employers must decide how to react. So far, opinion is divided (see the survey reported in Ferguson, 2008), with some seeing a business opportunity, others a threat to productivity and security.

Nevertheless, there is an increasing trend towards just-in-time learning with the realisation that the majority of learning that people do is informal, and that the easy availability of information on the web reduces the need to pay for formal training courses. Even in more formal training, however, the market for e-learning continues to increase globally (although the financial future is uncertain at the time of writing in 2008).

The Government's skills agenda following the Leitch report is a highly significant factor affecting workplace skills. A globally competitive economy that requires a more highly skilled workforce is a primary driver for government policy towards education and training at all levels. This need for workplace skills underlies major curriculum reforms like the 14–19 diplomas but also is a major driver for Harnessing Technology's attempt to push up attainment and draw in disengaged learners. The new skills agenda therefore has ramifications right across the education and training system. Within the FESR sector, there has been a growing push in recent years to drive up workforce skills for international competitiveness.

Changes in funding methodologies have forced colleges and other training providers to begin adapting their provision to employers' needs and towards workplace rather than classroom delivery. The growing (if not yet universal) recognition that the modern economy requires constantly updated skills and knowledge heightens employers' awareness of the need to ensure their employees have the skills for the job. It drives some employees to see learning and skills acquisition as a means to self-improvement.

Technology can increase the capacity of employers to provide flexible just-in-time workplace learning. There remains, however, a clear tension between the Government's main objective to ensure the whole of the workforce is qualified to level 2 and employers' need for training linked directly to short-term business goals.

One aspect of e-enabled learning which does appear to be taking root in workplace learning and elsewhere is the e-portfolio (Lewis, 2008). E-portfolios enable learners to build electronic records of their learning achievements and are portable between different settings.

Increasingly, the skills agenda drives HE expansion, and HE provision is shaped around the needs of employers, as in the rest of education and training, especially post-14. However, the skills agenda creates some uneasy tension with the traditional values and mission of universities and the existing structure of disciplines. Nevertheless, as a result, there is a widening of choice for students and a widening menu for those for whom vocational relevance needs to be readily apparent. Many institutions are strengthening links with other educational providers in their geographical areas; this might be by becoming involved in school links and by partnering with FE colleges in foundation degrees and the like, strengthening routes for academic progression (see, for example, Janet Collaborate [http://janetcollaborate.ac.uk]). Technology is becoming increasingly important in supporting learners' transitions between various opportunities and opening up access to wider groups.

Economic, social and technological drivers transforming education and training

The pace of social and technological change is unrelenting, and the education and training sector cannot and should not be isolated from this. Keeping up with change while continuing to educate and without sacrificing core educational values is a major and continuing challenge. More diverse patterns of institutional governance and funding and the forthcoming demographic dip in young learners, are beginning to change the character of the educational system in some respects.

The extent to which the adoption of technology in education and training leads to system change is as yet undetermined. Increasing competition for students in HE (and perhaps at previous stages of education), the development of open educational resources, greater incursions into what have been non-formal learning spaces, and the possibility of mass online courses available internationally put into question the future shape of the education and training system. On the other hand, calls for radical change which question the existence of schools themselves seem unlikely to succeed in an economy where working parents are more hard pressed than ever and there is a drive towards higher levels of skill attainment. While there are likely to be significant shifts in curriculum and pedagogy, these are likely to be within an education system that is evolving rather than undergoing a fundamental revolution.

Learning is becoming less institutionalised and now takes place over a lifetime across school, work and home settings. However, disparities in access to technology and the internet (the digital divide) can only exacerbate disparities in access to education and training. The trend towards strengthening links between parents or carers and the school through internet communication is an example where

disadvantaged pupils may be left behind, and yet they are often the very learners most in need of continuity. Concerns about access to resources were reflected in the Prime Minister's recent announcement that vouchers for ICT equipment will be given to low-income families to help the 1.4 million children who have no home internet access (Porter, 2008).

Mobile technologies, because they are portable, can play a role in blurring the distinction between learning in school and learning at home (Kenny, 2005). However, obstacles remain to realising this vision, not least the limited interoperability of current devices. Furthermore, the fast development of digital technologies means there is not yet robust, longitudinal evidence of the value of mobile devices for learning.

Safeguarding children and young people in their use of technologies remains a concern. Most parents have a positive attitude to the internet and its value to their children. However, parents' attitudes are far from uniform and are affected by numerous factors, including parents' knowledge and experience of the web and their child's birth order and personality (Byron, 2008). E-safety is integral to e-confidence, and e-confidence is integral to media literacy. E-safety is becoming embedded in the inspection regime, whole-school development plans, self-review frameworks and the curriculum. Teacher training and CPD programmes increasingly feature e-safety (see, for example, the web page 'E-safety in education' on the Training and Development Agency for Schools (TDA) website [http://www.tda.gov.uk/partners/quality/e_safety_in_education.aspx?keywords=e+saf ety]. However, as threats are understood and countered, new threats or worries about potential threats emerge, such as the potential for the grooming of young people through massively multi-player online role-playing gaming (MMPORG) (Byron, 2008). Constant vigilance is required to maintain the currency of inspectors' and practitioners' skills and the curriculum content.

It is now being recognised that to address e-safety requires engagement with parents. Family learning programmes are being developed around e-safety and wider IT user skills. The Government's commitment to increasing home access (through Computers for Pupils, the work of the e-Learning Foundation, BSF programmes and the Home Access initiative itself), presents a significant opportunity for intervention and engagement.

Similarly, e-safety is emerging as a driver for greater co-operation between the range of children's services and a greater understanding of new technologies among leaders and practitioners from those services. An early example is the South West Grid for Learning (SWGfL), which has pioneered a multi-agency approach in partnership with Avon and Somerset Police, North Somerset Council children's services and audit teams, a secondary school head teacher and industry, to form the Internet Safety Working Group. Local authorities are appointing dedicated e-safety co-ordinators to advise and support their schools and Local Children's Safeguarding Boards (LCSBs). These developments are broadly positive, but communication

needs to be sensitively handled to avoid exacerbating any exaggeration of the threats posed.

The impact of the UK Council on Child Internet Safety and the emerging self-regulatory codes of practice for industry (as proposed in the Byron review action plan) are yet to be felt but could be profound.

Specialist assistive technologies will continue to be developed to meet specific educational needs, but there is a trend for standard technologies to have specialised functionality built in (Abbott, 2007). The need for specialist technologies may diminish as symbol, graphic, text, audio and visual options become standard in off-the-shelf packages. Even where these are not yet available, there is evidence of groups of technologists and enthusiasts customising standard technologies – devising and sharing solutions to programming and design that is far from accessible. Producers and suppliers may make source code more openly available in order to extend access to their products to a wider audience. However, as yet, progress is slow, which, for many individuals, increases their disadvantage yet further.

There are many pockets of innovation using technology in the HE sector. A key question is whether it is best to use systems provided by institutions or to utilise those that are already available from non-educational providers, with implications both for university networks and also for issues such as validating work for assessment. The growth of online resources from sources outside education and from individual initiatives poses a challenge to institutions and HE libraries; policy responses such as the new access management initiative for online learning materials are being formulated (Young, 2008).

Challenges to the pedagogical role and professional development of teachers and other enablers of learning

The greater adoption of technological tools in education and training poses challenges in keeping educators' skills up to date so they can use the technology with confidence. While it is commonly said that young learners from the 'net generation' often outstrip the technical competence of their teachers, when it comes to vital digital literacy skills, the need for good teaching remains as strong as ever.

There is a need to ensure that teachers have the space and support to become confident pedagogical innovators with new technology. Recurrent debates over, for example, the pedagogy of interactive whiteboards show that pedagogical development following mass adoption of new technologies tends to be uneven across the system, and that there is a tendency for many teachers, often unwittingly or due to other pressures, to merely recreate old pedagogies with new tools, which can be a missed opportunity.

Moreover, it is not just a case of imagining new modes of learning with new tools. These new modes of learning can have wide-ranging implications and significantly alter such factors as classroom management, the pace of learning, teacher control and the learner–teacher relationship. Wrestling with such matters is a lengthy process which needs to be supported and enabled through the entire system of teacher training and personal development at all levels of education and training.

School leaders are developing technological skills in their private and professional lives; however, cutting-edge whole-school innovations are undertaken by only a minority of innovators (see, for example, Thomas, 2007). Many other school leaders have reservations about the integration of personalised technologies (ALT, 2008). These reservations arise in part from resistance to change and from people feeling out of the educational technology loop (Woolcock, 2008), but also reflect concerns about e-safety, logistics and sustainability; these are reasonable concerns given the high-profile failure of IT projects such as in the NHS (Department of Health, 2006).

Meanwhile, the accommodation of new technologies into traditional practices is evident across the schools sector. For example, the path of least resistance for e-assessment is towards automated marking that can produce summative results about the recall and application of facts, as in multiple-choice test papers (Burkhardt and Pead, 2003). Interactive whiteboards, which are potentially transformative technologies, lend themselves to chalk-and-talk (Hargreaves, 2003). The use of action research, in which leaders and teachers take control of systematic processes for innovation and implementation, offers a constructive way forward (Somekh, 2006).

Government programmes such as Every Child Matters aspire to join up and co-ordinate the growing workforce of professionals who deal with school-age children. However, there is a need to ensure that sufficient attention is given to persuading, training and supporting these professionals and other stakeholders, which inhibits the degree to which genuinely transformational change is likely to occur (Schmoller, 2006). Collaboration between educators, parents and carers, and other stakeholders is key to implementing and sustaining the infrastructure and processes required to transform and personalise school learning (Leadbeater, 2005). This top-down methodology can conflict with moves away from institutional networks as a platform for learning and towards Web 2.0 technologies accessed through personal devices, as advocated by some educational reformers.

A potential driver for curricular reform is the use of technology for assessment. Technology has the potential to drive more formative, qualitative assessment, including through the adoption of e-portfolios (Hartnell-Young, 2008). Assessment can become more robust and conceptual than the recall and application of factual knowledge promoted by traditional tests. However, the more common use of technology to reduce human workload and error, while a worthy endeavour, acts as an inhibitor by way of entrenching the current regime into the wider system (Burkhardt and Pead, 2003).

As with schools, FE college leaders and tutors are increasingly aware of, and persuaded by, the benefits of deploying new and emerging technologies to support teaching and learning. However, the disparities between institutions and their respective workforces are greater, with the high numbers of part-time staff continuing to exacerbate this situation. In the wider post-16 sector, disparities are even more marked. However, the situation is changing, and by 2010 all staff registered with the Institute for Learning (IfL) should have recorded a minimum of 30 hours' CPD (fewer for part-time staff), in which ICT can be expected to feature.

Clear evidence is, however, emerging of significant improvements in specific areas such as offender learning (Ufi, 2008), albeit from a low base. The development of a secure platform has been a major contributory factor to the success of the Ufi pilot programme and its subsequent extension to a significant proportion of the prison estate. In spite of initial apprehensions, this development relied upon the commitment of leaders from across the prison services and, in particular, from HM Prison Service IT Security department. To some involved in offender learning, this secure platform has far-reaching implications, resolving the last technical barrier to technology-supported learning in prisons and beyond.

Over the past decade (in particular, over the past five years), VLE and/or learning platform implementation has become widespread in FE colleges (Becta, 2006); it remains less pervasive in the wider FESR sector, although undoubtedly on the increase, most notably through open source solutions such as Moodle (Becta/Sero, 2008). There are great disparities across the wider FESR sector, with higher rates of implementation of learning platforms (and other technologies) among local authority providers. Early adopter status may explain the degree to which staff in the sector lack confidence in their use of learning platforms and remain reticent about the positive impact on teaching and learning (Becta/Sero, 2008).

The increased involvement of non-traditional education and training providers will be most keenly felt in the broader adult and/or community learning sector. The 'third sector' draws on a vast network of practitioners who bring specialist skills that are often above and beyond those common among more mainstream providers. These individuals have a valuable role to play in bringing new pedagogies and enriching the curriculum for both disadvantaged and mainstream learners. However, with the exception of those involved in creative and digital arts, these practitioners may not have the same level of digital skills as those in mainstream education. Practitioners have not benefited from the same CPD or schemes such as Laptops for Teachers. There is a clear risk that, if unsupported, practitioners will be unable to meet the digital needs and expectations of learners.

The development of mobile, ubiquitous and contextual computing

Increasingly, the availability of personally owned digital devices that have rich capabilities poses an opportunity to contribute towards a range of educational goals, including the personalisation of learning, linking learning within and outside the

classroom, enabling learning in a wide range of settings, and supporting just-in-time learning.

However, personally owned digital devices pose a challenge for the network infrastructure of institutions, which need to allow a wide range of devices to connect if the potential of the devices is to be realised. There is also an educational challenge in the need to develop the digital skills of users so they can manage their devices effectively and responsibly and use networks safely.

Pupils in their home lives now use everyday digital technologies including mobile devices, interactive television and online social networks. However, IT as a curricular subject is losing popularity across the school sector, suggesting that children and young people see digital technologies as useful tools rather than as interesting in their own right. The current National Curriculum emphasises innovative and thematic approaches to delivery across all school subjects; this reflects a drive towards providing learners with access to the National Curriculum in a way that suits individual needs and preferences, congruent with emerging personalised Web 2.0 technologies (Miliband, 2006). For example, a recurrent theme throughout the research literature is the difference between boys and girls in their use of computers and the web (Utter, 2007), although the extent of the difference may be narrowing. In the compulsory sector, providers must ensure the curriculum is accessible through the methods generally preferred by both sexes.

Mobile technologies, owing to their portability, are also expected to play a role in blurring the distinction between learning in school and learning at home (Attewell, 2005). Obstacles to realising this vision include the limited interoperability of current devices and a culture of pupils' own devices, particularly mobile phones, not being allowed in many classrooms (BBC, 2007). Nevertheless, some innovative schools have provided ubiquitous technologies to pupils, and to great effect (Paton, 2008). The cumulative increase of such examples over the next few years will provide an evidence base that can help to convince sceptics and result in growing communities of innovative practice that will have an impact on the national school culture.

Ubiquitous mobile devices (UMDs) are permeating education and training, and many learners carry personally owned mobile devices which connect to other devices and to information through infrastructure such as RFID, infrared and Bluetooth. Many opportunities offered by mobile devices, such as knowledge-sharing, collaboration (Zurita and Nussbaum 2004), assessment and personalisation (Sharples *et al.*, 2007), can be transferred to education and training. Mobile learning may be particularly appropriate in the FESR sector, where multi-site learning is already common (and will become more so with the rolling out of diplomas), and work-based learning, where logistical considerations are paramount. The FESR sector also has a clear remit to engage and retain hard-to-reach learners, and UMDs (when deployed appropriately) represent a useful addition to the tools available (LSDA, 2005).

Most university students are now confident and habitual users of technology and demand good provision from their institutions (Conole *et al.*, 2008). A recent development has been the effective use of Facebook to support the transition from school or gap-year activities to university. However, research among learners, such as the JISC Learner Experience programme, shows that a significant minority of learners choose not to engage with technology, and others regard the technology as theirs and resent what they see as institutional intrusion into their space. Moreover, easy inferences such as that, since many students play computer games, learning resources should imitate games, tend not to follow, because students draw a distinction between how they learn and how they play; in this example, learning in game-like environments can be a powerful tool not because it imitates play but because it enables serious learning to take place, and to that students will respond.

Growth in online spending and access to services

In the UK, more people are using the internet to purchase, access and consume resources, both personally and for business reasons. Primary research undertaken for this project shows that this trend is replicated in education and training. The trend towards online spending by consumers and access to services is accelerating. In commerce generally, around £26.5 billion was spent online in the UK in the first half of 2008, equivalent to 17p in every £1 (IMRG Capgemini, 2008). This is an increase of 38 per cent on the £19.2 billion spent in 2007. Capgemini now believes that between 30 and 50 per cent of all retail sales will be online in the next five years as sustainability issues drive growth, while Petevinos foresees even more fundamental change:

'As online reaches 20 per cent of all retail sales, retailers experience a tipping point which forces them to seriously rethink the future viability of their business model... We have seen this happen for books, music, DVDs and electricals, and more categories are sure to follow as the industry as a whole reaches this tipping point in 2008.' (Williams, 2008a)

Schools' purchasing arrangements must be put in context by comparison with consumer spending patterns.

People spend an average of 12 hours a week online, three-quarters of which is at home (Richards, 2008). Williams (2008b) suggests that people spend an average of 1.6 hours a week shopping online. It can be assumed that huge numbers of teachers shop online at major high-street supermarket sites, and book and other media sellers, and may buy or sell through online auction sites. Teachers access music online and regularly use facilities like online banking and travel booking. They are subject to incessant TV advertising by price-comparison sites.

The ability to research and make more informed choices, especially in a time of heightened price sensitivity, is a key advantage of purchasing online.

A large number of (mostly older) teachers and administrators, however, are only peripherally engaged in the online experience. The digital divide in education and training is real, and imposes restrictions on prescriptive advice for procurement, access, distribution and consumption.

Secondary research undertaken as part of this project shows that the digital divide in society at large is not closing as rapidly as some had hoped, with, for example, broadband access to the internet somewhat stalled at between 70 and 75 per cent of the population. BESA (2008) research finds this replicated in learners' access to broadband connections. In descending order, the literature segments digital capabilities as follows:

- Digital native students
- Digital native teachers
- Mainstream students
- Mainstream teachers
- Excluded students
- (Self-) excluded teachers.

It would appear that access trends will not reach a desirable end-state[3] until the final category of digitally self-excluded teachers are trained or they pass into retirement.

As fast-moving as consumer purchasing on the internet is, it is dwarfed by the growth in business use of the internet for purchasing and delivery. The advantages in costs, speed of ordering and reduced transaction costs in order processing have pushed online transactions from $100 billion in 1998 to over $1 trillion last year.

In the UK public sector, procurement practices have consistently served as a leading indicator of behavioural change. Starting with the MoD's proprietary logistics system (which was based on EDI systems as far back as the 1970s) and perhaps culminating with OGCBuyingSolutions (an executive agency of the Office of Government Commerce, providing Catalist as an e-procurement channel), pressure to purchase more effectively and to find ever-greater value for money has been a leading change agent that has later enabled shared services and transformational government.

The major trend in the UK public sector has been a strong migration to online procurement, followed by a smaller but growing trend to online access, and a nascent but noticeable trend towards online consumption of resources, as web-hosted applications become more robust and trusted. These trends were driven by

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[3] By 'desirable end-state', the research puts forward a tentative definition for review: 'Multiple procurement, access and distribution channels giving technology-confident providers a sufficient range of options for finding and gathering resources that best fit their own needs and the needs of both learners and learning organisations.' The definition makes clear that not all procurement or access should be online or even necessarily have an online component.

two initiatives, Shared Services and Transformational Government, and have been strongest in local government. According to Business Link, local government councils currently (at the time of writing, in 2008) spend £25 billion each year with 800,000 suppliers, and are mandated to push e-procurement.

Migration from traditional procurement channels to online procurement

Teachers may choose to use online access and purchase methods in their professional lives, as they do in their personal lives. If schools match the general trend, the current £92 million spent by schools through online purchasing will increase in five years' time to at least £208 million. This would have major implications for school systems. The recent opening of the online procurement system Zanzibar to schools may speed online procurement in future. However, this does not appear to be the case at present.

BESA (2008) explored the processes through which schools purchase resources. Although BESA discovered a recent shift from schools faxing or posting traditional printed catalogue order forms to suppliers, it was estimated that 41 per cent of primary schools still make more than half of their orders in this way; this number is expected to decline to 18 per cent of schools by 2010. By 2010, a higher proportion of schools will make more than half of their orders using other methods, including email and suppliers' e-commerce websites. However, in 2008, only 2 per cent of primary schools expect to use e-procurement for more than half of orders; this percentage is anticipated to increase to only 9 per cent of schools by 2010.

BESA also explored how schools identify products to purchase.

Two-thirds of primary school respondents indicate regularly using general search engines to search for products. Administrative officers and finance managers are the most likely to use search engines. The responses also indicate that bursars are the most likely group of respondents to go direct to suppliers' websites. If commonly used supplier websites do not provide a product match, half of bursars will use a general search engine and a quarter will go to BESA's website of suppliers.

Most secondary school respondents regularly use general search engines to find products. Compared to respondents in primary schools, respondents in secondary schools are more likely to indicate using more than one method of finding products online.

Another popular option, especially for deputy headteachers, is subject association websites. Nearly half of sampled deputy headteachers frequently use subject association websites to search for products. Bursars and administrative officers are also likely to use subject association websites for sourcing products. It is very unlikely for any group of respondents to make use of newspaper or journal websites.

BESA (2008) found that brand loyalty is an important factor in purchasing decisions. When primary school respondents were asked to rank four identified supplier

attributes, the one most likely to be highly ranked is trustworthiness: the supplier currently used by the school and trusted is likely to be favoured. It is interesting to note that more than a third of schools did not see lowest cost as being an important consideration. Similar results were found from secondary schools, where 45 per cent prefer to purchase from a current and trusted supplier, and ease of ordering and rapid delivery is ranked first or second by more than half.

Choosing and buying relevant classroom consumables and resources can take a substantial amount of time and is important to those involved. However, the sums involved are a very small percentage of the whole school budget. BESA (2008) indicates that a secondary school with a total annual budget of £3.75 million will spend only £245,000 (6.53 per cent) on resources, with a further £64,900 (1.73 per cent) on ICT. A primary school with a total budget of £0.69 million spends only £15,800 (2.289 per cent) on learning resources, with a further £14,870 (2.163 per cent) on ICT resources. With a total English education budget for primary schools of £13.3 billion in 2008, this suggests that £304 million is spent on learning resources. In secondary schools, with a total budget of £14 billion, the amount spent on learning resources equates to £914 million.

Based on these figures, it can be inferred that in 2008–09, a total of £1,218 million will be spent in England alone on resources. It is anticipated that this amount will continue to increase by 5 per cent each year and will also need to reflect the additional amounts needed to allow for raising the school leaving age to 17 by 2013 and to 18 by 2015.

Preference for free ICT resources over one-off purchases or subscription models

Decision-makers in education and training increasingly favour free resources over one-off purchases or subscription models. Many of the free learning resources available online may have been produced by teachers at home or in non-contact time; suppliers now offer free tools and content. The *Guardian* (Dodson, 2008) reported that:

'A growing number of UK schools are relying on Google to manage the bulk of their ICT needs. Google Apps Education Edition is a bundled package of web-based email, calendar and office software originally tailored for business but now being offered – free – to schools. And universities are beginning to take note, too. Google says adoption of Google Apps in schools replaces the need for paid-for software suites, such as Microsoft Office, email clients and project management tools. A Google spokesman says: "This means schools and universities don't need to install or maintain any software or hardware as Google provides the technology for free."'

Google's move into education is purely an extension of its offering to consumers and business, though the advertising through which Google makes money is turned off in Google Apps Education Edition.

In interviews about the education market and whether there are any plans for a wider suite of freely available resources aimed at the schools market, senior Google staff confirmed that Google Apps are developed (and will continue to be developed) for general use for business and consumers. Google's development model does not cater for specific market verticals, which appears to indicate that Google expects teachers and learners to appropriate the tools for their own purposes, and that offering learning content is not fitting for a technology company that – at the root of its operation – aggregates everybody else's.

Open source software does not appear to be developing in education at the expected rate in the UK, principally because open source solutions are often not curriculum based (Kable, 2008).

Preference for peer-to peer-approaches to disseminating innovative ideas and practices relating to ICT

Primary research indicates that, within education and training, peer-to-peer approaches tend to be the most successful ways to disseminate innovative ideas and practices. Partnerships between schools emerge as a particularly important mechanism for encouraging and diffusing innovation. Practitioners consistently cite opportunities for collaborative development and learning from their peers as being more effective than any other form of CPD. A move from offering guidance to offering more support may be needed as users become more confident in using ICT systems.

Local authorities play a significant role in providing ICT purchasing advice to schools. Often local authorities provide centralised purchasing and negotiate licences for resources. However, in recent years, numbers of local authority ICT advisory staff have diminished. In May 2007, Naace (National Association of Advisors for Computers in Education) commissioned a survey on concerns about changed priorities. It was clear that, while Government and its agencies insisted that policy changes did not mean ICT was a lesser priority, a different message was picked up by management teams in many schools and local authorities. Naace members thought that much of the progress made with ICT in education was being placed at risk.

The situation is different elsewhere in the education and training sector. When FE colleges came outside local authority control in 1993, most were large enough to develop their own independent models of support, and these were added to through, among other things, JISC Regional Support Centres. (FE and other education and training sectors will be further explored in the final trends report.)

Conclusions and next steps

In identifying issues for consideration for this report, we took account of the nature of the trends emerging across the research programme to identify where a broader pattern of trends is emerging. The trend that comes closest to having cross-cutting impact is the arrival of ubiquitous computing – the specific trend 'Ubiquitous mobile devices' (trend 11 in the appended list). However, the expansion in mobile social networking does not necessarily translate into opportunities for supporting ubiquitous learning related to formal education and training.

The next phase of work on pedagogy and curriculum will comprise a more systematic investigation and analysis of emerging and prospective disruptions that may have an impact on technology-enhanced learning, informed by a process of peer review with two groups of external experts. This analysis will form the heart of the next report and will lead to the identification of a range of scenarios which would have a significant impact on the development of technology for curriculum and pedagogy. This will, in turn, lead to conclusions about new modes and strategies of learning which are emerging or which are being proposed that promise ways of responding to the emerging picture over the next three to five years.

The research will take account of the trends identified in each project to appropriately address the issues in the ongoing research work and the next trend analysis.

References

Abbott, C. (2007), Futurelab Series Report 15: 'E-inclusion: Learning difficulties and digital technologies'. Bristol: Futurelab.

ALT (2008), 'E-learning – making it work: From the preserve of enthusiasts to organisation-wide implementation'. ALT in association with QIA.

Attewell, J. (2005), 'Mobile technologies and learning: A technology update and m-learning project summary. LSDA.

Attewell, J. (2005), 'Mobile technologies and learning'. London: Learning and Skills Development Agency.

BBC (2007), 'Mobile phones: "Offensive weapons"'. 26 June, 2007. Available at: [http://newsvote.bbc.co.uk/1/hi/education/6241108.stm].

Becta (2006), 'ICT and e-learning in FE survey: The key findings'. Coventry: Becta.

Becta/Sero (2008), 'E-maturity in personal and community development learning'. Coventry: Becta.

BESA (2008), 'Resources in English schools – 2'. London.

Boase, J. and Kobayash, T. (in press), 'Kei-tying teens: Using mobile phone e-mail to bond, bridge, and break with social ties – a study of Japanese adolescents'. *International Journal of Computer Studies*.

Business Link 'Benefit from eProcurement'. Available at: [http://www.businesslink.gov.uk/bdotg/action/detail?type=RESOURCES&site=181&itemId=5000523946].

Byron, T. (2008), *Safer Children in a Digital World*, the Report of the Byron Review. DCSF.

Candy, P. (2006), 'Laudable but misguided', presentation at the 2006 ALT Conference. Available at: [http://www.alt.ac.uk/docs/phil_candy_20060907.ppt].

Conole, G., de Laat, M., Dillon, T. and Darby, J. (2008), '"Disruptive technologies", "pedagogical innovation": What's new? Findings from an in-depth study of students' use and perception of technology'. *Computers and Education*, 50(2), 511–524.

Department of Health (2006), 'The national programme for IT in the NHS'. London: Stationery Office.

DIUS (2008,) 'Building Colleges for the Future: The LSC's National Capital Strategy for 2008–09 to 2010–11'.

Dodson, S. (2008), 'Chips for free', *Guardian*, Tuesday 6 May.

Ellison, N., Steinfield, C. and Lampe C. (2007), 'The Benefits of Facebook "Friends": Social capital and college students' use of online social network sites', *Journal of Computer-Mediated Communication*, 12: 1143–1168.

Ferguson, T. (2008), 'Staff web 2.0 skills can boost work productivity', WebWatch. [http://networks.silicon.com/webwatch/0,39024667,39292543,00.htm].

Garrison, D. (2007), 'Online community of inquiry review: Social, cognitive, and teaching presence issues', *Journal of Asynchronous Learning Networks* 11(1), 61-72.

Haddon, L. (2008), *Mobile Access to Social Networking Sites: A UK survey*. London: London School of Economics. Available at: [http://www.lse.ac.uk/collections/media@lse/pdf/Mobileandsocialnetworking.pdf].

Hargreaves, L. (2003), 'How do primary school teachers define and implement "interactive teaching" in the National Literacy Strategy in England?' *Research Pages in Education*, 18(3), 217–236.

Hartnell-Young, E. (2008), ePortfolios in the UK. EARLI Assessment SIG. Potsdam, August.

Hayes, D. (2008), 'Teachers call for ban on mobiles to curb bullying', *Evening Standard*, 25 March 2008. Available at: [http://www.thisislondon.co.uk/standard/article-23463728-details/Teachers+call+for+ban+on+mobiles+to+curb+bullying/article.do].

Hoare, S. (2007), 'Students tell universities: Get out of MySpace!', *Education Guardian*, 5 November 2007. Available at: [http://education.guardian.co.uk/students/news/story/0,,2205512,00.html].

IMRG Capgemini (2008), e-Retail Sales Index. Available at: [http://www.imrg.org/8025741F0065E9B8/(httpPages)/FAE5B4EDA9020E448025744F0038D60B?OpenDocument]. Accessed 22 September 2008.

JISC (2008), 'Great Expectations of ICE: How higher education institutions are measuring up'. Available at: [http://www.jisc.ac.uk/media/documents/publications/jiscgreatexpectationsfinalreportjune08.pdf].

Kable (2008), 'Education ICT in the UK Public Sector to 2012'.

Kamibeppu, K. and Sugiura, H. (2005), 'Impact of the mobile phone on junior high-school students' friendship in the Tokyo metropolitan area'. *Cyberpsychology and Behavior* 8(2), 121–130.

Kenny, J. (2005), 'the personal touch'. *Times Educational Supplement*, 17 June 2005. Available at: [http://www.tes.co.uk/article.aspx?storycode=2110133].

Kluth, A. (2006), '"Among the Audience", on the growth of personal and participatory media'. *The Economist*, 20 April 2006. Available at: [http://www.economist.com/surveys/displaystory.cfm?story_id=6819704].

Kreutzer,T. (2008), MA thesis abstract. South Africa: University of Cape Town.

Laurillard, D. (2008), 'Modelling learning design', seminar at the Learning Sciences Research Institute, University of Nottingham, 10 June 2008. Available at: [http://portal.lsri.nottingham.ac.uk/Seminars/Events%20%20Seminars%20Related%20Files/Diana_Laurillard.ppt].

Leadbeater. C. (2005), *The Shape of Things to Come: personalised learning through collaboration*. Available at: [http://www.innovation-unit.co.uk/images/stories/files/pdf/TheShapeofThingstoCome.pdf].

Lee, S.J. and Chae, Y. (2007), 'Children's internet use in a family context: Influence on family relationshops and parental mediation'. *Cyberpsychology and Behavior*, 10(5), 640–644.

Lewis, P. (2008), 'Adoption and implementation of an e-portfolio assessment system and its integration with a course management system', in K. McFerrin *et al.* (Eds), *Proceedings of Society for Information Technology and Teacher Education International Conference 2008*, pp. 95–98.

Miliband, D. (2006), 'Choice and voice in personalising education', in *Personalising Education* (pp. 21–30). OECD/CERI.

Morrison, D.S. (2007), 'Can Japan's Mixi take the mobile web?' MocoNews.Net. Available at: [http://www.moconews.net/entry/419-can-japans-mixi-take-the-mobile-web].

NAACE (2007), 'Naace concerns in relation to reductions in local authority workforces supporting ICT and perceived downgrading of ICT as an educational priority'. Naace position paper, 12 June 2007. Available at: [http://www.naace.org.uk/naace/attachment.asp@attachmentId=33671&menuItemId=1].

Oblinger, D. (2008), 'Growing up with Google: What it means to education', *Emerging Technologies for Learning*, vol. 3. Becta.

Ofcom (2008), *Ofcom Communications Market Report 2008*. Ofcom: London.

Olswang (2007), *Olswang Convergence Consumer Survey 2007*. Available at: [http://www.olswang.com/convergence07/convergence2007.pdf].

Paton, G. (2008), 'Mobile phones "boost school standards"'. *The Telegraph*, 4 September 2008. Available at: [http://www.telegraph.co.uk/connected/main.jhtml?xml=/connected/2008/09/04/dlmobile104.xml].

Perey, C. *et al.* (2008a), *Mobile Social Networking: Communities and Content on the Move*. London: Informa TM.

Perey, C. *et al.* (2008b), *Mobile Social Networking Companion Volume: Service Profiles and Analyses*. London: Informa TM.

Porter, A. (2008), 'Labour conference speech: Gordon Brown to vow home internet access for all children', *Telegraph*, 23 September 2008. Available at: [http://www.telegraph.co.uk/news/newstopics/politics/labour/3062140/Labour-conference-speech-Gordon-Brown-to-vow-home-internet-access-for-all-children.html].

Redback Networks and YouGov (2008), 'YouGov survey results'. Available at: [http://www.redback.com/Redback/data/YouGov-Rbak-April2008.pdf].

Richards, E. (2008), 'The future of Public Service Broadcasting', lecture to the Royal Television Society, March 2008. Available at: [http://www.ofcom.org.uk/media/speeches/2008/03/rtspsb]. Accessed 18 September 2008.

Roberts, D.F. and Foehr, U.G. (2008), 'Trends in media use', *Children and Electronic Media* 18(1), 11–37.

Rogers, Y. (2007), 'Can mobile devices facilitate more integrated learning?' Seminar at the Learning Sciences Research Institute, University of Nottingham, 6 November 2007. Available at: [http://mcs.open.ac.uk/yr258/LSRI_seminar_Rogers.pdf].

Schmoller, S. (2006), 'Educational change and ICT – a new report from Becta says "concentrate on people not technology"' Available at: [http://fm.schmoller.net/2006/12/educational_cha.html].

Sharples, M., Graber, R., Harrison, C. and Logan, K. (2009), 'E-Safety and Web 2.0 for children aged 11–16'. *Journal of Computer-Assisted Learning* 25(1), 70–84.

Sharples, M., Lonsdale P., Meek J., Rudman P.D. and Vavoula G.N. (2007), 'An evaluation of MyArtSpace: A mobile learning service for school museum trips'. In Pearce, J. and Norman, A. (Eds), *Proceedings of mLearn international conference* (pp. 238–244). Melbourne: University of Melbourne.

Somekh, B. (2006). *Action Research: A Methodology for Change and Development*. McGraw-Hill Education.

Sylva, K., Melhuish, E. C., Sammons, P., Siraj-Blatchford, I. and Taggart, B.((2004), The Effective Provision of Pre-School Education (EPPE) project, Technical Paper 12 – *The Final Report: Effective Pre-School Education*. London: DfES/Institute of Education, University of London.

Takahashi, T. (2008), 'Mobile phones and social networking sites: Digital natives' engagement with media in everyday life in Japan'. Paper presented at the Media, Communication and Humanity 2008 Media@lse Fifth Anniversary Conference, London, 21–23 September.

Talae, E. (2008), Trend data from the EPPE 7–11 project. Data in progress. Oxford: University of Oxford.

Thomas, K. (2007), 'Switching on to learning'. Futurelab. Available at: [http://www.futurelab.org.uk/resources/publications_reports_articles/web_articles/Web_Article829].

Utter, D. (2007), 'Girls dominate the social networking world', WebProNews. Available at: [http://www.webpronews.com/insiderreports/2007/01/08/girls-dominate-the-social-networking-world].

Vandebosch, H. and Van Cleemput, K. (2008), 'Defining cyberbullying: A qualitative research into the perceptions of youngsters', *Cyberpsychology and Behavior*, 11(4), 499–503.

Williams, I. (2008a), 'One fifth of all spending now online'. Available at: [http://www.vnunet.com/vnunet/news/2222134/spending-online-imrg-capgemini]. Accessed 18 September 2008.

Williams, I. (2008b), 'British surfers turning online to snag bargains', The Inquirer. Available at: [http://www.theinquirer.net/gb/inquirer/news/2008/08/12/surfers-turning-online-snag]. Accessed 14 August 2008.

Wilska, T.-A. and Pedrozo, S. (2007), 'New technology and young people's consumer identities', *Young Nordic Journal of Youth Research*, 15(4), 343–368, SAGE publications.

Wilson, D. and Logan, M. (Ufi 2007), 'An evaluation of the Learndirect ESF Pathways project in prisons and probation'. Available at: [http://www.ufi.com/home/section1/6_projects/ESF%20Evaluation%20booklet.pdf].

Woolcock, N. (2008), 'Technophobe teachers wasting millions', *The Times*, 8 July. Available at: [http://www.timesonline.co.uk/tol/news/uk/education/article3142536.ece?print=yes&randnum=1199785157531].

Young, T. (2008), 'Fresh funds flow into e-learning', Yahoo! News UK. Available at: [http://uk.news.yahoo.com/vdunet/20080925/ttc-fresh-funds-flow-into-e-learning-6315470.html].

Zurita, G. and Nussbaum, M. (2003), 'Computer supported collaborative learning using wirelessly interconnected handheld computers', *Computers & Education*, 42(3), 289–314.

Appendix A: 24 broad trends identified in the pedagogy and curriculum research

1   Economic policy: Continuing government investment in education and training with technology

2   Globalisation: Increasing worldwide investment in technology for learning, with significant cultural differences

3   Building Schools for the Future (BSF): Major investment in capital rebuilding at secondary level

4   Online learning environments: Increasing investment in learning platform technologies particularly at school level

5   Curriculum innovation: Implementation of curriculum innovations, including support for collaborative and cross-curricular learning

6   Expanded children's workforce: Growing workforce of professionals who deal with children, particularly in non-formal sectors

7   Non-traditional education providers: Expanded role for the third sector in learning

8   New pedagogies and teacher roles: New technology creating the conditions for new types of learning and teaching

9   21st-century teachers: teachers developing skills in exploiting technology for creativity and social networking

10 Co-option of technologies designed for business and social use: Striking the right relationship between the technology used in education and in the workplace, and the financial issues raised for education

11 Ubiquitous mobile devices: Mobile and ubiquitous technologies offering opportunities for personally managed learning within and outside the classroom

12 Personalisation and Web 2.0 services: Technologies developed for personalised commercial sites being adopted for education

13 'Perpetual-beta' technologies: Web 2.0 technologies in continual development by software companies and by users

14 E-safety: Concerns of society about the risks to children of internet use, influencing the adoption of technology in schools

15 Just-in-time learning: Knowledge-based technology enabling learners to access content and services to meet their immediate needs

16 Reconfigured learning spaces: Learning spaces being reconfigured to facilitate new modes of learning which support personalisation

17 Lifelong multi-context learning: Learning seen as a continual and connected process across a lifetime

18 Technology-enabled whole-school services: Institutional services becoming more integrated

19   Learners as participants and co-creators of learning: Learners being engaged in designing and creating their own learning, enhanced by technology

20   Online assessment: Technology offering new forms of personal and formative assessment

21   The learning habits of the Net Generation: Younger learners, used to pervasive digital technology, transferring their habits of working with that technology to their learning

22   Integrating formal and informal learning: Increasing recognition of the need to connect formal and informal learning

23   Changing IT user skills: New ways of interacting with the internet affecting how learners study and learn

24   Gender divides: Boys and girls differing in their use of computers and the web.

Appendix B: Research teams and projects

Oxford University is conducting research on 'the learner and their context'. The work is concerned with topics such as the learners' experience outside formal education, learner voice, online cultures, and developments and trends in learners' behaviour and experience.

Nottingham University and Sero are looking at 'pedagogy and the curriculum'. This research is concerned with a broad range of topics such as assessment, teaching approaches, formal and informal learning, personalisation and differentiation. It encompasses research into approaches resulting from and afforded by technology developments.

Kable and the Innovation Unit are investigating 'business processes for delivery'. The research is concerned with processes, support and services at a local, regional and national level, including funding mechanisms, procurement approaches, training and professional development. An important aspect of this research is the development of an understanding of successful approaches taken in other sectors and markets, and identifying how similar benefits can be realised within education and training.