

BITS OR BAUBLES: THE OPPORTUNITIES FOR BROADBAND TO ADD VALUE TO EDUCATION AND LEARNING

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INTRODUCTION

Clearly there needs to be a rapid and comprehensive effort to capitalise on the power and potential of broadband. In particular, three emergent properties of broadband are significant

- much faster data transfer,
- the ability to transfer more complicated data with great fidelity
- the advantages of the network being always on.

It is recognised that issues persist concerning the digital divide, and the importance of gender and cultural differences in Internet use. The uptake and use of broadband (and the Internet in general) is not simply related to education, age, or income. Because the innovative and entrepreneurial uses tend to be individual, there has been little dissemination of new ideas and good practice. From considerable research in e-learning and e-business we recognise that a much greater attention to the design of online activities is required at the outset. Solutions that simply try to copy offline practices to the online environment are fated to be less successful. There is a lack of strategic coordination in planning for the adoption and application of broadband in almost every sector (schools, higher education, health, public and voluntary

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agencies). This has serious knock-on implications for other areas of policy as emergent thinking has dramatically moved the issues of fast, easily accessible Internet connections from a private luxury to a central civic facility much like roads, waste disposal and defence. The availability of high-speed broadband services will have a crucial role to play in the delivery of education (all levels), transport reduction (collaborative working and telecommuting), public services (democracy) and health (equitable access to specialist services). While there is no doubt that private enterprise will have a key function in service delivery and innovation, the issue is too large and important to avoid strategic state guidance and intervention. Cost savings, redeployment, and convergence of technologies will reinforce pervasive access and quality of service for the public. A major task ahead is to enable existing broadband applications such as Internet radio or television, telemedicine and collaborative working solutions to be given a higher profile in order to engage and benefit more citizens.

THE ADDED VALUE OF BROADBAND

For the purposes of this article we are focusing not simply on improving the use of ICT in education, nor even on better use of the Internet, but specifically on the added value of broadband Internet access for educational purposes. At the simplest level, the benefits of broadband are easier access, faster data transfer, and more accurate relay of complex digital information, but its real value is in its emergent properties. Many university and college campuses have enjoyed fast-access Internet connections for a considerable time, but this has not been the case in most schools, local study centres, and other places of learning such as the home or the workplace. The emergent properties of broader bandwidth enable an always-on and almost real-time global connectivity with both individuals and other stored resources, but more than that, the combination enables a range of exciting educational opportunities that are impossible in the face-to-face and narrow bandwidth environments.

In this context a recent report to government on the 'opportunities and barriers to the use of broadband in education' highlighted five main areas of added value (BSG 2003). These are:

- 1) Transforming the learning experience
- 2) Improving inter-institutional collaboration

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- 3) Achieving new potentialities
- 4) Improving efficiencies in existing provision
- 5) Widening access to education

It makes sense to explore these five areas in turn.

1) Transforming the learning experience

Although broadband deployment is at an early stage, there is evidence that the speed and convenience of access to the Internet has encouraged both staff and students to incorporate a greater amount of Internet information and resources in lesson plans and projects. The move towards wider access to broadband will enable an experience for everyone similar to campus-based accessibility and is likely to hasten the decreasing reliance upon classroom-based learning activities. Faster download times, together with an explosion of new materials being added to the World Wide Web, mean that much more high quality learning resources are becoming commonly available. In this we do not simply mean easy access to large and complex files in the growing list of elearning information¹ or electronic journals (both through commercial portals and Open Access journals²) but also new resources that have not so far been available to users lacking broadband access. Examples of this might include:

- Animations³ that could be used to demonstrate audio-visual sketches, engineering operations, and other moving diagrams.
- Video streaming⁴ of (asynchronous) short clips that can show filmed examples⁵ of educational activities (such as a field trip, or snippets of an interview) with accompanying voice support from a tutor.

¹ *ELearning Information Portal* http://draigweb.co.uk/cgi-bin/linkusers/elearning/main.cgi?action=print_link

² *Directory of Open Access Journals* <http://www.doaj.org>

³ *Audio on the web -Talking Heads* <http://www.virtualpresenter.com/cp/demo.php#>

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- Short bursts of real-time (synchronous) engagement either with other locations (via a web camera⁶ or a net meeting⁷) or with another person (via instant messaging or the VOIP – voice-over-Internet-protocol).

In many instances the ability to quickly download complex data at any convenient time allows a level of intimacy that is not possible at narrower bandwidths. Asynchronous access allows good examples to be prepared in advance and catalogued for access by the learner when s/he feels ready for it. This could be compared with replaying selected highlights from a football or rugby match, lasting only a few minutes or seconds, but critical to the outcome of the match. Educational examples might be video footage of a geological feature from a distant location, or a close-up of a critical reaction in a chemistry laboratory. Synchronous access transmits emotions and nuances of language or facial features that are largely lost in text-based Internet communications. This could include special short ‘master-classes’, short responses from specialists to ‘just-in-time’ problems, or, in the case of one Canadian example, fiddle tuition to a remote school that was unable to benefit even from peripatetic music teachers.

Lastly, although the main beneficiaries might appear to be learners who are remote from their teaching campus, the added value of the broadband access is beginning to transform the campus learning experience. The vast learning resources of the web create a rich learning environment in which students can explore topics more deeply than is possible in class time. Other learners can use the resources to revise and reinforce learning activities that they may have had problems with in class (JISC 2004).

⁴ *Streaming Audio and Video Project at*
<http://sociology.camden.rutgers.edu/curriculum/streaming.htm>

⁵ *Hewlet Packard research website* <http://hp.feedroom.com>

⁶ *Webcam of Loch Ness* <http://www.lochness.co.uk>

⁷ *Pilot Flashmeeting tool of the Open University*
<http://flash.kmi.open.ac.uk:8080/flashmeeting/index.php?code=demo&room=demo>

2) Improving inter-institutional collaboration

The speed of connectivity can be used to enhance collaboration and inter-activity between institutions and between sites on multi-campus institutions. In the latter example, an institution such as UHI, with 15 main academic partners and dozens of subsidiary learning centres, has developed a range of networked degree courses, with individual modules being delivered from separate colleges to all parts of the extended network. Distributed learning solutions that include a shared Managed Learning Environment and library facilities, network videoconferencing, and multi-campus face-to-face support have encouraged the innovative adoption of technological tools for education. Currently the UHI do as much videoconferencing as all the rest of the universities in the UK put together. Clearly this is a particular response to the particular circumstances of the UHI, but the strength of the system serves to emphasise its potential, and further refinements to the way that tuition and administration through videoconferencing is managed, for example by combining it with simultaneous access to web based resources, shows considerable potential. There are already a variety of commercial software applications that facilitate collaboration in the workplace between remote participants (e.g. Groove networks⁸) but many of these are hampered by narrow bandwidth to the point of becoming inoperable. Although the technology that will encourage and support administrative collaboration will not suit every business, there are obvious benefits for large multi-site organisations, such as networks of schools, hospital/health centres, local authorities, and other public sector agencies with a geographical distribution. Lowering the access barriers to permit ease of use, and providing online dissemination of resources for schools, colleges, and universities⁹, will help the spread of online collaboration in the administration and management of education, but it is also likely to exacerbate the digital divide. As computers become omnipresent, and Internet use a daily occurrence for many learners, the divide will be between those who have the skills to exploit the new technology, and those who do not. Will the education system require the

⁸ Groove networks <http://www.groove.net/home/index.cfm>

⁹ Joint Information Systems Committee (JISC) www.jisc.ac.uk/elearning

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introduction of 'ICT skills' to the basic learning support areas of 'literacy and numeracy' as key remedial areas?¹⁰

Examples of learning support that are being piloted include the virtual transition project (BSG 2003) designed to support the transition of pupils from primary to secondary school¹¹, and the provision of counselling services for remote students by videoconference contact (Ross 2000).

3) *Achieving new potentialities*

Perhaps a more exciting, and by definition cutting-edge, use of broadband technology is to use the possibilities of the enriched online environment to capitalise on a new potential for teaching and learning resources. This may be at the specialist, technical end of formal education, such as the provision of broadband access for medical students at the Peninsula Medical School¹², enabling them to access videorecorded dissection of human cadavers and allowing quick, searchable access to extensive collection of medical textbooks as e-books, but there are broader applications. In a concise overview of emerging good practice, JISC (2004) summarised good design principles for e-learning and gave 10 short case studies of effective applications in further and higher education. While not restricted to broadband, the ability to provide broadband access to e-learning opens the door to video streaming, complex data sets and large file handling or transfer that is simply not possible at narrower bandwidths. This ability to extend the rich online learning environment 'anyplace, any pace' has been recognised not only for being able to take formal learning into people's homes, workplaces, and 'third places' of social interaction (Oldenburgh 1995) but also as a major resource for informal, adult education (Selwyn and Gorard 2004; Clark 2005). In adult education, particularly, there is a fine line between what learners acquire through formal education, and what they pick up informally, with many learners oscillating back and forwards between the

¹⁰ *Learnativity* <http://www.learnativity.com/index.html>

¹¹ *Birmingham Grid for Learning* <http://www.bgfl.org/bgfl>

¹² *Peninsula Medical School* <http://www.pms.ac.uk>

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two modes. Several initiatives have been designed to exploit the convergence¹³. Examples of this convergence may be found in the ballet and dance instruction manuals¹⁴ available on the web that combine video and audio, as well as the possibilities, as we observed in Canada, of using the web to provide musical tuition at a distance for primary schools that are just too isolated even to benefit from a peripatetic tutor face-to-face. Recent pilot work with the Royal Scottish Academy of Music and Drama, using the UHI videoconference system to provide assessment at a distance for school pupils studying for grades in traditional music, is an exciting innovation and one that shows huge potential for social and educational inclusion of minority subjects when universal broadband access is considered. Nor is potential restricted to text-based or sound files. As we have described previously (Rennie and Mason 2003) the interactive combination of complex files that present high resolution images (art work) with text (poems) and sound (recitation) in projects such as the Leabhar Mor¹⁵ initiative (Great Book of Gaelic) provides a unique insight into the culture of a lesser-used language, and a unique opportunity for the minority culture to present and project their self-identity to a global audience. Opportunities for language learning online, for 3d imaging, and for linking with Global Positioning Systems to provide spatially interactive resources can be combined with the increasing convergence of reception devices (witness the rise and evolution of the mobile phone) to provide a seamless transition between formal, informal, and 'accidental' learning (Rennie and Mason 2004).

4) Improving efficiencies in existing provision

The immediacy of broadband access offers new educational opportunities for efficiency gains and resource sharing. This may be in the area of e-procurement (institutions banding together to purchase online) or in the

¹³ *TrEACL – Technology to Enhance Adult and Community Learning*
<http://www.acllearn.net/content/treacl>

¹⁴ *Dance instruction manuals can be found*
[athttp://memory.loc.gov/ammem/dihtml/divideos.html#vc034](http://memory.loc.gov/ammem/dihtml/divideos.html#vc034)

¹⁵ *Leabhar Mor is at* <http://www.leabharmor.net>

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extension of networked libraries and resources, or simply through sharing modules between institutions. A recent report of the joint Scottish Further and Higher Education Funding Councils stated that ‘fundamentally, we believe students in the future are going to need and demand greater flexibility in the mode of delivery, in the choices which are available to students, and in the ways in which students interact with each other and with their teachers’ and that they ‘... kept returning to the possibility that e-learning may become a mainstream embedded feature of Scottish further and higher education.’ (SFEFC/SHEFC, p. 3)

As digital data archive resources are created and linked through portals, or gateway sites, the gap between the learning resources available to universities and those for the general public is narrowing. SCRAN¹⁶ is a learning resource service hosting a huge range of images, movies and sounds from museums, galleries, archives and the media. It can be used generically – as a substitute for clip art – or for particular learning applications and is generally copyright free. Fox and Johnson (2001) stress the importance of network solutions for enhancing learning and the exciting potential of new generation Internet techniques or applications that make new opportunities possible, for instance ‘Internet2 networks provide the kind of real-time, high-quality audio and video that, for the first time, enable distance coaching at the highest levels of musical performance.’ (Fox and Johnson 2001). They also emphasise that networked solutions for e-learning and e-administration should be incorporated within the mainstream of the institutional operational systems, rather than be regarded as some sort of high-technology add-on. High definition video, interactive TV and online games that involve bulk file transfer or complex interactivity with others also become possible with broadband, and it will be interesting to observe the changing importance of ‘edutainment’ in relation to the formal educational systems at primary, secondary, and tertiary levels (Buckingham and Scanlon 2004). We are loath to make any predictions in this fast-changing environment, but feel secure to say that the incorporation of broadband access into both formal and non-formal education will result in learners engaging with more multimedia presentations or simulations, and will see a burgeoning of more diverse forms of assessment.

¹⁶ SCRAN is a www.scran.ac.uk

5) Widening access to education

Three major areas of transformation in this sector include: new learning opportunities, the reduction of psychological barriers to access (making technology more transparent, more context and less content-driven) and a fundamental shift to student centred learning in which the learner is able to exercise a real choice in what, when, and how they construct their learning experiences.

The spread of broadband to the home promises a blossoming of informal learning as all members of the family find resources on the web to capture their interest. Informal learning through games, browsing and online interaction may soon overtake formal learning as the primary educational use of the Internet. Broadband access from the home reduces the difference between the campus, the home and any other place of study. It therefore raises the issue of what the best use of the campus actually is? Socialisation? Support?

Broadband can be exploited to widen access to educational material and new learning opportunities by using links from schools to the wider communities, such as libraries, museums, theatres and other cultural institutions. Broadband is also used as a means of widening access in rural areas and providing access to education materials to learners with disabilities or behavioural problems. Nash et al (2004) gave nine examples of ICT-facilitated networks in education and learning;

- Community of previously excluded learners
- Open access to online experts
- Teacher-teacher
- School-school
- School-community
- College-college
- University-students
- University-schools
- University-community

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They stress the possibilities for more flexible modes of governance and institutional change though using broadband-enabled networks that by their nature encourage rapid interaction, are less hierarchy-dependent, and function through adaptive change. They also list six potential roles for technology in reconfiguring access in learning and education:

- Restructuring networks (moving away from a one-to-many teacher-led broadcast model)
- Redistributing communicative power between providers and consumers (students network with each other and experts sources to develop their own views)
- Creating or eliminating gatekeepers (utilising teachers in different roles)
- Expanding and contracting geography (enabling educating outwith the classroom or campus)
- Control over content (students become content providers as well as consumers)
- Changing cost structures (raising the costs of elearning production, but lowering delivery costs)

The growth of repositories in universities and colleges across the UK by JISC and other bodies is another way in which access to both formal and informal learning has already been extended. A repository is a digital store of information, such as research outputs and journal articles, but also potentially a wealth of other information, created by teachers, academics and researchers. In the case of JISC, these are made openly available to all who wish to access them. Their great advantage is that they enable the free sharing of information, encouraging collaboration and the widespread communication of UK education and research activity.

WHAT ARE THE DOWNSIDES?

It would be wrong to paint a uniformly positive picture of the world with universal access to broadband. Information without the skills to apply it, to distinguish the useful from the misleading and to know how to analyse, select and summarise is just information overload. What it does highlight is that

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access to information is no longer the real issue. Teachers need to rethink the whole curriculum, consider the skills students need, and cease to be led along by the technology. Students need to develop the facility to study from the screen, to work with people they have only 'met' online, and generally to think digitally. E-learning can be a very isolating experience when students are unfamiliar with the environment, and learners need a lot of self-motivation in order to persist. We can very quickly become dependent on the system always being there, virus-free, working 24/7, and responding instantly.

The online world has its own etiquette which some learners resist. The speed of broadband helps prevent this resistance, but many learners seem to be permanently wedded to words on paper as the only medium for learning. Broadband offers a much richer learning environment – voice, moving image, learning by doing – but learners need to be adaptable and willing to learn in new ways.

One of the tensions in the deployment of this technology is that the need for standards conflicts with the desire for putting access to resources in the hands of learners. Even if Scotland achieved universal broadband access, it will still be a long time before this is available to the rest of the world. This is especially true of the rural world, with the bias of the existing telecommunications infrastructure towards major urban centres presenting a particularly urban-rural context to the digital divide. In fact, whatever the technology, there are always the have-nots. This has knock-on effects in planning and deployment of broadband. This does not just mean coping with the threat of destructive computer viruses, the dependence on connectivity and the frustrations of downtime or the challenges of plagiarism. Hvorcky (2004) likened the ability to cross the digital divide to crossing an economic barrier, and noted that 'broadband connection, high-resolution screens, and other course producers' expectations are often difficult to achieve in many countries.' Even within the UK, the limitations of being unable to guarantee a consistency of high quality connection to Internet facilitated resources will restrict the speed of adoption of new applications and techniques by e-learning course designers in formal education, with the equivalence of student experience becoming an emerging issue of contention. Once a robust network access has been established, there are of course new difficulties in the identification and selection of appropriately reliable learning resources, as the entertaining 'postmodernism generator' of random nonsensical papers clearly

demonstrates¹⁷. Foremost among the concerns of e-aficionados are 1) achieving the 'culture-shift' among their colleagues to view the incorporation of technology as a potential solution to enhance learning rather than a technological irrelevance to be avoided or resisted; and 2) ensuring the adoption of a new etiquette for electronic communications and Internet use that is consistent across the institution and beyond. This consistency would include a relevance to staff workload, student aspirations, means of staff-student interaction, and a recognition of realistic costing methods for learning resources. In many instances that expectations of students are already well in advance of establishment recognition of their needs (Weyers et al 2004).

SUMMARY

A considerable amount of energy has been directed at campaigning and planning for the deployment of broadband Internet connection across Scotland. Recent announcements give encouragement to hopes of wider access, even in very rural and remote areas, using a variety of technologies including fibre, wireless, and satellite. Far less consideration has been given to the possible applications of broadband once a user has access, and this is an area of prime concern for the immediate future. Although evidence from areas that have had broadband access for some time (especially Canada, Scandinavia, and UK hotspots) has shown a remarkable variety of new uses, there has been a very poor dissemination of case studies (good and bad) with even this largely restricted to circulation within specialist areas (medicine, e-business etc.). Huge opportunities exist for awareness-raising, training, and cross-sectoral sharing of ideas.

Research shows two clear aspects:

- 1) Simply transferring off-line business or learning practices to an online format is of little use without a re-appraisal of the culture of the organisation and purpose of the activity. Businesses and educational activities that identify the strengths of broadband and the online medium, then re-design their working practices to capitalise on the new media, appear to be most successful.

¹⁷ *Postmodernism Generator of randomised spoof academic publications*
<http://www.elsewhere.org/cgi-bin/postmodern>

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- 2) The opportunities that may be realised by activities that adopt such a culture-shift demonstrate levels of innovation and entrepreneurial activities that are both rapidly changing and unpredictable.

Although the 'digital divide' between those who have access and those who do not is set to be a continuing issue, a recent study has indicated that 98% of current school-age children make use of the Internet. As these people enter our work places and higher educational institutes they will expect the wider resources and services that broadband can support. As schools, health centres, and other public buildings are connected to a broadband network, there will be increasing internal and external pressures to maximise the capacity of the broader bandwidth. Comparisons with Canada and Ireland indicate a major shift in perceptions takes place as society moves from considering broadband as an enabling infrastructure to seeing it as a key determinant of socio-economic development. We are still in a culture in which e-learning is a newcomer, despite much compelling evidence that e-learning is part of a distributed education solution to widening access and strengthening learner-centred provision. We consider that the difference between what is possible in the shift from narrowband to broadband is itself of an order of magnitude greater than the shift from face-to-face to narrowband e-learning. This being the case, we have barely scratched the surface of what it will be possible to provide in the way of educational resources and student support, far less have we begun to address the issue of staff development and awareness in the educational sector. Teachers, lecturers, and training agencies are on the cusp of a major culture change in education, and yet the majority of educators appear to dismiss the issue as just something to do with computers.

Woodill (2004) has itemised five steps that he believes need to be taken in order for e-learning to succeed:

- 1) Learners and instructors must each be prepared for working with e-learning.
- 2) The focus of the industry must shift from electronic technologies to electronically mediated teaching methods.
- 3) New instructional activities and strategies that use the unique characteristics of interactive and networked electronic environments need to be developed and made easy to use.

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- 4) New understandings of both learning, and the differences in the generations of learners, need to be articulated and incorporated into instructional design, especially new research on brain functioning and learning, and on 'embodied recognition'.
- 5) The computer interface with learners needs to be broadened beyond the computer screen to new configurations such as wearable computers, digital paper and ink, and invisible embedding of computers in the environment.

With ubiquitous broadband access to the transfer of digital information, it will be lack of imagination that will limit our capacity for distributed learning rather than accessibility or cost issues.

ISSUES FOR THE FUTURE

The introduction of broadband 'represents a major systemic change to traditional methods of teaching, learning, and administration and therefore needs to be accompanied by effective change management processes to ensure that all stakeholders feel motivated and reassured to want to use it' (BSG 2003)

Crucial to the uptake and widespread use of broadband is the upskilling of teachers. Instead of trying to control technology, teachers need to embrace it. Education should be the driver, not technology. Broadband should allow teachers to let educational priorities dominate and technology become the servant. This will, however, result in a change in the experience of knowledge – from being something that is given (or told) to us, to something that we seek out, verify, and to some extent personalise to our own appropriate context. It is also about using broadband technology to assist in providing an 'educational pull' rather than a 'technological push', and although there will be heightened elements of training required, both for staff and for learners, this should be on how to best use the technology, rather than studying the technology itself. Inherent in all of these culture shifts is the establishment of repeated patterns of trust:

- Between the learner and the new technology
- Between the learner and the institution
- Between the staff and the learner

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Seen in this context we might see universities as access doors to facilitate knowledge acquisition and analysis – they become ‘key learning providers’ rather than the historical repositories of knowledge. The policy implications of this for the entire educational establishment are enormous. As we see a steady shift towards ubiquitous access to education and independence of place or time (including mobile and wireless access) some fundamental questions are raised regarding the balance between the continued investment in bricks and mortar and the investment in the training, support, and even the remit of educators.

When other public and social policies are examined through the lens of broadband accessibility and uptake, the concern is no longer simply of striving to maintain a level of international competitive advantage, but is itself a driving force for change and sustainability. Matters of copyright, the use of knowledge, and the transparency of decision-making come to the fore. A strong argument has been made for the ability of broadband to assist in nurturing local distinctiveness and niche marketing of local quality to global markets. Opportunities for new levels of partnership present a vision not simply of ‘lifelong learning’ but of pervasive learning situations that combine the best of the workplace, the lecture room, and networked libraries and museums. The convergence of technologies offers innovative solutions for both business and leisure, with a window for Scotland to have a hub position in the design, development, delivery, and facilitation of next generation Internet services. All of this requires that educational services be re-positioned to take full advantage of the benefits while striving to resolve new solutions to minimise the disadvantages.

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June 2005