# Innovative pathways to the next level of e-learning

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# EXECUTIVE SUMMARY

Debates about the future of e-learning have reached fever pitch in recent years as governments across the globe have increased investment in information and communication technologies (ICTs) in schools, universities, libraries, households and other locations where e-learning can take place. This paper aims to clarify the key issues of that debate, which started with computer-aided instruction systems in the 1960s, in order to offer a better understanding of the 'next level' of e-learning and how that might be reached. It does this by mining the discussion and other knowledge drawn from a policy forum organized by the Oxford Internet Institute (OII).

**The key issues**

Despite some sharp differences in areas of contention and shadings of emphasis on common ground, a number of clear themes emerged from the Forum:

- *The problem*. The patchy quality and generally conservative current uses of the technology indicate that more effort is needed in promoting e-learning effectiveness in many different contexts, rather than just investing in the provision of ICTs.

- *The solution.* The next level will achieve such improved effectiveness if it makes teachers, students and others involved in education feel that they are at the centre of education and learning networks. ICT-based networks offer the potential for a 'virtuous cycle' of change, in which networks are one of the fruits of innovation and, in turn, stimulate further innovation through the ways in which they are used in online education, peer-to-peer groups and in supporting and complementing face-to-face communication.

- *The means.* A bottom-up model of change that encourages dialogue, reflection and adaptation between networks of players at all levels is the most promising pathway to the next level, given the unpredictability, complexity and rapid pace of education and learning change tied to ICTs. One such approach highlighted at the Forum was the concept of the 'Trojan mouse': small, manageable innovations that combine with other small changes to make substantial long-term impacts.

- *The benefits.* Putting people at the centre of e-learning networks in an environment that supports adaptive change would help to sustain policies and efforts that aim to:

    - stimulate reflection and rethinking about the aims, nature and quality of the education process and its traditional approaches, including exploration of the new network communication model as an alternative to an unhelpful dichotomy between teacher-centred and student-centred learning; and

    - extend the reach of high-quality educational resources across social, geographic and economic divides.

- *The facilitators and barriers*. The move to the next level can be inhibited by the 'messy', but clear and present, realities of everyday learning, such as

time and curriculum pressures, limitations of space and budget and an overly rigid educational system. But the move could be encouraged if people are motivated by seeing how ICTs can assist in reaching their own goals, in the context of the pressures and constraints in which they currently operate.

**Policy implications**

- *Rethinking (e-)learning*. The Forum's main policy recommendation was the need to reconceptualise the process of change in e-learning to nurture both 'e-technology' and general learning dimensions in harmony, through a virtuous cycle of network-enabled innovation at the next level. This can be achieved, for example, by shifting the focus of public policy from developing and designing e-learning content to a greater emphasis on providing social and personal, as well as technical and financial, incentives and support for a diverse range of networking initiatives to be taken forward by the people involved in them.

- *Avoiding centralization strait-jackets.* Vital policy challenges to centralized methods of testing and curricula were raised, particularly their potential constraints on bottom-up adaptive innovation, for instance in exploring the potential benefits of adopting peer-reviewing processes that are popular in many successful commercial and community networks. A network model of communication in education is proposed to offer policy makers a way of promoting bottom-up innovation without top-down imposition of a particular educational approach.

- *Going with the motivational grain*. Forum discussions on the facilitators and inhibitors of e-learning innovation emphasized the need to identify appropriate motivating factors for different actors, in order to work with, rather than against, individual and group goals. Here, policies should be underpinned by an understanding that outcomes of change result from interactions between competing and cooperating actors who may have different goals, such as a drive for efficiency by educational administrators being perceived as a cost-cutting threat by teachers.

- *Evidence to support policy making*. Assessments of the current level of e-learning indicated that, despite its near fifty-year history, e-learning still stands on the threshold of what could be achieved by ICT capabilities which have begun to converge in a mature and reliable way only since the recent wider diffusion of the Internet. This means policy makers require more evidence from critical studies of the actual use and impacts of ICTs in learning and education to help understand what works and what doesn't, and why some things work in some contexts and not in others. Empirical studies can inform priority issues identified, such as: the features, benefits and risks of new learning paradigms; new networking opportunities from ICT-assisted learning; the potential for personalization of the learning process; and ways of using ICTs in education to bridge rather than reinforce economic and cultural divides.

**Structure of this paper**

After an Introduction that provides a more detailed overview of the main themes and conclusions summarized here, this paper explores the five key issues outlined above. In the final two sections, the authors suggest an analytical framework to help understand the issues raised and conclude with an examination of the main policy aspects of this analysis. Appendix I lists Forum participants. Appendix II provides a glossary, including expansions of abbreviations and acronyms used in the paper.

# FOREWORD

This is one of a series of forum-based discussion papers produced by Oxford University's Oxford Internet Institute (OII). It is different from more traditional summaries of research findings, or reports on events such as forums. In addition to drawing on the research of many Forum participants (including position papers written for the event),[1] it is informed by their relevant knowledge and practical experience in education, business, government and research. Wider sources than those covered at the Forum are also drawn on to provide a broader background. Its authors move beyond just reporting, offering their analysis of the Forum's discussions, which they hope might be of value in shaping discussion of research, policy and practice concerning the development, application and support of both ICT-enabled learning systems and related pedagogical models that establish the educational objectives of e-learning. The great commonality of issues between different sectors and levels led the Forum's organisers to decide to cover the whole spectrum of education and learning, while recognizing that there will be many specific variations between sectors.

*Acknowledgements*

The Next Level of e-Learning Forum was organized by the OII in collaboration with the University of Oxford's Department of Educational Studies. It started on 22 January 2004 at Oxford University's Politics and International Relations Faculty, with keynote lectures by John Naisbitt, the internationally respected author of books of futurology such as *Megatrends* and *High Tech/High Touch* (Naisbitt 1982, 1999), and Marc Eisenstadt, Founder and Chief Scientist of the Knowledge Media Institute (KMI) at the Open University in the UK.[2] The main Forum discussions took place on the next day at Oxford's Saïd Business School.

The authors are indebted to all participants in the Forum (see Appendix I). Their expert, lively and questioning contributions to the discussion provided a rich source of material for this paper, even where the authors could not credit specific individuals. I would like to thank, in particular, John and Marc for starting the Forum with informative presentations that helped to stimulate subsequent debate, as did the excellent presentation on the morning of 23 January by Diana Laurillard, Head of e-Learning Strategy Unit at the UK Department for Education and Skills.[3]

We greatly appreciate the financial support, participation and encouragement of the Forum's sponsors: Microsoft and the Japan–America Institute of Management Science (JAIMS). Special credit is also due to the team at the OII who made the arrangements work so smoothly, including Miranda Turner, Lucy Martin, Laura Oultram and Arthur Bullard.

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## INTRODUCTION

### Transforming learning: poets as well as computers in classrooms

Substantial and growing investment in ICT systems for education and learning by governments around the world has led to a flood of statistics that are often promoted as indicating that 'progress' in e-learning is strongly underway and is being widely enjoyed. This is typically represented by metrics like the growth in broadband Internet access in schools and ratios of computers-to-students nationally, regionally or within a school or university campus.

Participants at the OII 'Next Level in e-Learning' Forum generally felt it was time to move beyond such counting of ICT access points to ask more pertinent questions regarding the *effects* of choices made about the use (and non-use) of e-learning technologies, at all levels and in all educational sectors. There was agreement that provision of the artefacts of e-learning—access to ICTs—has not led to universal use or benefit, and that the divide could widen unless attention is paid to correcting gaps and flaws in current approaches.

Author John Naisbitt crystallized a broad social perspective expressed at the Forum when he quipped, 'In addition to a computer for every child, there should be a poet in every classroom.' He sees this as an example of a 'high tech/high touch' approach, which he has characterized as: 'Embracing technology that preserves our humanness and rejecting technology that intrudes upon it … it is questioning what place technology should have in our lives and what place it should have in society … It is recognizing when to avoid the layers of distraction and distance technology affords us. It is recognizing when technology is not neutral. It is knowing when to unplug and when to plug in. It is appropriate human scale.' (Naisbitt 1999: 26)

### The parenthesized 'e-': two dimensions of (e-)learning

The way in which outcomes from a technological innovation like e-learning are intimately bound up with the broader social contexts in which they are used is the key reason why the 'e-' in e-learning is frequently parenthesized in this paper: to indicate that both the 'e-' and general learning dimensions need to be nurtured in harmony in order get anywhere near the transformational claims made by e-learning enthusiasts.[4]

Stephen Coleman, OII's Cisco Visiting Professor in e-Democracy, encapsulated the two distinct forces shaping debates about the next level of e-learning: 'There is one huge push in the direction of seeing e-learning as being the one big change required, and there is another huge push in the direction of seeing e-learning as one of many objectives to be met by an evolving education system.' Diana Laurillard, Head of the e-Learning Strategy Unit at the UK Department for Education and Skills (DfES), saw a common goal: a rationale for e-learning that focuses on helping to achieve the broad objective of contributing to the creation of 'an education system that works better for learners, brings more people into education, keeps them there longer, raises standards, and so on.'

In this context, it was not surprising that much discussion at the Forum focused on the importance of the underlying educational paradigms and human-scale everyday concerns at stake, as well as those related directly to e-learning technologies. This is supported by a report from the DfES that rounded up the results of empirical studies of the impact of e-learning on educational performance (Pittard et al. 2004). This study's overall conclusion was that ICTs in learning and education can have a clear positive impact on pupil attainment and on school standards. This was balanced by a comment that 'any added value of ICT in educational terms is clearly not just based in the fact of ICT provision' but that the 'crucial component' affecting outcomes within education is the teacher's 'pedagogical approaches' (Pittard et al. 2004: 17).[5]

An understanding of the key role played by the educational, social, cultural and economic environment in shaping e-learning outcomes helps to explain why the same e-learning tool can produce different results in different contexts, and why excellent learning results can be achieved through educational innovations that do not employ ICTs. In addition, apparent anti-ICT phobias can also mask a different underlying crux of anxiety: fears that a hidden and unwanted educational or 'efficiency' agenda lurks beyond the screen, keyboard and mouse—which the apparent technophobe is happy to embrace for different tasks that offer clearer personal benefits.

A frequently cited concern was that the 'future perfect' visions of e-learning enthusiasts stand in stark contrast to what Peter Birmingham, a researcher at the OII and Oxford University's Department of Educational Studies, described as, 'the messy realities of life in the classroom'. He feels that e-learning is too often seen as offering an unrealistic promise of relief from these realities, which can lead to disillusion with actual outcomes. The difficulty of making such an escape from today's realities was a repeated refrain at the Forum. For example, many participants criticized what they saw as the strait-jacket of a standard curriculum and rigid fixed-time, examination-based testing. They also highlighted specific everyday pressures, such as: stressful demands on teachers' time and attention; inadequate physical space for housing and using ICT systems; and the increasingly complex levels of support required for ICT multimedia and mobile networks. Wider issues of global and local social deprivation, economic divides and physical and educational disadvantages were also prioritized.

**The next level of (e-)learning: promoting a virtuous cycle of change**

Given the diversity of views among participants and the range and complexity of topics discussed, there was naturally no detailed consensus among Forum participants. However, some significant pointers were provided to the future (e-)learning innovations and processes that are likely to best fulfil the technology's potential to support new learning models or enhanced outcomes for a wide range of people. Integrating such approaches into mainstream educational practices was also regarded as a crucial indicator of effectiveness.

Awareness at the Forum of the significance of networking in e-learning futures arose from participants' mentioning of numerous examples of how the use of the Internet, wireless technology and other ICTs is creating a wide diversity of new forms of social networks involving teachers, learners, parents, schools, universities, managers of educational institutions and other stakeholders in the wider community. Table 1 offers

a glimpse of the wide variety of such network-based learning activities that were discussed at the Forum. These relate to two broad categories:

- communities of online e-learning, such as Notschool.net, the Virtual Seminars for Teaching Literature or Jones International University;

- networks whose primary role is in diffusing and developing learning innovation at local, national or global scales, such as CLUTCH, Talking Heads and the Technology and Learning Community of the League for Innovation.

Some networks in Table 1 were established as formal government or institutional policy initiatives, such as Talking Heads. Others arose spontaneously, for instance the Virtual Seminars for Teaching Literature Website that was set up in the late 1990s 'as an afterthought' to teach First World War poetry, according to its Project Manager Stuart Lee, Head of Learning Technologies at the Oxford University Computing Services. An increasingly varied range of communities of learning and networks of innovation is likely to emerge as products of this kind of successful user-driven (e-)learning innovation, which uses the technology to establish new learning models. New forms of networking between teacher and student are also taking place within classrooms and campuses, for example using Virtual Learning Environment (VLE) 'courseware' and WiFi (Wireless Fidelity) networks.

The kind of networking illustrated in Table 1 is both a defining feature of the next level and a means of getting there, in a virtuous cycle of change that unleashes the innovative potential of e-learning by acting as a catalyst for change and becoming a probable result of that change. This is similar to the way innovation in ICTs led to the Internet, which enables collaboration that supports further technical innovation.[6]

**Getting there: sustainable pathways of (e-)learning innovation**

A vital ingredient in getting to a more effective next level of e-learning creativity was seen to be the design and development of e-learning systems that gain the immediate attention of students, teachers and other potential users—while also opening opportunities for users to take advantage of longer-term e-learning innovation throughout their lives. Such pathways to the next level were explored at 'macro' global and national levels, and in 'micro' personal, family and community activities where personal choices are reconfiguring how people use ICTs to get in touch with each other and to tap into learning-related information and other resources (Dutton 1999). More specifically, choices about the design and uses of ICTs can place the producers and consumers of learning at the centre of their own virtual e-learning networks of people, information, services and technologies.

*More flexible modes of governance and institutional change*

The kind of sustainable cycle of innovation promised by e-learning networks is most likely to flourish in an environment that allows for a flexible, 'adaptive' mode of governance and institutional change. This is needed to deal with the complex and unpredictable social and organizational change that arises from the use of rapid advances in an array interconnectable ICTs. Such an adaptive model seeks to balance top-down and bottom-up innovation. It involves multi-level, self-motivated change

through strong lateral as well as vertical channels of communication and networks of innovation.

**Table 1. Examples of ICT-facilitated networks in education and learning**

| Type of network | Examples |
|---|---|
| Community of previously excluded learners | Notschool.net uses various forms of e-learning approaches to develop the self-esteem of learners (see www.notschool.net). An independent evaluation concluded that the project had succeeded in providing a way back to learning for those young people who had previously not had opportunities to learn with methods that motivated them (Duckworth 2001). |
| Open access to online experts | Virtual Seminars for Teaching Literature offers Web-based education on poetry of the First World War, with a bulletin board giving access to teachers around the world who will answer students' questions (www.oucs.ox.ac.uk/ltg/ projects/jtap/). |
| Teacher–teacher | Talking Heads is an online community for school head teachers within the UK National College of School Leadership (www.ncsl.org.uk). It focuses on informal online learning through active facilitation by educational professionals, including the talk2learn Web-based environment for engaging with colleagues (see also www.ultralab.ac.uk/papers). |
| School–school | Video conferencing is helping to share specialist resources between schools, such as at Monkseaton Community High School in the UK which offers French language lessons to other local schools (see www.becta.org.uk/page_ documents/technology/vc/vc_classroom/sectc.pdf). |
| School–community | Kent County Council's 'School that Never Sleeps' project seeks to enable access to learning resources at any time throughout the community (www.apps.kent.gov.uk/coreinfo/supind2/documents/brief2002.pdf). |
| College–college | The Web-based Technology and Learning Community of the League for Innovation, an international consortium serving community colleges, includes the iStream online educational multimedia service (www.league.org). |
| University–students | Growing provision by universities of on-campus distributed learning; 'virtual universities' delivering distance learning services (e.g. Jones International University, at www.jonesinternational.edu, the first fully accredited 'university of the Web' in the US); and students around the world comparing university Websites when deciding where to apply. |
| University–schools | The Motivate maths project enables students (from 5 to 18 years) to work with mathematicians and scientists on a variety of problem-solving projects (www.motivate.maths.org); and the Open University helped to build a broadband network to link schools and libraries in its local area (www.mkschools.net). |
| University–community | The Open University partnered Living Archive, a local independent documentary arts organization, in running the Computer Literacy Understanding Through Community History (CLUTCH) project to support local history projects among parents and children (http://clutch.open.ac.uk). |

Adaptive change seeks to harness creativity through dialogue and innovation that takes place within and between different levels of educational policy and practice. Change can then percolate through the system more easily from wherever an innovation originates, as stakeholders experience the benefits of choosing to use the new learning technologies. This is applicable to institutions at all levels, from government departments and global businesses to individual universities, schools and classrooms.[7] It was contrasted with what were seen as strong constraints on innovation arising from widespread attempts to drive innovation using a mechanistic, top-down structure in which commands are issued to specify which innovation route everyone is expected to follow.

Bottom-up innovation and the manner in which local enthusiasm can move beyond the initial context is illustrated by John Plunkett, a science teacher at the Cornwallis School in Maidstone, Kent (UK), who won a national teaching award in 2003 for developing and maintaining the www.LitNum.com Website. This now assists literacy and numeracy learning for secondary-school children across the country by enabling students to learn at school, home or elsewhere through an individually paced approach using interactive games that allow for mediation by a parent, teacher or other adult.

Roger Higton, ICT Coordinator at Lord Williams's School in Thame, Oxfordshire (UK), gave an illustration of how effective local e-learning initiatives can be sparked by grassroots enthusiasm fired by an appreciation of the actual benefits that can be gained by choosing to explore e-learning opportunities in the 'messy' real world of education. He recalled that a teacher at his school, who had previously found computers completely alien, one day walked past an ICT room in which she saw students being enthusiastically involved with the computer systems. 'She then asked me to help her construct a Microsoft PowerPoint presentation, and from then on she was sold on the technology,' he noted. 'Her payback was raising standards for the students that she taught—teachers work long hours but if there is a return because their students get an improvement in their education they will learn all the new technology that we want them to learn.'

Non-threatening, small and well-focused e-learning innovation with possible far-reaching cumulative long-term effects were highlighted as being particularly important in everyday learning processes. This crystallized around the 'Trojan mouse' concept introduced to the Forum by Tristram Wyatt, Director of Oxford University's Distance and Online Learning Department.[8] An example of a Trojan mouse could be the 'intelligent whiteboard' or 'smartboard': a touch-sensitive screen that can be used with an electronic pen in a similar way to a traditional whiteboard, while also offering access to the Web and the display of video clips, software and students' work.

To be effective, a Trojan mouse innovation needs to be incremental and appealing enough to be understood and owned by all those directly involved, while also delivering clear and immediate learning gains. The cumulative impact of these kinds of incremental choices could be transformational as they seed the spread of new ideas (Dutton 2004a). A relatively minor Trojan mouse innovation could stimulate its user's imagination to lead to much wider, and in some cases more radical, longer-term changes in teaching and learning processes. For example, intelligent whiteboards could lead to a rethinking of participation in 'classroom' discussions, and how and

from where those discussions are accessed in wider networks of learning where both teachers and students can be at the centre of interactions at different times. The Internet itself can be conceived of as a Trojan mouse, being an incremental step for PC users that can have major implications for change.

*Rethinking (e-)learning to widen educational opportunities*

An important strategic gain from exploring the transformational potential of networking and other e-learning innovations is the stimulus it can give to the rethinking of educational approaches and to imagining 'future perfect' outcomes through the effective exploitation of e-learning's technological opportunities. For example, the Forum emphasized how ICT-enabled networks could help to bring high-quality education to economically, socially, physically and geographically disadvantaged groups that were previously unable to access such opportunities. Providing support for subjects where teaching resources are often scarce, like foreign languages and science, is another significant potential benefit from e-learning.

ICT-enabled forms of networked collaboration also open fresh opportunities for rethinking the relationship between different stakeholders because it gives them all more choices about how they engage in education and learning activities. Previously, the main competing paradigms were seen to be 'traditional' teacher-centred classroom instruction or student-centred, activity-based learning in which the teacher acts more as a facilitator than instructor (Figures 1 and 2).

**Figure 1. One-to-many communication model: teacher centred**
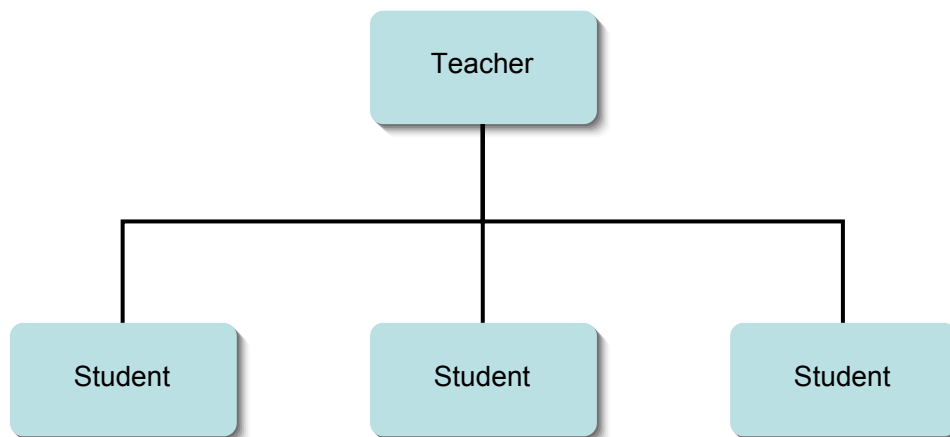


**Figure 2. Tutorial communication model: student centred with teachers as facilitators**

The new 'network communication model' (Figure 3) offers an alternative, middle way between these paradigms because it gives teachers, students and other learners a new array of possibilities from which to select in order to reconfigure their access to people, information, services and ICTs. This can accommodate either of the other main models, where that is appropriate for local actors. At the same time, it creates new pathways for (e-)learning innovations, such as new forms of peer reviewing, sharing teaching and learning experiences or gaining information and advice from peers, experts and other sources—on a local or global scale.

**Figure 3. Network communication model: actors at the centre of their own network**
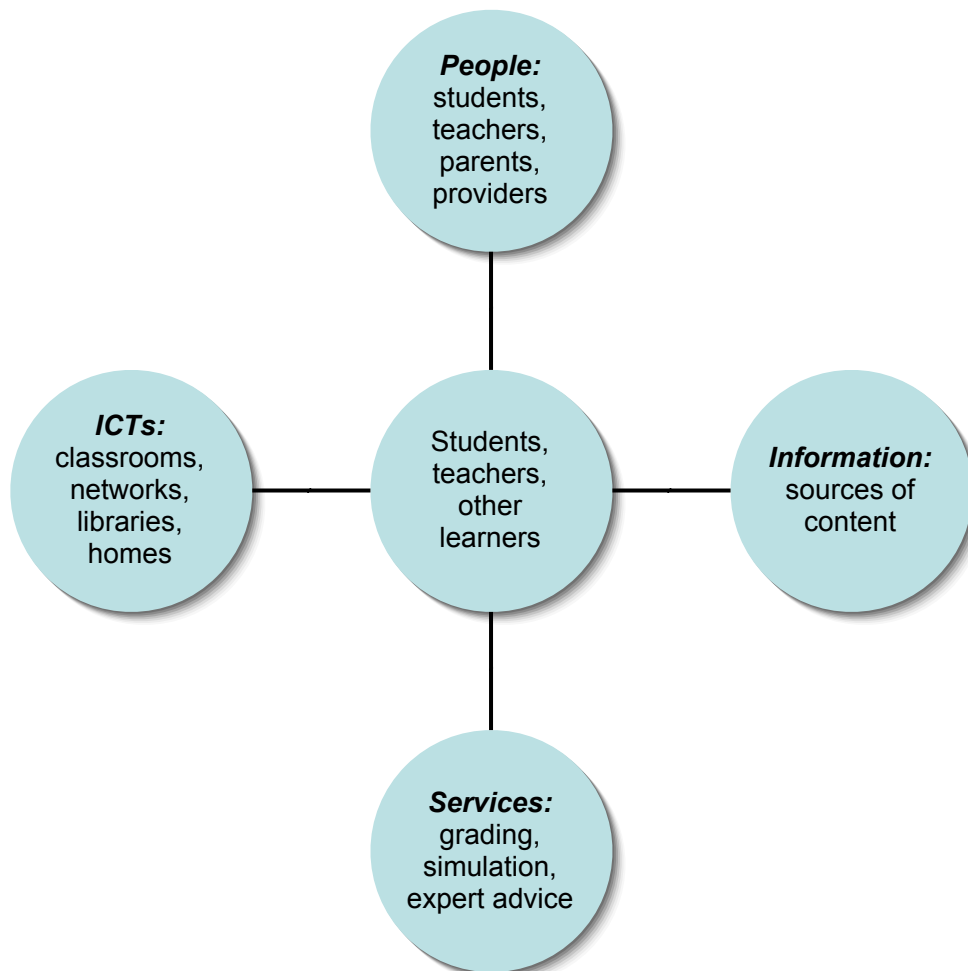


The next five sections expand the main themes summarized in this Introduction.

# 1. THE PROBLEM: THE CURRENT STATE OF PLAY IN E-LEARNING

## ICT provision in the first phase

Although much progress has been made in recent years to increase access to e-learning technologies, statistics about this kind of access offer a limited perspective on e-learning.

Across Europe, there seem to be declining disparities between countries in terms of the provision of infrastructure and technology, although precise figures are not readily available on a pan-European basis. A benchmarking study in 2002, drawing on the Eurobarometer survey, found that more than 93% of European Union (EU) schools were connected to the Internet by 2002.[9] However, there was still a gap between countries that pioneered e-learning (e.g. Sweden and Denmark) and those that have lagged behind on almost all e-learning measures (e.g. Portugal and Greece). Nevertheless, significant advances were made by the lagging countries in closing the divide between 2001 and 2002.

The UK provides an interesting example of public e-learning policies because successive governments from different political parties have extended and built on e-learning initiatives that started in the 1980s. This impetus was stepped up in 1997 after the election of a Labour government which had campaigned on a platform with three top priorities: 'education, education, education'. Progress in the provision of basic e-learning ICTs in the UK is impressive: about 99% of both primary and secondary (post-11) schools in the UK were connected to the Internet by early 2004, with 91% having access to broadband services. The computers-to-pupils ratio in schools fell from about 1:18 pupils in 1998 to 1:8 in 2004 overall, and from about 1:9 to 1:5 at secondary level (Clarke 2004).

The US displays similar success in expanding the infrastructure of ICTs in its schools. According to the National Center for Educational Statistics (NCES 2003), 99% of all US public schools had an Internet connection in 2003 compared to just 35% in 1994. In addition, 94% of public schools with Internet access now use a broadband connection, a figure that has risen dramatically since 2000.

Outside western countries, the picture is more mixed. For instance, Gordon Bruce of GJB & Associates, Technology Adviser to the Japan–America Institute of Management Science (JAIMS), explained that broadband is commonplace in South Korea, where virtually every urban household is wired up to the Internet, including all apartments. However, he added that 200 schools in the Philippines had to be networked together out of Hawaii and that areas with limited bandwidth access have additional challenges to physical access, such as having lower expectations about the level of sophistication required for delivering content (Jussawalla and Taylor 2003).

In some less developed countries, the provision of adequate telephone coverage has yet to be achieved, as indicated by the observation of the Director-General of UNESCO, Koïchiro Matsuura (2003), that 80% of people in the world had never even heard a dial tone by the early twenty-first century, let alone surfed the Web (see also Dutton et al. 2003: 37; Dutton 2004a).

**Beyond the provision of ICTs: making effective use of the technology**

*The current patchy pattern of progress*

Laurillard articulated a more rounded view of the current level of e-learning than that provided by access metrics alone: 'There are pockets of e-learning excellence in the UK, where we have done a lot. The same is true in many other countries. But it is not embedded in the mainstream warp and weft of the way in which we do things.' This reflected the Forum's general assessment that available e-learning systems are frequently under-used or not deployed in the most educationally beneficial way. Moreover, statistics on PCs and Internet access in education and e-learning do not tell us about the actual use being made of that access, such as who and how many have the confidence, skills or time to apply the technology well, if at all.

This was reflected in an assessment by the UK schools inspectorate, the Office for Standards in Education (Ofsted 2004: 6), of the Government's 'ICT in schools' programme between 1999 and 2004: 'The positive impact of financial support from the government has been noticeable mainly in staff confidence, record resource levels and improvements in pupils' ICT capability. The spread of ICT as a tool for teaching and learning has continued at a slow, albeit steady, rate. This is especially the case in secondary schools, where departmental organization can hinder whole-school progress. As yet, the government's aim for ICT to become embedded in the work of schools is a reality in only a small minority of schools. More typical is a picture in which pupils' ICT experiences across the curriculum are sporadic and dependent on teachers; in many schools, opportunities to exploit the technology are lost on a daily basis.'

The gap between e-learning potential and the reality highlighted above is implicit in asking how to move to the next level of e-learning. However, it is perhaps a sign of the success of previous investment programmes that questions such as these have not only become the focus of policy debates, but that political leaders have acknowledged they are important. For instance, the UK Secretary of State for Education, Charles Clarke, has commented: 'Simply because you have an electronic whiteboard in the room or a PC in the corner, doesn't of itself mean that education changes at all, it depends on whether it's used, how it's used and whether it's used in the most effective way' (Clarke 2004). The UK government has therefore initiated a wide range of projects (e.g. see DfES 2003a) to encourage more effective use of ICTs in education, such as developing appropriate skills, spreading best practise and supporting a variety of e-learning communities (see Table 2).[10]

*Old educational wine in new e-bottles*

Many at the Forum suggested that, in their enthusiasm to roll out the infrastructure of technological access as quickly as possible, many e-learning advocates in education, government and ICT industries paid insufficient attention to the realities of teaching and of implementing the technology, which often constrain innovation and the speed of change. Current limitations were typified by the cases and research cited at the Forum showing that new e-learning tools are typically being used in old ways. For example, OII Director William Dutton described a study in the US of a university-wide VLE that found most instructors used the system largely as a replacement for the copy machine

and other traditional media; only a few professors and students employed it for more interactive discussion and remote access (Dutton et al. 2004).

**Table 2. UK initiatives to support e-learning**

| Aim of initiative | Description |
|---|---|
| Gateway to educational resources on the Internet | The National Grid for Learning offers a network of selected links to Websites with educational content and information for learners, teachers, managers and others who support learning activities (www.ngfl.gov.uk). |
| Assistance in evaluating e-learning tools | Teachers Evaluating Educational Multimedia (TEEM), funded by commercial publishers and the UK Government is an independent evaluator of e-learning products and trains teachers to do evaluations (www.teem.org.uk). |
| Online resources to support teachers' skills updating | Access to bulletin boards, Web-based discussion forums, keynote talks and interactions with experts are provided in a £50 million network of nine regional and one national Science Learning Centres (www.sciencelearningcentres.org.uk/); the National College for School Leadership (NCSL) offers career-long teacher learning and professional development for existing and aspiring school leaders (www.ncsl.org.uk). |
| Pedagogical support for e-learning | The e-Learning and Pedagogy Programme funded by the UK Joint Information Systems Committee for Learning and Teaching is investigating how e-learning approaches can facilitate learning (www.jisc.ac.uk). |
| Accessibility to disadvantaged groups | The Cybrarian project is developing a personalized Web search interface tailored for people who find access most difficult, e.g. because of physical or learning disabilities or lack of skills or confidence (www.dfes.gov.uk/cybrarianproject). |
| Connecting all public libraries to the Internet | The People's Network has created over 4000 ICT-enabled library centres, with specially trained staff to help people learn new skills and find information (www.peoplesnetwork.gov.uk). |
| Encouragement of e-learning innovation | The Futurelab initiative of the National Endowment for Science, Technology and the Arts (NESTA), which is funded by a National Lottery endowment, pioneers innovative e-learning technologies (www.nesta.org.uk). |
| Providing laptop PCs to help familiarise teachers with the technology | The Laptops for Teachers initiative is backed by £300 million over four years, starting in 2002 (lft.ngfl.gov.uk). |

Although Dutton pointed out that VLEs are complex systems still at an early stage of development and implementation experience, similar patterns were identified even with simpler and more established systems. For instance, Laurillard criticized the bulk of e-learning sites on the Web as being too full of flat text and multiple-choice questions, as if they were text books rather than interactive multimedia. Naisbitt saw

this as an example of what communication guru Marshall McLuhan (1964) suggested in the 1960s in relation to mass media: that a new medium is always used in the context of the old one, for example in the way television started by consuming the content of movies and radio until the content forms that are uniquely enabled by the new technology started to emerge. Naisbitt's own analysis of long-term trends in innovation shows that a cluster of innovations, such as those surrounding ICTs since the microelectronics revolution of the 1970s, takes decades to be absorbed, perfected, extended and developed before people are fully able to exploit any truly transformative potential special to that innovation.[11]

Bill Fowler, Education Director of Cisco Systems' Internet Business Solutions Group, emphasized the limitation of the current focus on physical ICT access: 'Boasts are often made about the fall in the students-per-computer ratio—even though there is nothing to show that this, in itself, has any beneficial effect.' Marc Eisenstadt of the Open University's Knowledge Media Institute indicated the difficulties of tracking actual long-term effects of e-learning innovation when he pointed out that some key outcomes may emerge much later in unexpected ways, for example in the stimulus given to the UK's computer games industry from the launch in the early 1980s of the British-made Sinclair Spectrum, one of the world's first PCs used widely in education. In looking to the next level, a new focus will be needed to take account of the complex and unpredictable nature of changes in education and learning tied to ICTs.

## 2. THE SOLUTION: NETWORKING AS THE NEXT LEVEL FOR E-LEARNING

### The emergence of e-learning networks as a defining characteristic

The variety of forms of ICT-enabled learning and education networks mentioned at the Forum covered both formal and informal, new and established networks encompassing real and virtual communities, at all ages and levels of attainment: teachers and learners, students networking with each other, parents networking with each other and with schools, universities networking with teachers and local communities, teachers and head teachers sharing experiences with each other, and many other combinations. Achieving the full benefits of ICT-enabled interactions within and across such local and global communities will depend increasingly on having greater equity of network access.

The opportunities to create new forms of more informal learning networks were seen by many as particularly exciting. Kevin Carey, Director of humanITy, an ICT and social-inclusion charity, enthusiastically looked forward to the creation of new links between homes and schools that would mean 'educating parents alongside children, for example by allowing children to teach their parents IT skills rather than having parents going to an adult education environment in which they feel uncomfortable'. New possibilities for lifelong learning are also being opened through Internet-based access to a rich range of cultural heritage, scientific content and other resources drawn from museums, research institutes and a variety of digital multimedia libraries.[12] Dutton exemplified how ICT-enabled networks can facilitate the sharing of resources between educational institutions by pointing to the efforts of major research universities in the

US to use e-learning to support liberal arts colleges that do not have the resources to cover all topics.

An anecdote from Michelle Selinger, Education Specialist at Cisco Systems UK, captured the excitement of fresh thinking that younger generations are bringing to the creation of new lifestyles built around the opportunities for social networking and collaboration, in which decisions about the use and non-use of ICT networks plays an important role. She interviewed a young teenage boy who told her that he often conducted six online conversations simultaneously by keeping open six Instant Messenger windows on his PC at home. He added that some of these conversations were about sharing ideas on how to do homework set by the school—but when he and his friends were given group work, everyone would come over to his house to do it. Finding ways of harnessing such enthusiasm and maintaining the ability to tailor networking to the needs of each person and group was another key Forum theme.

**People at the centre of their own 'anywhere, anytime' networks**

When Forum participants were asked to look ahead ten years, a vision emerged of a diverse range of more inclusive local and global networks of learning, drawing in even those who previously felt they did not believe in education. This could generate new locations and spaces for learning both within specific institutions, with the assistance of appropriate architectural designs, and at sites throughout a community (e.g. libraries, sports clubs and cafés) and the world at large (via the Web, distance education, etc). Stephen Uden, an Education Relations specialist at Microsoft, said this kind of 'anywhere, anytime learning' recognizes that learning starts and ends outside formal education institutions, with ICTs able to extend the learning experience to wherever the learner happens to be, at the time of their choosing.

A comment from Naisbitt developed this theme into a graphic image of a key dimension of where e-learning is heading: 'The really powerful networks are those where every member of it experiences that they are in the centre, and all the information is coming and going through us: we are the nexus, we are the centre. If the student feels they are in the centre of the network, with two million points out there that criss-cross through them, that is powerful. And the teacher will feel the same way, or the principal or whomever is in a network. This possibility is what is new with ICT networks and is the opposite of the hierarchical systems we have been used to.'

This paper characterizes the 'next level' of e-learning by this ability of the Internet and related ICTs to enable each student to be at the centre of a network of educational resources, as well as each teacher to be at the centre of a network of their own learning, teaching and administrative resources—and each parent, administrator, policy maker and other player at the heart of their own resources relevant to their roles in education and learning.

There was some disagreement over the extent to which the future of e-learning would actually resemble the status quo or be radically different from it. Networking can complement existing institutions or enable transformations over time. The debate about educational paradigms and their relationship to e-learning also raises more fundamental questions, such as: do we really know what it would mean to use the technology in the most educationally effective way? And if we don't know, how can

we be so sure that ICTs are, or are not, being used to enhance rather than erode educational quality?

**Networks for building networks**

*The potential of (e-)learning networks to create an 'education epidemic'*

A key premise of the argument in favour of adaptive change is that it can capitalise on the strength of networks within and between the institutions and people responsible for delivering education and other public services, for example by extending existing social networks and stimulating new forms of online communities. Dutton noted that the ability of such networks to move beyond the bounds of traditional educational models was highlighted by the many examples of networking discussed at the Forum, which he said would not have been thrown up 'if we had stayed in the box of asking how teachers should use the new media to reach students'.

Dutton argued that anxieties about possible hidden motives for the introduction of e-learning, for example electronic media being seen as substitutes for teachers, could be allayed 'if we can shift the discussion from e-learning to networking that supports teaching and learning in classical as well as innovative models'. Fears that e-learning could undermine their jobs not only threatens teachers, but also challenge students, who could think their teachers will be distanced from them by the technology. 'Yet the reality is that students and teachers are using networking to augment their resources as a complement to what they are already doing,' commented Dutton.

OII Research and Policy Officer Victoria Nash believes networks of innovation are a particularly good model for the dissemination and uptake of effective e-learning approaches because 'learning about an experience directly from someone you trust who has been involved in a project is more likely to stimulate others to experiment than just reading about "good practice" case studies and guidelines'. In support, she cited Hargreaves' (2003) view that effective lateral innovation networks among school teachers could 'make an education epidemic'. Nash stressed the social dimension in such networks by drawing on her personal experience of how many teachers on the small island of Guernsey had gained a positive attitude to e-learning innovation through the exchange of knowledge and experience within the informal and informed social networks that occur naturally among teachers in this close community. She saw virtual networks similarly helping the flow of innovation—provided they can capture this sense of trusted social interchange.

*Challenges to creating sustainable networks*

In addition to the general support for networking, the Forum also raised a number of issues that can militate against the creation and effective use of innovation networks in education and learning unless they are addressed in a positive manner. Table 3 summarizes these in six broad but overlapping categories: psychological (e.g. isolation v. community), social (e.g. collaboration v. competition), institutional (e.g. resource sharing v. walled boundaries), classroom realities (e.g. teacher-plus v. teacher solo), learner attitudes (e.g. student-plus v. student-solo) and technical (e.g. support v. frustrations).

**Table 3. Factors affecting the creation of sustainable networks of innovation**

| Factor | Drivers | Barriers |
|---|---|---|
| Isolation v. community | Help to overcome a sense of isolation through collaborative networked dialogues and sharing of resources, e.g. to assist small schools and colleges, and those in remote areas. | Failure to address a sense of isolation in virtual communities by providing sufficiently wide channels of communication to enhance face-to-face contact where possible. |
| Collaboration v. competition | Development of a trusting collaborative environment in the local community, for example between universities and schools; competitive motivation to become a high-tech leader. | Competition between schools or universities; lack of trust between potential partners in the local community; poor understanding of the needs of collaborative partners, e.g. academics in school–university partnerships being remote from school realities. |
| Resource sharing v. walled boundaries | Educational, social and other gains from collaborating with other institutions, e.g. by sharing specialist teaching skills; universities helping local schools; secondary schools assisting primary schools; schools in different countries being 'e-twinned' (e.g. elearningeuropa.info). | Administrative structures that militate against sharing resources, e.g. when trying to network public-sector activities that cross administrative responsibilities, such as schools, libraries and youth centres. |
| Teacher-plus v. teacher-solo | Availability of teachers' networks of innovation to support local (e-)learning needs (e.g. Talking Heads, Table 1); specialist e-learning mediators; system for sharing specialist teaching resources. | Lack of time and other resources to ensure valuable ICT capabilities are employed effectively, even easy-to-use capabilities like e-mail and instant messaging. |
| Student-plus v. student-solo | Building on learners' familiarity with, and enthusiasm for, collaborative possibilities opened by chat rooms, instant messaging, e-mail and other ICT networking features. | Use of networks by many learners primarily for undesirable learning activities, e.g. for students' plagiarism, cheating or lazy way of getting answers. |
| Technical support v. technical frustrations | Provision of adequate technical support; agreement on technical and administrative standards between systems to provide an easy-to-use and stable platform for innovation. | Complexity of support requirements for networking or premature standards that hamper bottom-up innovation, resulting in negative reactions from some teachers. |

An example of a psychological issue is the feeling of isolation and community which was identified in a study of a UK network set up for teachers aspiring to school headship, the National Professional Qualification for Headship programme. The researchers found that 'the online space can be an isolating one' and that members of the network tended to appreciate tutors who also supported the community through other non-ICT channels of communication (Bradshaw et al. 2002: 12). However, Sally-Ann Saull, Marketing Manager of Lifelong Learning and Higher Education at e-learning

systems supplier RM plc, suggested a sense of isolation in the real world could also facilitate the establishment of networks in other contexts: 'The informal networks that exist between rural schools work very well because of the collaboration and support that comes from the element of isolation in tiny schools, where everyone is expected to be specialist although they cannot be—so they need to collaborate and tap into other people's resources.'[13]

Saull pointed out that there is generally no competition between small rural schools, but that the competition between schools and colleges within a geographically close area is 'a de-motivator to collaboration.' Carey added that in everyday life 'we spend most of our time collaborating and asking other people to solve problems that we cannot solve—yet the dynamic political drive behind our whole system is competitive autonomy'. This competitive drive is shown in government-imposed requirements, such as school league tables and the University Research Assessment Exercise (RAE) in UK universities.

Nash noted that it becomes much harder to diffuse innovative practice if support and trust is currently lacking between, say, schools and local universities, businesses and others in the local community. Good intentions may also not always be enough in establishing trust if the support offered is not appropriate. For example, Wyatt commented that university and research staff usually know little about the realities of teaching in schools, and most universities do not have sufficient pedagogical and technical expertise in online learning.

Carey gave an example of current institutional constraints on collaboration within communities. He recalled a time some years ago when there were village colleges in Cambridgeshire, UK, at which adults and children learned together, from 8 am to 10 pm. Yet, when he recently tried to merge the IT suites in his village-centre youth club, the local primary school and the library—which were based in contiguous buildings on the same compound—he found he had to deal with four departments at the county council. 'I couldn't get them to agree to merge the suites, despite it being an obvious solution to a clear problem,' he reported.

Classroom pressures on teachers' time and mental concentration pose significant practical constraints on the use of simple ICT tools like e-mail or instant messaging. When Selinger suggested that teachers should follow the example of businesses in using instant e-messaging to keep in touch with colleagues, Michael Woods, Head Teacher at the Cornwallis School in Maidstone, retorted that teachers simply didn't have the mental space or physical time to do this while keeping control of a classroom. And Higton noted: 'I work in a school where no telephones are in classrooms, so you cannot even pick one up and ask about something on a noticeboard.'

Attitudes of learners could seriously undermine the effectiveness of some networks, for example by plagiarism or other forms of cheating.[14] Lee noted that on tutor-mediated networks, 'there is a real threat that some students go online simply to type up their essay questions in order to get an answer, and then disappear or become abusive if the tutor responds to a question by saying the issue could be discussed if the learner posts his or her thoughts first'. Dutton pointed to the risk that lazy students might sometimes access online lecture documentation just to avoid taking their notes, rather than to free them to listen more closely in class.

Eisenstadt saw a key practical technical constraint resulting from the rapid convergence of digital ICT media, which has created what he called the 'Moore's Law versus sustainability paradox':[15] 'As the technology gets better, faster and cheaper, supporting its use becomes more elusive and expensive, for example in needing bigger and more powerful networks.' He illustrated its impact from his experience of being involved as a parent and a technology expert in assisting local schools to establish a wireless-based ICT network (Box 1).

**Box 1. The growing complexity of supporting ICT networks: a schools example**

One Sunday evening, Marc Eisenstadt had a phone call from the head of the local technology college, for which he and other Open University colleagues had helped to establish a wireless network. 'What has happened to my Internet connection?' the college head asked. When the problem was subsequently investigated, it was found that a cleaner in a church that was being used as a communication relay station had seen a wire dangling down and had decided to turn off the power.

The head's urgency had been caused because that week he had put an advertisement in a major educational publication to recruit five teachers. In order to show that his college was a strong high-tech outfit, he said it was accepting responses only via the Internet. When the connection went down, the deadline passed and he lost his applicants.

'The moral of this story is that we were running this as a hobbyist activity, and we had to bring in people to run it as a grown-up, fee-paying activity,' said Eisenstadt. 'One needs a bit of both. You can gain some insight and leadership from anyone willing to help, such as parents and the local university community, but you actually have to run your ICT network as a proper managed service in order to serve the schools.'

*Innovative experience-sharing and assessment opportunities through networking*

Building and supporting new networks may be difficult in some contexts, yet many Forum participants felt progress in developing and using e-learning technologies would, in their turn, spontaneously generate new virtual and social communities as people decide to communicate and collaborate with others via new electronic media. Such networking with people they would not otherwise know has much potential value in inspiring teachers, pupils and others involved in education and learning, as highlighted by Naisbitt's view of the motivation and sense of power that comes when people feel they are at the centre of their own networks.

Eisenstadt developed this notion by conjuring up an exciting vision where peer-to-peer (P2P) networking and file-sharing tools, such as the Kazaa (www.kazaa.com) music downloading system, could be harnessed to create a recommendations network for teachers that would help them to share resources and teaching tips. He felt learners could benefit from such an approach, for instance by participating in collaborative projects to produce course content, assessing each others' work or just communicating with young people from other countries.

Another option opened by such networks, according to Eisenstadt, would be to find novel ways of using peer evaluation and self assessment for teachers and learners. For instance, he said a financial online discussion board like Raging Bull (www.ragingbull.com) allows participants to reward others by giving them points for the ideas they post

on the board. He mused: 'What if there were a teachers' network where points awarded by peers for good posts could lead to rewards in terms of career advancement, money, recognition, fame?' Dutton hoped that this focus on the use of networking to support learning would help to overcome some underlying anxieties about what 'e-learning' will mean in practice.

# 3. THE MEANS: SUSTAINABLE ADAPTIVE CHANGE

Among the ideas discussed for ways forward to more effective e-learning, the most consistently championed approach was the need for governance and institutional systems capable of sustained adaptive innovation. Reconceptualizing the processes of change at all levels towards an adaptive model was therefore seen to be key to facilitating the diffusion and uptake of effective innovative e-learning practices.

**New modes of governance and institutional adaptation**

*Adaptive change: like throwing a bird*

The overall direction for the discussion on changes to governance processes was set by Laurillard's presentation of the UK government's strategy for e-learning (DfES 2003b), in which she highlighted the notion of the 'adaptive state' as a creative and flexible model:[16] 'The adaptive state would be a learning system in the sense that it could achieve sustainable improvement by empowering teachers and learners to take responsibility for the ongoing improvement of the quality of the learning process.' She saw this bubbling-up of innovation as a key ingredient of adaptive governance policies and institutions that would be flexible enough to produce timely responses to rapidly changing social, economic and technological change.

Laurillard believes the greater flexibility and responsiveness to innovation that this offers has become essential because the educational system faces rapid change, including having to 'learn several different types of curriculum over the next twenty years'. Chris Yapp, Head of Public Sector Innovation at Microsoft Ltd, agreed that, 'Technology is leading us to a point where there is no consensus on the kind of skills that a five-year-old today will need when they are twenty, or the kind of skills that a twenty-year-old today will need when they are forty.' Dutton emphasized: 'As one cannot predict the future at a time of great change, then it is important to create a process where you nurture innovation and experimentation, try to capture good practice and seek to diffuse that in ways relevant to changing circumstances. Then you must trust the process.'

Laurillard invoked the simile of 'throwing a bird'[17] to describe reform in education and other public services: 'You simply do not know where it is going to end up.' Her view of the adaptive state not only accepts the public sector's features of unpredictability and interconnection, but makes a virtue of them. It allows and encourages dialogue, reflection and adaptation between networks of players at all different levels of the system in order to help them to achieve their personal goals. Although much Forum discussion referred to the 'adaptive state' notion, the examples given demonstrated how adaptive change is applicable to, and achievable by, institutions and groups of all

sizes and at levels of educational governance and practice, for example as illustrated above in relation to experiences at Lord Williams's and Cornwallis schools.

*Mechanistic change: like throwing a stone*

Laurillard contrasted her view of the adaptive state with a mechanistic model that has prevailed until now, in which change is seen to take the predictable path of a stone when is thrown. In this, the nature of the desired reform and the means of its implementation is decided through top-down command and control, for example in countries with more centralized educational systems that try to impose innovation in schools, colleges and universities in a pre-ordained form. Laurillard said this approach may work for a while, but will then lose its energy. Any changes are then likely to either dissipate with little impact on the majority of institutions or players, or result in changes that may be implemented widely but achieve little of the potential benefits because there is no buy-in or commitment from those involved.

In these circumstances, Laurillard identified a tricky paradox for government in seeking 'to balance the top-down and the bottom-up, the central control and the local innovation, the organization, standardization, collectivization, personalization, localization, and all the things that seem to contradict each other'. The extent to which governments and other educational authorities retain control in trying to find an appropriate top-down/bottom-up balance is a crucial area where there is little clear guidance as yet. If such a move is deemed to be desirable, it could be very difficult to establish because the concept of the adaptive state is so different to the common experience in many countries with traditions of central government control.

## The revolutionary potential of the Trojan mouse

*A small change for one person contributing to a giant stride for all*

Despite what could be seen as the pessimistic tenor of discussions about the effects of entrenched institutional and other 'messy reality' constraints, the identification of the potential at the next level of a virtuous cycle of innovation based on, and generated by, networks was not the only cause for optimism at the Forum. Another came from the Trojan mouse concept, which challenges the view that significant change should come from a once-and-for-all paradigmatic shift requiring a dramatic overnight revolution, which can be difficult to implement without causing disruption and resistance that limit the benefits of any actual innovation.

The incremental, painless change that can be conveyed by a Trojan mouse could trigger wide and radical long-term change by resonating across a system through knock-on and feedback effects. If the initial change is easily grasped and is not externally imposed, the people directly affected are more likely to feel a sense of ownership and to take pride in developing and extending it along the path that most fits the needs of their particular context. If the Trojan mouse fails, the consequences will be limited and a general loss of confidence in the technology is much less likely than with a large-scale change. This also met Naisbitt's key criterion for effective change: 'You don't get real innovation by sitting down and saying here are the steps we will have to take. You get results by doing something in the dynamic, then building on that by doing something creative and exciting with it.'

For example, Woods highlighted how an 11-year-old at his Cornwallis School had used the Macromedia Flash animation tool, with less than two hours of training, to create a colourful animation of a flower's growth as part of his science curriculum study identifying qualities of living things. He commented: 'If he had merely listed the qualities of living things, I suspect they would have been forgotten by the end of the week. I doubt if he will ever forget now—I certainly won't.'[18]

Trojan mice can have positive, negative or neutral impacts, as illustrated by the different views expressed about the one most frequently discussed at the Forum, the intelligent whiteboard. Woods explained why he believes they can make a significant impact: 'They have put teachers back where they belong: as educators. Without this, many teachers eschewed the use of ICTs as they felt that computers came between them and their students.' In the terms of the next level identified in this paper, this means putting teachers in the centre of a network. Yapp also saw a long-term radical edge for the technology: 'Intelligent whiteboards give teachers a frame of reference. They do not feel as though the rug has been pulled out. It is in their comfort zone. But over a period of time, they get themselves into a position that fundamentally disrupts the way the classroom operates.'

Selinger, on the other hand, felt this focus could miss the broader pedagogical context of learning innovation. She contended that a key innovation should involve a restructuring towards an activity-based learning environment that places learners at the centre, rather than teachers: 'Interactive whiteboards do not change that structure, and they should be tried only when there starts to be an associated fundamental change in the way that teachers perceive learners.' Selinger's objection would be met by the network communication model if it proves in practice that ICTs can support both, thereby removing the apparently entrenched dichotomy between teacher-centred and student-centred learning approaches.

Presentation software was seen as another possible Trojan mouse, although Dutton acknowledged that so far it has been used mainly as a substitute for the overhead projector rather than a means for enabling new approaches to learning and education. 'But teachers are beginning to use it more creatively in activities like updating lectures in real-time and providing students with access to the material at times and places of their choosing,' he noted.

Designers of e-learning tools could also exploit Trojan mouse capabilities found in systems that learners have found interesting in different contexts, such as online chat rooms and peer-to-peer networks that have made many people familiar with collaborative dialogues and resource sharing. Fowler saw handheld computers, such as Tablet PCs, as a Trojan mouse for introducing what he believes could be a significant long-term change towards what he calls 'frontal education'. This moves teachers away from the chalkboard or smartboard to get them 'engaged directly, eye-to-eye, with their students', for instance by allowing the teacher to move around the room or to hand over the lesson to the pupils using a handheld system linked to a display screen.

*Balancing top-down versus bottom-up change*

Whatever the specific debate about a particular Trojan mouse, the general concept appeals to many as an alternative to a top-down imposition of change. For instance, even an advocate of intelligent whiteboards like Woods expressed concern at a government plan to provide every secondary school in London with one of these devices.[19] 'My worry is that somebody on high is taking that decision,' he commented. 'Why can we not just allow the teacher to decide how they want to teach, or let learners decide how they want to learn?'

In contrast, Fowler gave an example from his experience that indicates it is possible to have a successful top-down imposition of a policy—provided that a compelling reason is given for the compulsion. An area education board in the US achieved targeted efficiency gains by giving an e-mail address to all heads, teachers and others in their schools, accompanied by an explanation that the amount being spent on paper records and the distribution of a large number of physical memos could no longer be afforded.

The Trojan mouse approach to innovation has clear policy implications, in that it suggests a drive to encourage and implement rapid change could be counter-productive if it appears to take little account of the 'messy realities' of existing teaching and learning environments.

# 4. THE BENEFITS: RETHINKING (E-) LEARNING FOR ALL

Building on innovative developments in networking and Trojan mice while seeking to make changes in broad governance processes are relatively conservative means of moving forward. However, the hopes and visions of many Forum participants indicated more radical long-term objectives centred around re-thinking (e-)learning goals and processes, including fresh opportunities to use the technology to extend high-quality learning across all social, economic, cultural and geographical divides.

**Opening new ways of learning**

*The e-learning stimulus to reassessing educational paradigms*

Glenn Miyataki, President of JAIMS, articulated a core dilemma and challenge raised at the Forum: 'If we think of e-learning as a methodology of learning, the next level has to consider other paradigms and possible new ways of learning. It seems that everyone knows that, but we do not seem to really know how to learn differently.' This concern was reflected in debates about educational paradigms that were generally more intense and prolonged than those on the specifics of e-learning content and tools. ICT-bearing Trojan mice were seen by many as often having most impact in the way they trigger reflection on the nature of learning itself.

'Just thinking about going online has often changed people's ideas, as it is frequently the first time they have had to make concrete what they were doing,' noted Wyatt. The most far-reaching impact of the e-learning Trojan mouse could therefore be in engendering this kind of rethinking process. For instance, the potential of e-learning technology has stimulated interest in using it to change the role of the teacher in the

classroom to become more of an activity facilitator than content deliverer. However, Dutton warned that 'change will not await the arrival of a new model or paradigm of how we do what we do in e-learning and education'. The rapidly growing availability of e-learning technology in educational establishments and from homes and elsewhere in the wider community has created a rapidly growing generation of young people skilled in using ICTs, and eager to use them more.

As already indicated, much was said at the Forum about the two main current pedagogical paradigms, illustrated in Figures 1 and 2 in the Introduction:

- *The 'traditional' teacher-led, classroom-based model most people experience as a child*. This favours drill-and-practice techniques following a set curriculum, with performance tested at pre-fixed milestones to produce quantified and often certified 'summative' assessments of the learner's progress to that point.

- *An activity-based, learner-centred approach emphasizing learning-through-experience*. Here, the focus is on learning rather than teaching, with learning seen as a social process in which students participate as an active agent in constructing knowledge (Table 4). It favours frequent 'formative' assessments whenever appropriate, with the primary aim of gathering feedback from the learner to help improve learning in the future. Laurillard (2004) pointed out that although this model is often viewed as being 'new', such approaches have been formulated for over a century by many researchers and educationalists from several disciplines and methodological perspectives, including Jean Piaget (2002), Lev Vygotsky (1987) and Seymour Papert (1999).

Although there was much support at the Forum for the activity-based paradigm, there was no agreement that this should be an inevitable consequence of a move to e-learning, or on which aspects (if any) of traditional approaches should be preserved because of the educational, cultural or administrative value they may have.

It was also recognized that, whatever its merits, the traditional paradigm would have to be accommodated by e-learning for much time to come because it is so deeply embedded in educational policies, institutions and practices that it has become integral to widely held social and cultural perceptions, for example in the way self-esteem, school selection, university placements, employment recruitment and peer judgements are linked to traditional summative measurements and certificates. This suggests an urgent need to identify and understand how different approaches to teaching and learning can best utilise the potential of ICTs inside and outside the classroom to suit different contexts.

*The intertwining of educational paradigms and e-learning tools*

The exploration of new (e-)learning models requires an examination of why current teaching practice takes the form it does, what is intended to be achieved and what alternative learning goals and methods are available. In this way, the *e-learning* Trojan mouse reveals its revolutionary potential in this debate, simply because, like a set of Russian dolls, it hides within itself something more: the *learning* Trojan mouse.

The sharp divisions over different paradigms were highlighted by Eisenstadt. He said that some advocates of the activity-based view see a major shift to the technology as a catalyst that will greatly enhance learning performance by consigning the traditional teacher-led paradigm to history. This encapsulated the promise (for some) and fear (for others) of an all-out push for e-learning: that its great potential will be used as a lever to replace the central role of teachers, externally monitored standards, curriculum-setting and other aspects of the traditional educational system.[20]

**Table 4. Activity-based learning**

| Role | Activities |
|---|---|
| Learner | To be active agents, learners need to:<br>• engage in goal-oriented tasks;<br>• practise skills;<br>• explore and experiment;<br>• use feedback to adapt what they do;<br>• discuss what they do;<br>• reflect on what happens;<br>• articulate what happens; and<br>• take responsibility for their own learning. |
| Teacher | To support learners, in addition to the traditional role of 'telling the story of their subject', teachers need to:<br>• define an achievable goal;<br>• give meaningful feedback on their actions;<br>• offer the means to reflect on the feedback;<br>• allow repeated actions with feedback to achieve a goal;<br>• encourage discussion of the task; and<br>• provide the means and rewards for articulating their ideas. |

*Source: Adapted from Laurillard (2004)*

This helps to explain why debates that are apparently about e-learning actually mask strongly conflicting underlying contentions about the purpose of learning, teaching and education in general. That tension led many participants to recommend a greater acceptance of e-learning as just one of a number of important factors in shaping learning and education outcomes. 'The key issue is how e-learning can contribute to the process of changing and improving how classrooms are used, not how can we change classrooms to incorporate e-learning,' observed Chris Davies, Senior Research Fellow in the University of Oxford's Department of Educational Studies.

Software-centred e-learning tools can be, and have been, programmed to support either approach, or even a mix of the two. It is therefore important to have a transparent understanding of the relationship between a tool and the learning model that shapes the actual use and outcomes of e-learning. For instance, intelligent whiteboards can complement teacher-led approaches, while Internet-enabled networking is often seen

as ideally suited to the activity-based paradigm. Most examples mentioned at the Forum as being admirable 'next level' systems exploit such activity-oriented multimedia networking capabilities (see Table 5 for a few of these). Higton described the value to the English Faculty at his school of one of these, Kar2ouche, in teaching Macbeth to 14 year-olds: 'Its ability to allow students to mimic performance has enabled them to see the text as actors speaking rather than just words on a page. This has meant that lower-ability students can engage with the play without having to write essays and higher-ability ones can focus on the performance of the play.'

Learning activity management systems, such as LAMS in Table 5, were highlighted by some Forum participants because they offer capabilities that allow teachers to design sequences of learning activities which involve groups of learners and teachers interacting within collaborative environments, rather than remaining focused on traditional e-learning approaches based on single-learner, self-paced processes. Distinctive elements of the LAMS 'learning design' approach are a greater focus on context rather than content, an activity-based view of e-learning and a recognition of the significant role of multi-learner, rather than just single-learner, environments.

LAMS operates in a similar way to that in which teachers have traditionally designed their own learning activities in the form of a lesson plan populated with appropriate content. In LAMS, and similar systems, this plan would incorporate interactions with online digital resources such as video clips, educational simulations, animations and video conferencing with experts, teachers or other learners. 'If such tools and resources were available and easy to use, then teachers could not only lead the discovery of the new pedagogies, they would also have the means to capture, share and improve on each others' designs,' Laurillard noted.

Sara de Freitas, Research Fellow in ICTs at London University's Birkbeck College, observed that many teachers and tutors draw from their own experience rather than theory, choosing a method that reflects a more pragmatic approach. This is indicated in the Dutton et al. (2004) study in a US university which found that the VLE software used was sufficiently malleable to enable instructors to support their own pedagogical models, although it was constrained by some traditional analogies built into it, for instance making it difficult for students to form their own groups.

Those who wish to keep pedagogical innovation in teachers' hands will look for e-learning tools that enable teachers to design learning activities themselves. Others will emphasise e-learning approaches oriented towards the empowerment of learners. For example, Yapp praised e-learning tools that nurture creativity from an early age through music-teaching software that starts by getting even very young children to compose music, rather than just to play it. If a solo-learning, drill-and-practice pedagogical strategy is deemed necessary in a particular context, an appropriate solution honed to meet that requirement could be designed or chosen.

Unresolved differences were aired at the Forum about the significance of learning styles. For instance, Woods spoke for those who believe e-learning could be of value in meeting the needs of children who prefer a visual learning style rather than one based on symbolic language: 'We have to let all sorts of different things go on at school by way of experiment to encourage organic growth, rather than insisting on particular ways forward'. On the other hand, Wyatt, said he was 'very sceptical about

learning styles', or about personalizing teaching for those deemed to favour visual learning.

**Table 5. Examples of e-learning systems**

| Type of system | Description |
|---|---|
| Managing collaborative activity-based learning | The Learning Activity Management System (LAMS), developed at the Macquarie E-learning Centre of Excellence, Macquarie University, Australia, focuses on collaborative e-learning as well as allowing single-learner, self-paced methods traditionally adopted by e-learning tools (Dalziel 2003). It includes tools to enable a teacher to author and adapt learning sequences, the run-time delivery to students of those sequences and teachers' run-time monitoring of sequences. |
| Learning through multimedia collaborative role-playing | Kar2ouche uses three-dimensional animation in collaborative role-playing scenarios to assist learning about Shakespearian plays, operas, history, science and many other school subjects, including citizenship topics like drugs awareness and respect for diversity (www.kar2ouche.com). Scenarios are authored using the Composer, which includes notes for teachers, guides on step-by-step activities and a library of digital characters, props, backgrounds and audio resources. It was designed and developed with the help of the Department of Educational Studies, Oxford University (Davies and Birmingham 2002). |
| Community history resource | The BBC's People's War Website (www.bbc.co.uk/dna/ww2) allows people to share their own and their families' experiences of the Second World War. |
| Mobile learning innovation | The mLearning project of the Centre of Educational Technology and Distance Learning (CETADL) at the University of Birmingham, co-sponsored by Microsoft, is equipping students at the University's School of Engineering with handheld Tablet PCs in a research investigation into the future of mobile technology in higher education (www.mlearning.bham.ac.uk). |
| Networked virtual mathematics workshops | The NRICH project at the School of Education, University of Cambridge, gives 5-to-18 year old students the opportunity to access a large, developing resource base to help them explore and engage with mathematical ideas (www.nrich.maths.org.uk). It includes an online 'Ask a Mathematician' expert advisory service and Web conferencing facilities between school pupils and university students. |
| Virtual laboratory experiments | The Virtual Laboratory in the Department of Chemistry at Oxford University offers a variety of individual experiments that can be controlled online, as well as online pre-university and specialist chemistry courses (www.chem.ox.ac.uk/vrchemistry/default.html). |
| Management and visualization of the presence of others in collaborative virtual networks | The BuddySpace at the Open University is studying 'enhanced presence management' capabilities to assist users to manage and visualise the presence of other people in collaborative learning, working and other contexts, including the multimedia attributes that characterise an individual's physical location, mental mood and other relevant factors (http://kmi.open.ac.uk/projects/buddyspace/). |

*Processes of (e-)learning: moving beyond classrooms and teachers*

The classroom is the key arena in which most teaching and learning takes place. However, Dutton warned that the dynamics of the classroom are changing in dramatic ways as ICTs redefine notions of space and time—whether or not we have a model for a new world of the borderless classrooms.

For instance, the role of the teacher in regulating access to course materials inside and outside the classroom is being challenged by e-learning that can create new forms of networked virtual proximity to overcome previous physical barriers of place and time. This opens potential access to a fresh range of choices about where education takes place, who is involved and how it is carried out. It is no longer essential to co-locate teachers and students in one physical classroom, as it is now possible to have online distance learning in which a teacher or subject expert interacts with a virtual class in many locations, perhaps on a global scale. Higton saw this as 'a value-added opportunity to break down the walls of schools so we can see what is going on outside'.

Carey articulated a strongly critical view of traditional teaching approaches: 'Teachers still want to be sole agents for teaching, and the first thing that needs to be overcome is that sort of trade monopoly.' However, even some strong advocates of e-learning recommend caution in relation to the degree to which the teacher's role should alter. For example, Saull and Gant (2004: 45) argued: 'The teacher's purpose should remain unchanged in the advent of new technologies; they are not and have never been just a facilitator (guide on the side). Therefore, we should not consider a straight replacement of the teacher for an online learning resource. As we open up opportunities for collaborative learning outside of the school walls again, there needs to be consideration of the balance and blend of personal face-to-face interaction and online tutorials. A PC cannot motivate, encourage, provide advice and be a role model to the individual they are looking after.'

Echoing Naisbitt's high tech/high touch philosophy, such a mixing of face-to-face interaction with online learning in a 'blended learning' approach was seen as valuable in maintaining perceptions of trust and authenticity in virtual learning environments, where the difference between what is real and fake can be difficult to judge. Nash said the trust that is essential if progress is to be made by most students is normally developed through physical interaction: eye contact, personal support and face-to-face interaction in situations 'loaded with complex meaning'. She therefore felt it would be understandable if educational institutions were cautious about implementing new practices that challenged such well-understood ways of working and building relationships—unless there is a clear benefit from a new approach.

*Formative versus summative assessments of learners*

Student assessments play a crucial role in all education and learning systems. At the Forum, there was a wide and strongly expressed view that learning would be facilitated by a move away from an overarching influence of traditional forms of summative assessments, typified by course examinations and school Standard Assessment/ Scholastic Aptitude Tests (SATs) based on national or local curriculum and test standards. These typically take place at set times, such as the end of a term/semester

or the conclusion of a course or module within it, and have become familiar ways of establishing accountability for educational outcomes and for ranking and certifying competence.

An alternative 'formative assessment' approach was advocated by many at the Forum. Its three key phases were summarized by Higton: finding out where the student is at the evaluation point; making explicit where they need to go; and, finally, what they need to do next.[21] Feedback from teachers, self-assessment by learners and evaluation by their peers, parents and other relevant sources are encouraged, with the aim of adapting learning plans to meet a student's specific needs (Black 2003: 2–3). Freda Wolfenden, Content Development Officer in the Learning and Culture Directorate of Oxfordshire County Council, sees timing flexibility as a significant advantage of formative assessments: they take place at frequent intervals, largely according to the reaching of particular objectives by the learner, rather than at the pre-fixed milestones of the summative method.

Higton looked eagerly towards the availability of more effective formative assessment tools to enhance his ability to identify his students' particular strengths and weaknesses, which would help him to reorganise 'the society within the classroom' so that he could put strengths with weaknesses to enable students to be better able to support and communicate with each other. Fowler saw formative assessment as being 'absolutely crucial in the next level' because he has found the ability of teachers to make mid-course corrections to be a key feature of successful e-learning projects with which he has been involved. Yapp went even further in arguing that, 'if we do not shift the assessment model, anything we do in e-learning content, training practices or whatever will not have an impact.'

Despite such support for formative assessment, there was also a recognition that formal summative tests, like SATs and certification examinations, are entrenched in the educational, social and economic systems of most countries, with the results achieved playing a central role in job markets, school league tables, and so on. Even formative assessment advocates at the King's College Assessment Group (Black 2003: 13) have said that it would be unrealistic to try to move totally to this approach, but recommend instead that formative assessment ideas should help to change summative methods, for example by assisting students to be reflective when reviewing their work and study plans in preparation for summative testing.

**Moving beyond person-plus and mass customization models**

According to Dutton, one of the strongest e-learning visions has been of using the technology to move from the 'broadcast' one-to-many instructional model centred on the teacher, to the approach in which the student takes the learning centre stage and the teacher acts more as a coach than instructor. He placed such a paradigm shift through the use of ICTs in the context of the four models of communication between teachers and students summarized in Table 6: 'No one model is intrinsically better than any other and you probably need all these types of interaction. But sometimes when we say one approach to teaching is better than the other, we are actually favouring one model of communication over the other.' The debate at the Forum about traditional versus activity-based paradigms showed how such communication models are intimately bound up with pedagogical paradigms.

**Table 6. Models of educational communication**

| Pedagogical model | e-Learning example |
|---|---|
| Teacher-directed classroom | Intelligent whiteboards, where the teacher remains in charge and the students are not distracted |
| Student–teacher interaction | Interactive multimedia systems such as Kar2ouche |
| Student–student interaction | Instant messaging, e-mailing, mobile technology and online learning communities, e.g. Notschool.net (Table 3) |
| Student-solo | Individualized problem-solving software, e.g. simulations |

Another strong vision for e-learning has been built around the ability of ICT-enabled networks to support new models of distributed and distance learning (Dutton and Loader 2002). Table 7 summarizes a view of how this creates new opportunities for collaboration, the locations and times where learning can take place and how self-paced and cohorted working are balanced.

**Table 7. A distributed education and learning model**

| | At own pace | Cohorted |
|---|---|---|
| Real location | Provision of drop-in learning centre | Enhanced traditional class-based learning |
| Anywhere | Just-in-time 'pure' e-learning at home and in the workplace | Video-conference enhanced 'distance' seminar |

*Source: Adapted from LSC (2002)*

Rethinking learning processes along the lines illustrated in Tables 6 and 7 raises questions about, for example, whether e-learning could and should move education away from teacher–student communication models towards 'student–student interaction', or what has been described as 'person-plus' as opposed to the traditional 'person-solo' (Perkins 1990). Dutton explained: 'People have generally been educated on the basis of working person solo, and some still claim that is the right way. In other walks of everyday life, however, we expect to operate person-plus: plus colleagues, plus a computer, plus a mobile phone, plus Post-it notes, plus everything else.' This opens out learning processes to encompass broader social contexts affecting learners, such as the communities and families in which they live. It also again emphasizes the value of learning networks, as it shows that they can support both teacher-plus and student-plus approaches.

Miyataki used the term 'mass customization' to encapsulate emerging approaches that combine the solo and person-plus models.[22] He said this was enabled by e-learning systems 'where you get a body of knowledge and then tailor it so each individual can learn in their own way'. In support, he pointed to research by Thompson and Randall (2001) that concluded e-learning is most effective where it gives people access to

carefully focused learning materials, when and where required (see Bruce et al. 2004).

Uden agreed strongly: 'The ability of ICT to provide instant feedback and contextual information enables learners to progress at their own pace and style, even when part of a larger learning group. For example, a student at a lecture can ask questions in real time and drill down into background or supplementary information while following the lecture. Systems can also analyse the way in which a learner addresses a task and provide feedback and guidance for improvement.'

Saull and Gant (2004) also indicated the practical difficulties that could reduce the effectiveness of individualizing e-learning: 'We need to focus very clearly on supporting teachers in their role, and providing the right blend of resources and support that they need to succeed. Many people talk about self-paced learning—do we really want 13-year old boys learning at their pace, or do you want to drive their learning at the pace you know they are capable of?'

**Steps towards education for all: global learning and social inclusion**

Forum discussions generally reflected the suggestion by de Freitas that e-learning should be seen as a stimulus to reasserting the British nineteenth century vision of 'education for all'. The 'all' was viewed both in terms of a geographical perspective that encompasses global learning as well as a social-inclusion agenda within countries and regions. This reflects the view of United Nations Secretary General Kofi Annan (2003) that the 'digital divide' is actually several gaps in one: 'a technological divide in infrastructure, with 70% of the world's Internet users living in the 24 richest countries, which contain just 16% of the world's people; a content divide, with nearly 70% of the world's Websites in English and a frequent lack of locally meaningful material; and a gender divide, with women and girls in many countries, rich and poor alike, enjoying less access to information technology than men and boys.'

*Connecting civilizations: understanding the multicultural global marketplace*

The global intertwining of Internet, Web, wireless and other telecommunications channels is creating not only a global market for e-learning services and products, but also an increasingly significant need to address multicultural issues in education and content development. Coleman articulated the hopes of many: 'The global nature of the Internet has vast potential for encouraging new levels of communication and understanding between young people in different countries. We might then start to get some of the benefits of globalization through networks of previously unheard voices.'

This was brought vividly to life when Bruce quoted the principal of a school in Hawaii who said the technology had meant that 'while there is no way I could bring the students to the world, I could bring the world to us'. That was done by using ICTs to allow his students to communicate with other students around the world to exchange experiences, ideas and photographs. This gave them insights into how schools in other countries worked, as well as different ways of looking at mathematics, history, economics and other subjects. The provision by academic and commercial providers of online courses that create opportunities for lifelong learning is also propelling the spread of local educational content to a global market of learners. This can help to

overcome geographical barriers, for example in the use by the University of Hawaii of a long-established interactive television system to assist education across the widely dispersed islands of Hawaii.

Miyataki argued that effective global learning requires the development of a 'global mindset' to take account of the cultural heritage not just of students but also of the instructors and educational institutions that will impact, and be impacted by, any movement to achieve global thinking. Bruce pointed to some significant additional challenges of global learning compared to learning within a local community, such as in the kinds of technologies available, the language used and the compatibility of educational and technical standards across the world.[23] But he believes that addressing these issues will mean 'the global learner of today will change the model of tomorrow'. Carey saw the curriculum going into 'permanent revolution' because of such globalization, while Selinger's experience in a study of e-learning in eleven countries for the Cisco Academy brought home to her the importance of the teacher in localizing any global curriculum.

Miyataki emphasized the importance of bearing in mind the culture, history and pedagogy of the learners when developing e-learning programmes for international audiences: 'Crossing cultural boundaries to inspire others to learn requires great sensitivity and must not be taken for granted.' He illustrated this through the experience of a manager from Laos on a Diploma course at JAIMS in Hawaii who was not getting good grades when he presented his coursework using PowerPoint. The tutor felt he wasn't being assertive enough according to the American assessment standards being used, for example in terms of eye contact. However, the manager pointed out: 'In Laos, I cannot act this way. We cannot be assertive in my department; we have to be subtle.' The relatively straightforward technology of creating presentations can also cause misunderstandings because of the way some cultures prioritise gestures and other non-verbal forms of communication as customary means of communication. Miyataki emphasized that careful consideration of the tone, symbols and styles of communication is needed to address such cross-cultural differences.

Developers and users of more complex online e-learning systems face even more difficult challenges. Cultural variations in attitudes to authority figures can make it especially hard for a teacher from a different culture who is not physically present with the student to determine how much of the topic has been understood. For instance, Miyataki explained that in some Asian countries 'face' is lost if a person is seen to fail, which could raise a dilemma for students. Asking a question could place an authority figure such as a teacher in an awkward position of not knowing the answer and so being pressured to save face, at the same time as exposing the student to the risk of losing face if the teacher or peers perceive the question to be a poor one.

Language is also a reflection of cultural behaviour and carries nuances familiar to the learner. When learning takes place in a language foreign to the student, the results could be superficial if they are based on an understanding of only simple or straightforward words, without an appreciation of the subtle meanings that are accessible when learning in your native language. In their Forum position paper, Bruce et al. (2004: 19) point out that, 'even when English is spoken as a second language, receiving content in one's own language maximizes accessibility, eliminating a potential barrier

to learning'. Many 'second language' e-learners could therefore be at a disadvantage, as indicated by a Global Reach (2004) report that in September 2003 only 36% of the world's online population used English; 35% employed other European languages; and 29% used Asian languages.

Bruce et al. (2004) point out that learning in one's own language can be particularly critical in some activities, such as an airplane mechanic learning about servicing an airplane. But there are also cases where a common international language, like English, can be an essential part of a particular curriculum and pedagogy, for instance in cross-cultural negotiations and global business courses. Miyataki also feels that differences between individualistic and collectivist cultures are critical, for example in terms of the 'competitive autonomy' that characterizes much western education but which would not generally be understood in a fundamental way in more collectivist cultures.

Greater awareness of cultural differences and the need to take account of them by drawing on the potential of ICTs to address individual differences in learning styles could stimulate a more genuinely global, rather than western, approach. Provided such sensitivities are part of the system design requirements, ICT-enabled solutions could be adapted to meet diverse cultural requirements. For instance, the OpenOffice. org open-source system for word processing and other office applications is designed for multilingual needs, which can be of particular value in a country such as South Africa with its eleven national languages (www.openoffice.org.za). Bruce asked for consideration to be given to whether a 'seamless model' is required to provide consistency across cultures in presentation, content, reference sources, testing, grading, participation, group work and other (e-)learning dimensions.

*Bridging social, economic, educational and digital divides*

Despite the great potential for e-learning to contribute to an 'education for all' agenda, much scepticism was expressed at the Forum about whether the technology would actually be used to meet goals of social cohesion, rather than reinforcing existing social and educational inequalities. 'ICTs are a two-edged sword, perhaps widening knowledge gaps between students who start at different levels of capability, personal efficacy and motivation,' observed Dutton. However, Higton believes that, 'If young people receive an e-learning programme that is able to react and adapt to their individual needs, then education will become more inclusive.'

Nick Allard, a Partner in law firm Latham and Watkins and faculty member at Georgetown University in Washington DC, remarked: 'The real power of e-education is that it could provide solutions in places where nothing else is working, or could work.' He illustrated the practical difficulties and tangible benefits involved in achieving this in the District of Columbia (see Box 2), where he said many public schools have few books and the 'primary function of the day is to get through it without physical injury'.

Across the Atlantic, Woods reported that less able pupils at his school, particularly boys, enthusiastically sought to improve their literacy and numeracy abilities through the Web-based resource at www.LitNum.com, the site originally developed by a science teacher at his school. The UK government's Cybrarian project (Table 2) aims to develop a personalized Web search facility tailored to the needs of the socially

excluded. Online ICT environments have also helped learners with dyslexia to improve their reading age and adult learners with mobility difficulties to overcome isolation (DfES 2003b: 22).

**Box 2. Motivational influence of ICTs in a disadvantaged area: District of Columbia**

During the US government's 'Connect Every Classroom' initiative in the 1990s, it was found that asbestos coating in schools in the District of Columbia made it cumbersome, dangerous and costly to wire them up for ICT networking. Then, some ICT suppliers provided systems to enable the school to have high-speed wireless access to networks and e-learning material. The fast connection proved to be crucial, as teachers could not afford to have children sitting and waiting for any length of time when classes generally last only forty minutes. Although the teachers often did not have adequate computer skills, the children knew enough to learn through experimentation such powerful things that teachers and the students' families wanted to have access to those classrooms after hours, in order to keep up with what the children were learning

*Source: Nick Allard in discussion at the OII Forum*

Carey emphasized the importance of making a substantial investment to break the 'cycles of social deprivation that replicate themselves in the next generation'. He said this had been underlined by research undertaken by humanITy on a project to investigate whether people with different but narrow skills bases—in particular late teenagers and house-bound, largely disabled, people—could collaborate through the Internet to create multimedia content (Gracia-Luque 2002). He counselled against thinking that, 'an old Intel 386 machine and 5% of a development worker is enough— there must be state-of-the-art equipment and about 20% of a development worker, which you don't get if distance learning is seen just as money saving.' He added that the socially excluded typically display a lack of public curiosity by being 'bad askers', indicating that the degree to which the technology holds back or advances self-esteem is a key issue.

Carey fears a 'nightmare scenario' in which PC-based e-learning widens the education gap instead of narrowing it. 'As a majority of the population finds PC-based technology intimidating, any theoretical advantage from self-paced learning goes bang if the user interface is intimidating or bewildering.' In order to avoid his nightmare, Carey would like to see more work on the development of interactive dialogue in combination with the best of broadcasting, as typified by the BBC in the UK: 'Since Plato, dialogue has formed the basis of our education, and it is the perfect way to build self-esteem and to teach the kind of public curiosity that can operate within a realm of trust.'

Coleman summarized the positive cutting edge of e-learning in promoting social inclusion: 'The Internet offers opportunities for developing new networks of the previously silent, such as children in care whose first language is not English or pupils who have been excluded from school.' Cross-cultural differences are also important for nations and urban areas that are become increasingly multicultural, for example in areas within English-speaking countries where a high proportion of school children do not have English as the first language in their households. Higton also stressed that e-learning can allow gifted students to blossom, overcoming a danger that moving them

forward within the current education system could separate them from their peers, thus making them more demanding to teach.

The location and physical environment in which e-learning takes place were seen as other important factors in broadening education and learning opportunities. For instance, Yapp praised the hosting by the Newcastle United football club in the north-east of England of an IT learning centre shared by a number of schools in the area. At this centre in Newcastle's St James' Park ground, Yapp saw children and their teachers enthusiastically doing serious work. 'When I talked to the kids, they said it was much better than school,' he reported, which he felt indicated the value of looking for e-learning facilities in other local communities that could similarly motivate students.

## 5. FACILITATORS AND BARRIERS: ADDRESSING EVERYDAY REALITIES

### Differing perceptions of innovation drivers and barriers

An initial intention for the Forum was to try to identify the main factors that could be classified as barriers to, or drivers of, change. The obstacles that were clearly identified arose mainly from: widespread pressures on time, space and budgets; the availability of specialist skills; and, despite much progress in ICT diffusion, continuing problems of access to appropriate and reliable e-learning systems and ICT infrastructures. Otherwise, it was difficult to specify unambiguously those factors that in all cases will be a barrier or driver.

Many instances were mentioned of institutional or cultural norms that are facilitators in some contexts and for some stakeholders, but perceived as obstacles in different arenas by others. For example, competition between educational institutions, such as through school league tables, may make the adoption of new technologies attractive if it is likely to help raise performance outcomes and create a strong high-tech image. Yet, this kind of competitive environment also makes it difficult to establish networks of innovation among those who are competing for resources and advantage.

Even the apparently unambiguous barrier to innovation of an aversion to risk could have a positive side, in that risk-taking in education can have a destabilizing effect when a student's once-in-a-lifetime chance is at stake. Davies et al. (2004: 6) commented that, 'despite all the training, government investment and rhetoric, many teachers evidently do not wish to abandon routines, strategies and resources which they know to work well enough in favour of quite different, technologically based approaches that: (i) might not be better at achieving curriculum goals than established methods; (ii) might expose them as incompetent or under-prepared; and (iii) might go wrong.' This was why the low-risk Trojan mouse was seen to be such a productive mechanism of innovation.

As already indicated, the most widely discussed example of conflicting perceptions related to moves towards higher efficiency and tighter budgetary controls in educational institutions. While nobody questioned the need for efficient administrative support to underpin effective learning, many emphasized the fear that inside even the most

apparently friendly e-learning Trojan mouse there could lurk an efficiency drive that is insufficiently sensitive to the educational implications of economic cutbacks.

However, the acceptance of the need for efficiency indicated that it is also possible to foster complementary goals for administrators, teachers and students. Saull said educational institutions could learn much from the commercial sector to assist in developing efficient systems for administrative and business processes within and between educational institutions. This could bring tangible benefits to teachers and students, for instance through more integrated processes using a unified networked interface that allows access to shared databases to enable students to enrol online, teachers to track students' progress, and administrative staff to monitor key data of relevance to them. To achieve this, Dutton stressed the importance of targeting any investment in administrative systems and e-learning generally towards more cost-effective ways of delivering specific learning goals: 'Resources could be wasted by either under-scaling or over-scaling, investing too little or too much, in particular technical initiatives during a period when education budgets are severely constrained and demands are increasing dramatically, such as in student numbers.'

## Why e-learning Utopia may be postponed

Many at the Forum saw potential practical obstacles to the ability of e-learning to transform the nature of education radically. Higton was among those who emphasized that the rigidity of the institutional context within which the technology is introduced and used is likely to be a significant constraint on the ability of e-learning to produce dramatic change in the near future, unless there is a loosening of the rigidity of the institutional context within which the technology is applied: 'I believe in ten years there will still be a National Curriculum in the UK, there will still be government-set targets to be met and education will still be driven from the top down.'

The quality of e-learning content and the unrealistic enthusiasm of some technology advocates were also criticized. Eisenstadt, for instance, cautioned against believing the Utopian visions of an e-learning future where education would be transformed '*if only*' we could just finesse one more particular tool or application: 'Claims that an e-learning revolution is around the corner have been wrongly made ever since computer-assisted learning was first discussed in the 1960s, so there is a real fear that if we reconvened this Forum in ten years we would still be having the same discussion about the imminent profound pedagogical impact of the latest hot technological development.'

Others were more optimistic about the transformational potential of ICTs. Fowler reported on experiments using handheld mobile technology that he had observed in schools in Fairfax County, Virginia: 'Such wireless-enabled technology allows new forms of platform independence and mobility to provide one-to-one computer interaction that can change classroom practices completely.' This form of flexible access was seen by many as a key element in the next level of e-learning, as it permits learning both inside and outside the classroom, including while moving around. Wolfenden saw e-learning eventually taking place 'in a wider variety of locations around the community, be that in people's workplaces, libraries, museums, homes or learning centres, where it would be of benefit to the whole community'.

## The 'messy realities' of classroom life

Getting teaching practitioners on board was widely regarded as an essential step in successful e-learning innovation. To do this, considerable attention needs to be given by policy makers, managers and administrators to addressing the practical everyday concerns of teachers and students. For instance, Davies pointed out that the goal-driven strategy to enhance basic literacy in UK schools since the late 1990s 'filled teachers' time and consciousness, but did not give them the slightest hope that they then could take on diffuse innovations like e-learning. Yet e-learning could help to make that literacy effort achieve even better results.' To help motivate teachers, Yapp felt the biggest things they should be given is more time: 'Whether it is time in preparation, time in assessment or time to reflect on their own learning needs, all the effort has to go into finding them time to experiment, adapt, learn and develop their own skills base'.

Physical space was another critical 'messy reality', as was graphically illustrated by Davies' experience when visiting a history department at a secondary school. He was proudly shown their IT suite, but what he found made him think that, 'in industry you would be prosecuted for putting people together in appalling spaces like that, with so little ventilation.' Higton spoke of what can appear to be the 'alien' environment of a classroom full of computers: 'In the worst cases, the architecture of the room demands that students face the walls and have little opportunity to communicate with each other or their teacher—they are plugged into their machine by headphones and, with luck, held by the task on the screen.' To be successful, he added, e-learning needs to take account of education as being a social practice involving contact with others, which means 'good pedagogy will need to be supported by good architecture that facilitates and encourages collaboration and interaction'.

Offering educational institutions a wide choice of different spaces that move away from a teacher standing in front of a classroom was seen by many as an important ingredient in the next level of e-learning. This is one of the objectives of a 'classrooms of the future' project in the UK that has developed architectural designs to create a 'future-proofed' school infrastructure in which teachers and pupils can easily interconnect any wired or wireless communication device (DfES 2003c: 3). Another is to bind schools into their local communities and provide links to other schools and learning centres in the UK and elsewhere. One design seeks to open out the boundaries of a school by including a facility for children to display their work on the outside of the building as well as in classrooms (DfES 2003c: 59–63).

Dutton emphasized that although much progress had been made in the diffusion of ICT capabilities, a lack of access to appropriate ICTs in classrooms and households continues to constrain the use of innovations on the disadvantaged side of the continuing digital divide, even in advanced countries. He noted that 'it is in high-end multimedia, multitasking classroom environments with access to broadband Internet, VLEs and other advanced systems that students appear to gain the greatest role in managing information and communication resources'. Digital divides also include inequalities within educational institutions, for example when departments with high-tech skills and larger ICT budgets have better e-learning capacities than other units.

Uden argued that the practical appeal of the technology could be enhanced by broadening the focus of e-learning to encompass the development of critical workplace skills, such as the 'digital literacy' ability to validate, synthesise and present information.

## Governance and regulatory aspects

National and local government education strategies and broader political policies can strongly influence e-learning developments. For instance, the discussion above about the 'adaptive state' highlighted the constricting pressures on grassroots learning that can frequently arise from top-down directives, such as those insisting on curriculum and assessment conformity. These can become a major barrier to e-learning innovation, for example if teachers resent them as external impositions restricting local choice and causing them to have insufficient time to prepare adequately for immediate classroom requirements, let alone implement in a considered way any e-learning innovations that carry some risk.

Fowler and Selinger (2004) noted that governments can help to establish a level administrative, technical and legal playing field for all educational institutions by offering logical, stable and predictable requirements for student data, privacy, data interoperability and security. The effectiveness of e-learning is also shaped by regulatory and other issues that go far beyond education as such, for example, digital rights management (DRM) of copyright protection for electronic media, governance of the Internet, data and privacy protection, freedom of information and speech, and centrally supported innovation funds to enable bottom-up innovation.

## Technical dimensions of e-learning

In addition to the many social, institutional and political factors highlighted above as influential shapers of progress (or lack of progress) towards the next level of e-learning, technical issues can also pose a critical educational challenge. For instance, a good e-learning infrastructure and reputation is becoming an increasingly important element in the choices made by parents and students when selecting a school or university. Lee warned that this could backfire if a high-tech orientation seems to diminish the role of face-to-face teaching contact, as this is much valued by many as intrinsic to a 'good education'. As discussed earlier, a blended learning approach can enable ICTs to support and enhance valuable face-to-face teaching contact.

Technical problems at a basic operational level become increasingly important when educational institutions become more dependent on ICT systems, as the consequences of even small system failures can be of much practical significance to teachers, students and administrators. In the Dutton et al. (2004) study of a university VLE, many teachers cited technical glitches and failures, such as the long time the system took to load, as a key reason why they did not use the system in its early phases. This reflects the perception of the Web before broadband access became more widespread and reliable, when it was frequently referred to jokingly as the 'World Wide Wait'. Eisenstadt also pointed out that it is still easier for him to e-mail his local teachers at their homes rather than at their schools. His articulation of the 'Moore's Law versus sustainability paradox' also highlighted how the increasing complexity

of supporting multimedia networking poses a potentially critical technical block on innovation.

Two anecdotes at the Forum indicated the diverse results of this dependency on ICTs. Allard said that when law students in New York State sitting for the Bar Exam were confronted with power outages, many panicked about not being able to finish the exam using a computer and did not even think of picking up a pencil to write. In a very different context, Woods said that an 11-year-old girl at his school sitting a science test put down her pen after five minutes of the test and demanded of the teacher that she be allowed to use her computer, on which she was able to illustrate the science concepts with pictures using Flash. This raised a tricky educational and institutional dilemma about how to treat this girl's demand and further raised questions about the aim and appropriateness of different forms of testing.

Sarah Porter of the Development Group of the UK Joint Information Systems Committee (JISC) warned that a vast amount of investment in developing systems for education will be wasted if technical standards are not established to enable systems to be interlinked in ways that give users simple and reliable access to the content and resources they need. Uden added that standards for data interchange between e-learning and related educational administration systems are being agreed by suppliers of relevant systems because they all believe this is in the long-term interests of the marketplace. Yet, others worry that it is premature to fix standards in such a rapidly evolving technical area.

A major source of innovation facilitation or constraint lies in the quantity and kinds of ICT skills available to support the design, development, maintenance and use of ICT-based systems. One point of debate about this was the degree to which specialists were needed, beyond the support of the basic infrastructure.

Woods is in favour of all teachers knowing about ICTs: 'We are training some teachers as ICT teachers. Therefore, if I train as a history teacher, I relax in the belief that e-learning is somebody else's job. However, when slates [writing tablets] were the latest technology we did not have slate teachers. We expected every teacher to know how to use the slate.' Selinger argued for 'techie teachers' skilled in using ICTs to support e-learning because she believes students and staff will go to such a person to ask, 'How do I do this?', whereas students would ask a specialist technician: 'Please do this for me.' These views indicate that e-learning tools will be employed most effectively if teachers feel a sense of 'ownership' of the tools within the context in which they are used.

# 6. ANALYSIS: (E-) LEARNING CHOICES THAT RECONFIGURE ACCESS

## Reconfiguring communicative power through digital choices

A common theme ran through the many examples of e-learning innovations discussed at the Forum: how 'digital choices' made by people about the design and use (or non-use) of e-learning technologies change, or 'reconfigure', the way they gain electronic and physical access to each other and to a huge variety of learning-

related information, services and technologies offered by educational institutions, government, business and local communities. There are many different—sometimes complementary, sometimes conflicting—interests and perspectives among those making these reconfiguring choices: teachers, learners, managers, administrators, schools inspectors, academic assessors, product suppliers, ICT specialists, parents, employers and the many others with a stake in learning and education outcomes. This helps to explain why a driver to innovation for some people or groups is seen as a barrier by others.

Such digital choices can be influenced by a variety of motives, and have outcomes well beyond the original intention. For instance, a child may choose to use a home PC primarily for playing games and communicating with friends online, then find it is valuable for doing homework, organizing a study group and other forms of e-learning. It is also important to recognise that not all actors are equally capable of reconfiguring access to meet their personal interests. A head teacher can exercise more control over decisions about e-learning than individual teachers, and teachers have more power than students within the formal educational system.

In these ways, digital choices can create more than just new connections. They also enable the opening and closing of new forms of personal, social and economic capacities, relationships and power-plays for other individuals or groups. This process can change various actors' 'communicative power': the capacity to command knowledge, economic and technological resources to exercise control over the design, production, use, ownership and governance of communication media (Dutton 2004a,b).

ICT advances affect education and learning processes through their role in reconfiguring communicative power, which alters group dynamics in ways that advantage some players and disadvantage others. Table 8 summarizes the main processes that can be changed in this way.

Changes to the gatekeeping role mentioned in Table 8 indicate the significance and multifaceted nature of what happens when access is reconfigured. For example, ICTs can undermine or support the traditional gatekeeper roles played by teachers in the classroom, such as when ICT-literate students with access to appropriate systems enhance their communicative power relative to some teachers, as well as other students, by gaining more control over their ability to assemble their own learning patterns and resources. This can be done by employing a simple animation or complex online simulation to help grasp a scientific concept, through a Web search or by a multitude of other e-learning capabilities.

A new form of teacher-led gatekeeping is illustrated by a classroom arrangement at IMD (http://www02.imd.ch), a leading international business school in Switzerland with state-of-the-art multimedia lecture rooms (Dutton 2004a). The main IMD lecture room has a switch that can be thrown to close access to the outside world whenever the teacher believes students should stop multitasking using electronic communication. This recognizes the value of allowing instructors to have relatively more power as a gatekeeper in controlling access, while also offering students access to the Internet directly from high-tech classrooms.

**Table 8. The role of technology in reconfiguring access in learning and education**

| Process | Example(s) in education and learning |
|---|---|
| Restructuring networks | Moving from a one-to-many, teacher-led broadcast model to one-to-one, many-to-one and many-to-many networks of communication |
| Redistributing communicative power between providers and consumers | Students network with each other and expert sources to develop their own sources that challenge their teachers' views; use of e-mail enables students and parents to contact and interact with teachers outside classroom hours |
| Creating or eliminating gatekeepers | Intelligent whiteboards put the teacher into a gatekeeping position in demonstrating access to the Internet; direct access to e-learning content by students bypasses dependency on teachers for supplying learning resources |
| Expanding and contracting geography | VLEs enable a classroom without walls; wireless technology allows access from anywhere on a campus or other locations with a WiFi hotspot; an online site simulates scientific experiments that would otherwise require physical access to a laboratory |
| Control over content | Multitasking Internet-connected classroom gives students more control over content of learning resources they use; students become content providers not only consumers, e.g. through computer conferencing |
| Changing cost structures | Broadband delivers nearly-free or low-cost distribution of text, multimedia and conferencing, but can raise the costs of production, e.g. for creating a computer game |

*Source: Adapted from Dutton (1999): 60–68*

The technology can also foster new gatekeepers, including the administrators and technical support staff needed to regulate and control access to digital library resources and to make decisions about enterprise-wide systems like VLEs. Parents, teachers, department heads, government agencies, local advisers and others often select e-learning tools on behalf of teachers and students, thereby acting as gatekeepers who control the choices available to certain learners. Box 3 illustrates how sharply differing perspectives on the complex changes to classroom dynamics can result from changing gatekeeper roles, again showing how the same change can be viewed as a motivator or demotivator from different perspectives.

**An ecology of choices shaping e-learning outcomes**

Understanding the central role of ICTs in reconfiguring access can help to highlight the complex socio-economic and technical arenas within which e-learning pathways and outcomes are shaped. These arenas of choice form an 'ecology' of games' in which access to people, information, services and technologies are reconfigured between a wide range of different players as they make strategic digital choices at macro and micro levels about whether or not—and how—to use ICTs.[24]

**Box 3: Differing perspectives on classroom multitasking**

According to Dutton (2004a), the OII's summer doctoral programme included 28 advanced doctoral students from 15 countries who came into the classroom with 22 laptops, all linked to the Internet. While professors gave lectures, usually with computer slides, some students sat transfixed on what was being said. Others were multitasking in ways that meant they were variously, and often simultaneously, engaged in online activities such as downloading slides, instant messaging and e-mailing colleagues, visiting Websites, checking the schedules on the course VLE and working on their own presentations and papers—all while listening more or less attentively to aspects of the lectures and discussion. As one of the programme's organisers and tutors, Dutton was impressed by the vitality of this mix: 'They were excellent students. They enjoyed the class. They felt they gained from the programme.'

Coleman also taught in this summer school, but he told the Forum that he saw very differently what he called 'students mucking around with all that multitasking'. An example of his concern was that, after one of his presentations, the first comment voiced was from a student who said, 'I disagree with that point you made, but I agree with what she thinks'. When Coleman pointed out to the student that she was the first person to comment, she replied that someone else in class had sent her a message while he was speaking.

In acknowledging the broader teaching challenge posed by placing access to ICT networks in students' hands within the classroom, Dutton (2004c) cited the experience of a teacher of information technology in a state school in a relatively distressed area of the UK. While standing in front of a well-equipped multimedia classroom, this teacher had felt a complete loss of control over the attention and activities of his students because they were doing things like searching the Web for games to play. However, about six months later he felt in command of the class and was being recommended for advancement in that school system.

Very few actors are interested in e-learning innovation *per se*. Students pursue good marks or friendships; teachers want the time and resources to be able to apply successfully the educational approach that will be best for the educational performance of their students; head teachers, vice chancellors and departmental leaders seek overall high performance outcomes for their institutions; administrators and managers search for economies to stay within budget; government, institutional and local policy makers want to meet the broad demands of their constituencies and organizations; and so on.

Players often act in many games at the same time, taking different roles in different games. Each game interacts with the outcomes from other games, and the behaviour and decisions of all actors affect those of other actors. All players therefore have a role in shaping outcomes, although players will have different strengths in terms of their power to influence overall decisions. The same person can also take different views in different arenas, as illustrated at the Forum by Eisenstadt's description of himself as a 'reactionary 3Rs-loving parent' (i.e. in favour of basic traditional 'reading, (w)riting and (a)rithmetic' standards) as well as a high-tech school governor and head of a university research centre (in which roles he promotes ICT-based multimedia innovation). From his parental perspective, he warned that teachers should be very careful about thinking that Flash animations used to illustrate, say, Boyle's Law in physics are really profoundly paying their way in terms of cost to the school versus benefit to the pupil. Laurillard, however, said that generating an animation can be a much more challenging test of understanding a topic than writing words about it.

A key implication of the reconfiguring access concept is therefore that the next level of e-learning will be most effective if efforts are made to understand how e-learning is perceived to hinder or enhance the diverse goals and objectives of multiple actors.

**Examples of e-learning games**

An illustration of the complex interplay between different players with different interests and perceptions acting in different arenas is illustrated in Table 9 by a few e-learning games. Many of these have a direct impact on e-learning content, which Laurillard identified as one of the biggest challenges and most intractable problems for e-learning in most countries because the dual dimensions of (e-)learning make the design and development of content politically charged, educationally controversial and administratively and technically complex.

A primary content issue relates to the way those involved in the 'furthering a pedagogical paradigm game' in Table 3 seek to promote their own preferred approach through the choices they make in the design and use of software. According to Lee, activity-oriented e-learning tools make teachers think about the learning activity and the teaching process first and the content second, which could affect the pedagogy used. Higton argued that teachers need to be able to moderate, influence and direct learning to meet the needs of individual students: 'to lead e-learning and not feel that they are being led by e-learning'.

The game focusing on educational paradigms overlaps with, and is influenced by, the game identified in Table 9 as centred on the control of e-learning design and innovation. For example, the UK government (DfES 2003b: 36) warns that although commercial suppliers usually employ teachers at some stage in the design process, the 'lack of a direct relationship between the users and the suppliers means that the products developed are less likely to meet learners' and teachers' real needs'.

Whatever the outcome of this 'design game', the way an e-learning tool is actually deployed depends on outcomes from everyday activities in the 'classroom control' game. In this, the way e-learning can put both teachers and students at the centre of networks is crucial: it means there is no longer a conflict between choices that reconfigure communicative power towards teachers or students, as it becomes possible to do both. However, Davies contended that strict adherence to a framework like the UK national schools curriculum can mean that 'a very nice piece of educational software like Kar2ouche ends up being used for just preparing children to answer a couple of SAT questions, which makes what should be a rich experience into something more trivial. For the next level, that is an extraordinary constraint'.

An initiative that may seem desirable in the classroom context could create tension in a different game. For example, the value of attracting learners' attention by using capabilities familiar to young people from entertainment media, such as video games, could be resisted by some actors in the 'efficiency' game because this could involve a substantial investment, given the expense of creating games of a production quality that young people expect. Struggles over budgets can also be an ingredient in the 'institutional politics' game, in which there are conflicting and cooperating moves between the centre and departmental units, and between different units and groups.

**Table 9. Illustrative e-learning games**

| Game | Examples of players' strategies and moves |
|---|---|
| Furthering a pedagogical paradigm | Teachers and education managers choose e-learning tools to reinforce favoured learning paradigms. Students favour tools fitting the paradigm with which they are most comfortable. Policy makers and researchers try to influence the development and use of tools towards support of their preferred paradigm. Trojan-mouse pragmatists accept evolutionary innovation; e-learning enthusiasts seek rapid transformations. Tool developers adopt paradigms that facilitate marketing of their products. |
| Control of e-learning design and innovation | Practitioners foster e-learning tools that offer teachers easy-to-use control over their pedagogical deployment. Commercial tool suppliers focus on designs that give them a competitive edge. Policy makers nurture experiments to fulfil social objectives, such as meeting the needs of disadvantaged groups or promoting teacher involvement in content design. ICT specialists and institutional management struggle over choosing proprietary or in-house software. |
| Control of the classroom | Teachers use e-learning to enhance classroom control, such as by holding students' attention. Students look for more control over their learning patterns through a variety of ICT-enabled and social networking, within and outside classrooms. Advocates of the activity-based paradigm see e-learning as a lever to end the traditional teacher-led paradigm; traditionalists seek to reinforce their own approach. |
| Competition for time and attention | Suppliers of a variety of ICT media compete for users' limited time and attention. Teachers use media familiar to students (e.g. simulation games and animation) to engage them in productive learning. |
| Efficiency | Administrators, managers and governments try to lower the costs of education administration. Educational practitioners resist what they perceive as harmful cost cutting. Tool makers promote the claimed potential of their solutions to improve efficiency. |
| Institutional politics | Rich and poor, large and small, high-tech and low-tech groups compete for budgets, technical expertise, ICT systems and support. Corporate managers and vendors seek efficiencies from centralized standards and licensing. Users negotiate to influence system selection. |
| Implementation | Many teachers, administrators, students and others resist, assimilate, subvert or otherwise appropriate technical innovations that threaten to disrupt established practices. ICT support staff, users, non-users and suppliers struggle to implement and maintain ICT and e-learning innovations in the face of technical problems and social resistance. |
| e-Learning tools market | Suppliers compete to reach large markets by focusing on established curricula and pedagogical models; governments and researchers investigate approaches with other objectives, such as accessibility or learning innovation. High-tech enthusiasts focus on new technical capabilities. Practitioners choose whatever method they believe to be best for learning, even low-tech or non-tech approaches. |
| Education marketplace | Schools, colleges and universities (public and private) extend their reach through e-learning. Content producers seek new markets for existing and new content and infrastructures. Students and parents evaluate institutions on their high-tech and/or face-to-face commitments. Policy makers foster education as an economic strategy for an information economy. |

Other games summarized in Table 9 include everyday issues involved in implementing systems, where often subtle social processes of resistance to innovation coexist with enthusiastic promoters of innovation in a context where technical glitches can undermine even a well thought out e-learning strategy. Opportunities and threats are also arising in the expanded global and local e-learning and educational marketplaces being opened by ICTs.

# 7. POLICY IMPLICATIONS: RECOMMENDATIONS AND CONCLUSIONS

As reported in this paper, the Forum recognized that the move to a more effective level of e-learning faces some fundamentally limiting factors that are unlikely to alter in the short to medium term, such as classroom time, space and curriculum constraints. At the same time, many policy development options could build on motivations that drive innovation and help to overcome barriers to releasing more e-learning potential. This final section outlines such policy implications.

## Reconceptualizing change

One of the main policy implications of the Forum's discussions was the importance of reconceptualizing the processes of change—not for self-serving or academic reasons, but in order to support innovation. While participants disagreed about the ultimately conservative or radical potential of e-learning technologies, there was more consensus about the value of rethinking how progress might be achieved using concepts like networks of innovation and adaptive change. These acknowledge that an education system is so large, unwieldy and complicated that it cannot be turned around simply by top-down change imposed in a prescriptive, once-and-for-all manner. The mechanisms of change most appropriate to different parts of the education sector are likely to entail a focus not just on the structures through which innovation might percolate, but also on the incentives and disincentives that could encourage or discourage innovative behaviour.

For instance, a key to the Trojan mouse model of systemic change is that it works with the grain of current motivations and goals. This enables teachers, managers and technical specialists to fit the technology gradually around existing teaching and learning practices, thereby nurturing their sense of 'ownership' of the resulting changes. 'Only if ICTs are understood to support rather than disrupt existing successes will they give education practitioners the confidence to experiment further with more radical applications,' Nash commented.

However, Trojan mice are not a policy panacea. Not only may some of them fail, or lead only to relatively insignificant changes, but some could become a focus of suspicion that poisons the institutional atmosphere. For instance, a Trojan mouse could bring unintended change into the classroom, such as when an effective e-learning system that helps to reduce the teacher's workload in specific tasks, like marking answers, is seized on by some administrators to argue for a reduction in teacher numbers. This exemplifies the ecology of games analytical framework we introduced in the previous section, which describes how education policy makers, practitioners, e-learning system providers and other relevant actors pursue a multiplicity of goals, which may or may

not coincide. In this light, if innovation in e-learning is to flourish, it is not enough just to advocate the need for better and more diverse networks. In addition, it will be necessary to understand how the impetus of drivers within individual 'games' can be harnessed to stimulate change that supports rather than undermines familiar goals or practices, in ways that are sustainable.

**Box 4. Key areas of e-learning motivation and constraint**

- *Classroom, regulatory, environmental and professional pressures on the everyday work of teaching practitioners*, such as: time limitations; curriculum targets; suitability of the physical environment; concerns about learner performance; and relevance to e-learning of prevailing teacher assessment and reward processes.

- *Teachers' and students' perceptions of what 'good' education and learning means*, including whether e-learning enriches this or becomes a cheap version of education.

- *Social, institutional and technical aspects inherent in, or attached to, e-learning technologies*, including cultural obstacles, organizational boundaries, design constraints and a variety of barriers associated with perceptions of risk, such as: inadequate access to e-learning tools; a lack of skills training; insufficient specialist ICT support to assist use of the technology; excessive administrative bureaucracy; educationally disadvantageous efficiency drives; and technical incompatibilities that limit the choice of tools.

- *Political issues* concerned with: the centralization of power; devolution of power; principles about what constitutes best practice; and questions related to regulation versus the absence of constraint.

Despite the ambiguity inherent in this understanding that one player's motivational meat might be another's poison, Forum discussions of e-learning innovation drivers and barriers highlighted a number of areas where stakeholders are most likely to be motivated to take up e-learning, or encounter obstacles to such innovation (Box 4). Many examples in this paper (e.g. in Tables 3 and 8) of what motivates people to want to use, or resist, ICT networks as they engage in e-learning games illustrate how people could be encouraged to take advantage of the new opportunities in ways that make sense to them. These indicate, for example, that the involvement of teachers in the design of e-learning applications helps not only to make the resulting products relevant to classroom needs, but may also help to expand uptake.

**A new model of governance to support effective e-learning innovation**

The vision of a next level of effective and sustainable (e-)learning described in this paper is centred on a virtuous cycle that emerges and spreads through networks that shape innovation to address both the 'messy realities' of everyday classroom pressures and the need to open new pathways to enhance learning outcomes. However, we are clearly still a long way off achieving this vision, and many at the Forum felt a key reason was the failure to take adequate account of the realities of classroom life.

The significant policy issue here is not just that teaching is a very demanding profession, but that a political and institutional culture of tests, league tables and rigid curriculum standards serves to increase everyday pressures to a level that severely constrains the opportunities, motivation and ability to innovate effectively. This reveals

the priorities and actions of much current policy making as seeming to be largely incompatible with a truly adaptive education and learning system. Nevertheless, a sustainable, innovative education sector based on a model of adaptive change could still be achieved by the encouragement of bottom-up experimentation and risk-taking using networks.

At the same time, an over-emphasis on local initiatives could lead to fragmentation and a duplication of effort. Yapp voiced such a concern in relation to previous experience in the UK: 'The danger was that we had many experiments going on with no cross-sectoral learning, in the belief that schools were different from libraries, which were different from universities, and so on.' To avoid this, communication must take place effectively both across and within different sectors. If innovation is driven locally but not communicated more widely, the potential value of new e-learning methods could be lost, as innovation has to be driven afresh by every teacher in every school, university and college. Although the 'bottom-up' approach then becomes very inefficient, networking again offers policy makers with an approach to supporting e-learning innovation that could steer clear of these dangers, for instance by providing incentives for collaborative networks (e.g. see Table 1) that begin to dissolve institutional, administrative and social boundaries to the sharing of information.

Although encouraging bottom-up change is an important policy option, it is not possible—or even desirable—to do away with central or local government intervention, particularly where that is appropriate to provide a statutory and institutional framework within which e-learning innovation could flourish. For example, Fowler and Selinger (2004) argued that these responsibilities could assist e-learning by establishing standards and regulation that provide a trusted and efficient environment to deal with issues such as: digital rights management; handling information about students; privacy protection, data interoperability; security safeguards; and Internet governance. Central resources can be provided to support local initiatives.

Conflicts between bottom-up and top-down goals and practices can act as a break on adaptive change, as explained by Bentley and Wilsdon (2002b: 23): 'The current preoccupation with setting national standards as a basis for accountability obscures a tension that the process of adaptive reform must address; the specification of performance standards often narrows the scope for organizational innovation'. It is therefore vital to recognise the policy trade-offs entailed by an adaptive approach. The challenge is to determine how high-quality education for all can be nurtured through the provision of publicly accountable funds, in a way that allows gateways to innovation to be substantively controlled by those directly involved in education and learning.

An adaptive educational system is one in which individual players are free to take risks and spread the resulting innovations. This means that the state itself must be prepared to create the institutional framework within which risk-taking is possible. In supporting this, we recognise the counter-argument that perhaps the adaptive state is not such an attractive alternative after all, at least with regard to education. How much risk can or should we bear in relation to education? Indeed, is any risk at all acceptable when it comes to the future prospects of an entire cohort? And how much political risk can a government bear? Finding answers to these complex questions goes to the heart of the 'top-down versus bottom-up' debate and will remain a significant concern for all

those within and outside government who seek more responsive, flexible institutions that can respond to technical and other social change.

**Creating and supporting learning networks**

For policy purposes, the first and essential policy step toward promoting innovations in (e-)learning networks is to find ways of supporting the development of horizontal networks of innovation within educational institutions and their professional staff, as well as vertical networks between educational institutions and the different levels of authority.

These policies must address the important factors discussed earlier that could make it difficult to nurture and sustain learning networks, such as working within existing institutional and cultural constraints when trying to establish the interconnected dialogue, debate and innovation along which new ideas and practices for improving (e-)learning can flow freely in all directions. A competitive culture can also make it hard to build and sustain networks between different institutions. This means that forging local trust among potential partners through effective working relationships is an essential precursor to developing sustainable, innovative (e-)learning networks.

Two categories of networks were identified as being essential to these policies: networks of innovation that will spread and shape e-learning practice; and networks and communities offering specific, usually online, e-learning systems and support.

*Networks of innovation*

The networks of innovation that are key to furthering the future development of e-learning assume a degree of trust between educational institutions. In many cases, this may already exist or be easy to establish. However, such trust may prove hard to develop in an education sector characterized by a high degree of competition for resources and reputation.

The limits of this institutional context, and the differences between education and other sectors, are increasingly highlighted as the pressure to innovate grows. As David Hargreaves (2003: 3) has written in his recent work on stimulating an 'education epidemic': 'Much … creative innovation is locked in the heads of individual teachers: they do not know whether what they do is especially good practice; and even when it is known to be good, a practice spreads very slowly, if at all, within a school, let alone between schools. In other professional worlds, such as medicine or business, innovation has been developed in a much more explicit and coordinated way and then disseminated much faster than in education … The time is ripe for exploring new ways in which to increase teachers' professional knowledge and skill.'

There are many existing initiatives seeking to support such networks of innovation, as illustrated in Table 1. The UK's National College of School Leadership (NCSL) is a high-profile, high-budget project that aims to provide career-long learning and development for school heads and to engender wider communication and collaboration. While the NCSL has a substantial physical base, other less costly projects, such as the virtual Talking Heads community set up by Anglia Polytechnic University and now run by the NCSL, can also be used to establish and support these kinds of networks. This raises

policy questions about whether we need the buildings and the networks—whether the latter can be established without the former—or to what extent this is a false trade-off, as they can complement each other in particular contexts. This is obviously an area where the evaluation of existing projects and further research would be valuable. For instance, two strategies for supporting such networks of innovation that emerged at the Forum merit further consideration and research.

One strategy draws on participants' experience of trials in Fairfax County, Virginia, and Oxfordshire County Council in the UK (modelled on Fairfax). These funded the employment of specialist e-learning coordinators whose job was to support innovative applications of technology in the classroom; crucially, this role was shared between a number of local schools. The Oxfordshire coordinator has no fixed timetable but moves between schools as required, helping individual teachers and finding out and communicating experiences, problems and solutions between schools.

According to Wolfenden, without the personal relationship and trust built up over time by the coordinator, there would not have been improvements in the confidence among teachers in using the embedded technology and incorporating it into their planning. The coordinator also focused school attention on innovation by overcoming workload pressures and the absence of pre-existing communication networks, while the schools gained substantially from sharing this resource. These positive results suggest it would be worthwhile to study whether similar outcomes can be repeated on a wider scale, including an evaluation of the value-for-money returned by such an investment. Despite the successful outcomes, the funding requirements for a coordinator could lead Oxfordshire to move to a more self-sufficient model based on a virtual network, where teachers will coordinate e-learning activities among themselves.

The other strategy suggested was less well developed, but also proffered a realistic approach to encouraging networks of innovation between educational institutions, even within a competitive and time-limited context. Here, the assumption is that although competition can militate against collaboration, it could also be used to stimulate productive networks of innovation for the benefit of all learning stakeholders. For example, Eisenstadt's intriguing vision of using ideas developed on commercial services like Kazaa and Raging Bull to promote peer evaluations in e-learning networks, including peer-nominated rewards, could motivate teachers and learners to participate actively in these networks. This could help to develop and disseminate practical new ideas and bring new forms of reward, motivation and innovation, including professional credit for teachers and new friendships and better results for learners.

Another possible approach to working with competition, rather than fighting against it, would be to investigate whether schools could cooperate and collaborate in the same ways as universities. Although there is much competition among universities for reputation, resources and students, academics regularly collaborate across institutions, for example to raise funds for joint research projects. Could the same model be applied to schools in the pursuit of funds for e-learning pilots or to secure network support, as in the Fairfax/Oxfordshire example? As with universities, schools would then need to demonstrate that they have the expertise, experience or innovative ideas to justify the receipt of further funding. An important caveat is that it might be preferable to stimulate

network development in less bureaucratic ways than those often involved in university research funding, given the curriculum and administrative pressures in schools.

*Online learning communities*

Much discussion at the Forum of the second type of network, involving direct online learning, focused on their potential to engage teachers, students, administrators, parents and others involved in learning and education by making them feel as if they are at the centre of their own network of information and communication resources. The achievement of this would exemplify the general policy aim of finding ways of working with existing drivers in a bottom-up approach to adapting the rules and objectives of certain education 'games', in order to support a sustainable move to a more effective level of e-learning. This could include exploring the policy implications of applying to learning environments some successful capabilities developed for other sectors, such as the facilitation of self-motivated or peer-to-peer networks.

The notion of 'mass customization' of learning, or 'personalization' as it is increasingly called in policy circles, is seen by many as an important element in such self-motivation. Such personalization could range from the provision of online materials at different levels of complexity for learners proceeding at different speeds, to the more ambitious provision of examples, explanations and problems geared to each individual's language or interests, perhaps with in-built formative assessment aids. There could be a continuum of more or less personalized approaches for learners at different ages.

However, the personalization vision continues to cling, to a degree, to the one-to-many broadcast paradigm of communication and content creation. The general view at the Forum that tended to favour the collaborative nature of networking reflected concerns about the appropriateness of this. Networking indicates how such personalization could become counter-productive, for example if it leads to an excessive atomization of the learning process. Personalization should therefore be treated with some caution, with efforts made to study its impacts in practice.

In contrast, putting actors in the centre of e-learning networks moves away from a focus on tailoring content toward giving individuals access to more varied sources of information, to people otherwise inaccessible, to competing services and to a range of ICTs.

**Preparing for the unpredictable**

Concepts like networks of innovation and Trojan mice recommended in this paper convey the idea that the most successful innovations are often those that least threaten those who are required to change. This is especially relevant in large, complex organizations or systems—such as the education sector—that cannot easily be steered from the top and where the development of innovative practices and their impacts cannot be predicted or pre-determined.

It may be premature to have a single vision for the future of e-learning, but policy makers should be prepared to accept the need for practical experimentation and an element of risk taking. This is reflected in a comment by Woods that 'we need to be

sufficiently brave' to allow schools to find their own paths to innovation and growth 'in an atmosphere in which experimentation, risk taking and research is embraced and celebrated'. But he warned: 'The danger is that bureaucrats count the hardware and the computer-to-pupil ratios and fail to enthuse about the tentative experiments of our teachers and students. This, in turn, fails to give the teachers sufficient confidence to learn for themselves and from their pupils, or to embrace the potential of parents as partners in the adventure of learning with ICT.'

The role in this process of teacher-training policies was highlighted by Fowler: 'If teachers in their training can initially learn about the new tools in relation to their own ideas and experiences, safely and away from their classrooms, then the light bulb tends to come on and all the notions of change and new ideas percolating from lower-level creativity can take place.'

A drive to encourage and implement rapid change could be counter-productive if it takes insufficient account of the 'messy realities' of existing learning environments. The best policy options might therefore be those that support rather than disrupt existing successes in order to give education practitioners the confidence to experiment further with more radical applications. Putting people at the centre of learning networks, as anticipated by Naisbitt and developed in this paper, strikes us as the most promising vision not only of the next level, but also how to achieve it.

This analysis is used to identify some key e-learning policy implications in Box 5, which suggests a model of change that implies the need for changes in attitudes as well as policies. For instance, government, educational institutions and organizations who support or assess their performance should be prepared to scale down, at least in the short term, their expectations for all teachers to embrace new e-learning tools in a similar way. Instead, it should be recognized that they will move at different paces. Some teachers may find learning how to apply presentation or mind-mapping software a dramatic first step, while others are comfortable using powerful authoring suites to co-produce multimedia networked applications.

Training and assessment must allow for such differences, and any 'best practice' schemes should recognise not just the novelty of ICT use but also the 'distance travelled' beforehand. Although the development and dissemination of best practice guidelines is an appealing notion to those seeking to stimulate effective installation, the social, cultural, economic and pedagogical factors shaping learning outcomes mean that it is difficult to draw up detailed guidelines for all situations.

Networks of innovation and the use of Trojan mice were seen as more effective ways of spreading ideas and practices in ways that can be adapted for different contexts. Best-practice guidelines can also legitimate a misleading technologically deterministic view that a successful innovation in one context will automatically work equally well elsewhere.

This can be particularly unhelpful when a project failure could blight innovation in a learning environment for a long period, by undermining trust and a willingness to take risks. That is another reason for developing and implementing policies designed to enable actors to shape their own access in ways most appropriate for themselves and others in a particular learning context.

**Box 5. Key e-learning policy proposals**

- Wherever possible, innovation that emerges naturally from the inventiveness of teachers and students should be nurtured, in preference to top-down approaches.

- Strategies for putting students, teachers, administrators and all other actors in the centre of their own virtual networks of learning and education should guide initiatives at all levels, for example through policies that focus on supporting networks rather than providing or stimulating content production.

- Collaboration should be encouraged between all sectors and levels of learning and education as a basis for the development of (e-)learning networks, such as the provision of online networked resources and discussion forums backed by appropriate support.

- Public interventions should prioritise support for networks of innovation involving schools, universities and colleges with their teachers and students, as these are the prime channels through which innovative practices will develop.

- In addition to ICT hardware, software or infrastructure investment, public support should focus on building human capacity to improve the effectiveness of e-learning, for example by: training staff (including through peer-to-peer networks) in both basic ICT skills and the effective use of e-learning tools; providing appropriate specialist ICT and e-learning support, particularly for complex ICT networks; offering 'time out' or other initiatives to help teachers find space away from busy classrooms to reflect on how they use ICTs and what more they could be doing with the technology.

- The adoption of effective e-learning practices is more likely to become a reality by promoting the sharing of actual experiences through socially engaging networks than the formulation and dissemination of abstract descriptions of 'best practice', although such guidelines can provide valuable advice for implementation processes.

Great long-term educational value can also result from the way the technological potential can trigger a fundamental reflection by educational professionals and others on the purpose and expectations of different learning paradigms. Academia has a particularly important role to play in informing such reflections, helping to support the making of digital choices in learning and education. In particular, academia has a responsibility to undertake empirical and analytical research that provides policy makers with the evidence needed to resolve the many issues highlighted at the Forum as deserving further investigation. Table 10 summarizes some priorities for an e-learning research agenda.

In order to reach the next level of e-learning, we not only need to do the things we do now a little differently—but we also need to understand what we're doing and where we might want networking to take us next through a process of adaptive change. In so far as the technology itself can help provide new means of communicating and collaborating to enable all actors to move into the centre of their own educational network, it is possible that the next level of e-learning is not really so far away.

**Table 10. Key e-learning research issues**

| Issue | Examples of research questions |
|---|---|
| The actual uses and impacts of ICTs in learning and education | What are the contexts, outcomes and generalisable lessons that can be learnt from:<br>• experimental innovations;<br>• case studies; and<br>• survey research? |
| The features, benefits and risks of different learning paradigms | • What is the realistic potential of e-learning in enabling a shift from the traditional teacher–student 'one-to-many' paradigm?<br>• What possibilities are being opened for effective new models of learning inside and outside the classroom, such as the 'person-plus' model?<br>• What kinds of e-learning tools can best balance the needs and interests of teachers, students, educational administrators and other learning stakeholders as they reconfigure their communicative power? |
| The network potential of ICT-assisted learning | • What precisely would it mean to develop ways of teaching and learning that place individuals at the centre of their own learning network—and makes them feel this?<br>• How might this be best accomplished, and in what sorts of learning activities is it most likely to be effective?<br>• What are the implications of new forms of networking and multitasking for traditional location-based forms of education? |
| The potential for mass customization or personalization of the learning process | • What are the practical experiences of personalization through networking and what impact have they had on individual and group learning outcomes?<br>• Which stages in the learning process are most amenable to being paced and tailored to the needs of the individual through e-learning networks?<br>• What are the risks and benefits of these approaches, such as in relation to the atomization or isolation of learners, or in the scope and limits of using this capability to stretch reluctant learners through shared experiences? |
| Ways of using ICTs in education to bridge cultural divides, rather than reinforcing them | • What evidence is there to back the Forum's general belief in the unifying potential of e-learning in connecting civilizations more amicably?<br>• How effective are transnational e-learning initiatives, such as 'schools e-twinning' and other EU programmes (elearningeuropa.info)?<br>• What are the most effective methods of creating a global e-learning environment that helps to bridge educational, social, economic and cultural divisions? |

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## APPENDIX I. FORUM PARTICIPANTS

The following participants attended the OII e-learning Forum on 22 January 2004. Job titles are as they were at the time of the Forum.

| | |
|---|---|
| Nick Allard | Partner, Latham and Watkins, and Faculty Member, Georgetown University, Washington DC |
| Peter Birmingham | Researcher, OII and Department of Educational Studies, University of Oxford |
| Gordon Bruce | GJB & Associates, Technology Adviser to JAIMS |
| Kevin Carey | Director, humanITy |
| Stephen Coleman | Cisco Visiting Professor of e-Democracy, Oxford Internet Institute |
| Sara de Freitas | Research Fellow in ICTs, Birkbeck College, London University |
| Chris Davies | Senior Research Fellow, Department of Educational Studies, University of Oxford |
| Bill Dutton | Director, Oxford Internet Institute |
| Marc Eisenstadt | Founder and Chief Scientist, Knowledge Media Institute, Open University |
| Bill Fowler | Education Director, Internet Business Solutions Group, Cisco Systems |
| Rachel Gant | Senior Business Executive, Primary Business Marketing, RM plc |
| Roger Higton | ICT Coordinator, Lord Williams's School, Thame, Oxfordshire, UK |
| Diana Laurillard | Head of e-Learning Strategy Unit at the UK Department for Education and Skills |
| Stuart Lee | Head of Learning Technologies, Oxford University Computing Services. |
| Glenn Miyataki | President of the Japan–America Institute of Management Science |
| John Naisbitt | Author and futurist |
| Vicki Nash | Policy & Research Officer, Oxford Internet Institute |
| Malcolm Peltu | Editorial Consultant, Oxford Internet Institute |

| Sarah Porter | Development Group, Joint Information Systems Committee, UK |
|---|---|
| Sally-Ann Saull | Marketing Manager, Lifelong Learning and Higher Education, RM plc |
| Michelle Selinger | Education Specialist, Cisco Systems UK |
| Stephen Uden | Education Relations, Microsoft |
| Freda Wolfenden | Content Development Officer, Learning and Culture Directorate, Oxfordshire County Council |
| Michael Woods | Head Teacher, Cornwallis School, Maidstone, Kent, UK |
| Tristram Wyatt | Director, Distance and Online Learning Department, University of Oxford |
| Chris Yapp | Head of Public Sector Innovation, Microsoft Ltd |

## APPENDIX II. GLOSSARY, ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| *Becta* | British Educational Communications and Technology Agency |
| *Blended learning* | Mixing of face-to-face interaction with online learning |
| *Broadband* | Always-on high performance multimedia telecommunications capability, used for example to access the Internet and interactive digital TV services |
| *CAI* | Computer Aided Instruction |
| *DfES* | Department for Education and Skills (UK) |
| *Communicative power* | The capacity to command knowledge, economic and technological resources to exercise control over the design, production, use, ownership and governance of communication media |
| *Distance education/learning* | Use of electronic networks to deliver educational services to a location other than that of the instructor, such as to a remote classroom, household, workplace, study centre or other place where ICT-enabled learning can be accessed |
| *Distributed learning* | The use of e-learning within a university, college or school campus |
| *Formative assessment* | An activity-based approach to assessing learning performance that takes place whenever appropriate, with the primary aim of gathering feedback from the learner to help improve learning in the future |
| *Hot spot* | Location offering WiFi access to the Internet |
| *Intelligent whiteboard* | A touch-sensitive screen connected to a digital projector and a computer that can be controlled by touching the board directly or with a special electronic pen to provide a display that can be seen by everyone in a room |
| *JAIMS* | Japan–America Institute of Management Science |
| *JISC* | Joint Information Systems Committee (UK) |
| *Kazaa* | A P2P music downloading system |
| *KMI* | Knowledge Media Institute (Open University) |

| | |
|---|---|
| *LAMS* | Learning Activity Management System (developed at the Macquarie E-learning Centre of Excellence, Macquarie University, Australia) |
| *OII* | Oxford Internet Institute |
| *Ofsted* | Office for Standards in Education (UK) |
| *P2P* | Peer-to-Peer (networks), as opposed to networks with more centralized and hierarchical architectures |
| *PC* | Personal Computer |
| *RAE* | Research Assessment Exercise (for UK Universities) |
| *Raging Bull* | A financial online discussion board |
| *SAT* | Standard Assessment/Scholastic Aptitude Test |
| *Smartboard* | Alternative term for intelligent whiteboard |
| *Summative assessment* | Assessment/certification of learning performance at pre-fixed milestones, usually in relation to a set curriculum and quantified standards |
| *Tablet PC* | Handheld PC with an electronic pen to enable handwritten input |
| *Trojan mouse* | Small, manageable innovations that combine with other small changes to make substantial long-term impacts |
| *VLE* | (Virtual Learning Environment) Campus-wide networks that use software to manage and coordinate learning and administrative activities |
| *WiFi* | Wireless Fidelity |

## NOTES

[1] See www.oii.ox.ac.uk/collaboration/?rq=specialevents/20040122

[2] Ibid.

[3] Ibid.

[4] An acknowledgement of the significance of the debate about e-learning and broader pedagogical issues is reflected in research initiatives such as the UK e-Learning and Pedagogy Programme funded by JISC (Porter et al. 2004).

[5] For example, Pittard et al. (2004: 9) claim that studies by Harrison et al. (2002) and Becta (2003a,b,c) 'provide reasonably convincing evidence that pupil ICT use and school ICT provision impact positively on individual pupil attainment and on overall school performance. These studies also show that this relationship is not simple and is related to factors such as: types of ICTs adopted; how they are used across the curriculum in particular subjects and at different key stages; and the strength of school leadership.'

[6] See Castells (1996), Freeman (1996) and Dutton (1999) for further elaboration of the theoretical conception of networks as a focus for, and a source of, such cycles of innovation.

[7] The adaptive change concepts emphasized at the Forum draw on studies that apply complexity theory to organizational and social change in complex adaptive systems (e.g. Chapman 2002).

[8] See www.trojanmice.com for more background on the concept.

[9] www.europa.eu.int/information_society/eeurope/2002/benchmarking/list/2002/index_en.htm

[10] Wide-ranging e-learning strategies have been developed in a number of countries, such as the US (Department of Education 2002) and the UK (DfES 2003b).

[11] This lag in the transformational potential of innovations is also a theme of research by Freeman (1996) and David (2001).

[12] See, for example, the Network of Excellence for Digital Libraries project funded by the European Commission's 5th Framework Research Programme (http://delos-noe.iei.pi.cnr.it/).

[13] The physical isolation of rural schools was one factor behind an early e-learning network in Montana in the western US, called Big Sky Telegraph (Dutton 1999: 210, Box 8.4).

[14] See, for example, the UK's JISC online plagiarism advisory service for universities. http://online.northumbria.ac.uk/faculties/art/information_studies/Imri/Jiscpas/site/jiscpas.asp

[15] Moore's Law is the popularized version of microelectronics pioneer Gordon Moore's observation in the mid-1960s that microprocessor capacity would double about every eighteen months.

[16] The concept of the adaptive state draws on work by the think-tank Demos (Bentley and Wilsdon 2002a).

[17] Laurillard quoted this metaphor from Bentley and Wilsdon (2002b: 26)

[18] See www.ayeeg.com for this flower animation and examples of similar work by children at the Cornwallis School.

[19] This investment is part of the £50 million Interactive Whiteboards Project sponsored by the UK Department for Education and Skills, which is aimed at making intelligent whiteboards a national priority within its overall 'ICT in Schools' initiative (www.dfes. gov.uk/ictinschools).

[20] For example, a leading advocate of this view, Roger Schank, Professor Emeritus in computer science, education and psychology at Northwestern University, believes the most effective way to teach new skills is to put learners in situations where they need to use those skills, then to provide mentors to offer help when the learner needs it. He claims that e-learning techniques like simulations of real-world situations are the most effective ways of delivering this (see http://socraticarts.com).

[21] For more background on formative assessment, see for example the Website of the King's College London Assessment for Learning Group (www.kcl.ac.uk/depsta/ education/research/kal.html) and related publications (e.g. Black 2003; Black et al. 2003). This philosophy has guided the work of some e-learning pioneers for decades (e.g. Bork 2002).

[22] Bentley and Wilsdon (2002b: 19–22) call this 'universal personalization'.

[23] For example, the IMS Global Learning Consortium (www.imsglobal.org) is a non-profit organization seeking to establish requirements for effective interoperability and reuse of e-learning technology.

[24] The term 'game' is not used here in a strict game-theoretic sense, but more generally to indicate an arena of competition and cooperation structured by a set of rules and assumptions about how to act to achieve a set of objectives. Social outcomes are then seen to emerge from interactions between outcomes of a number of games in a larger system of action: an 'ecology of games' (Dutton 1992).