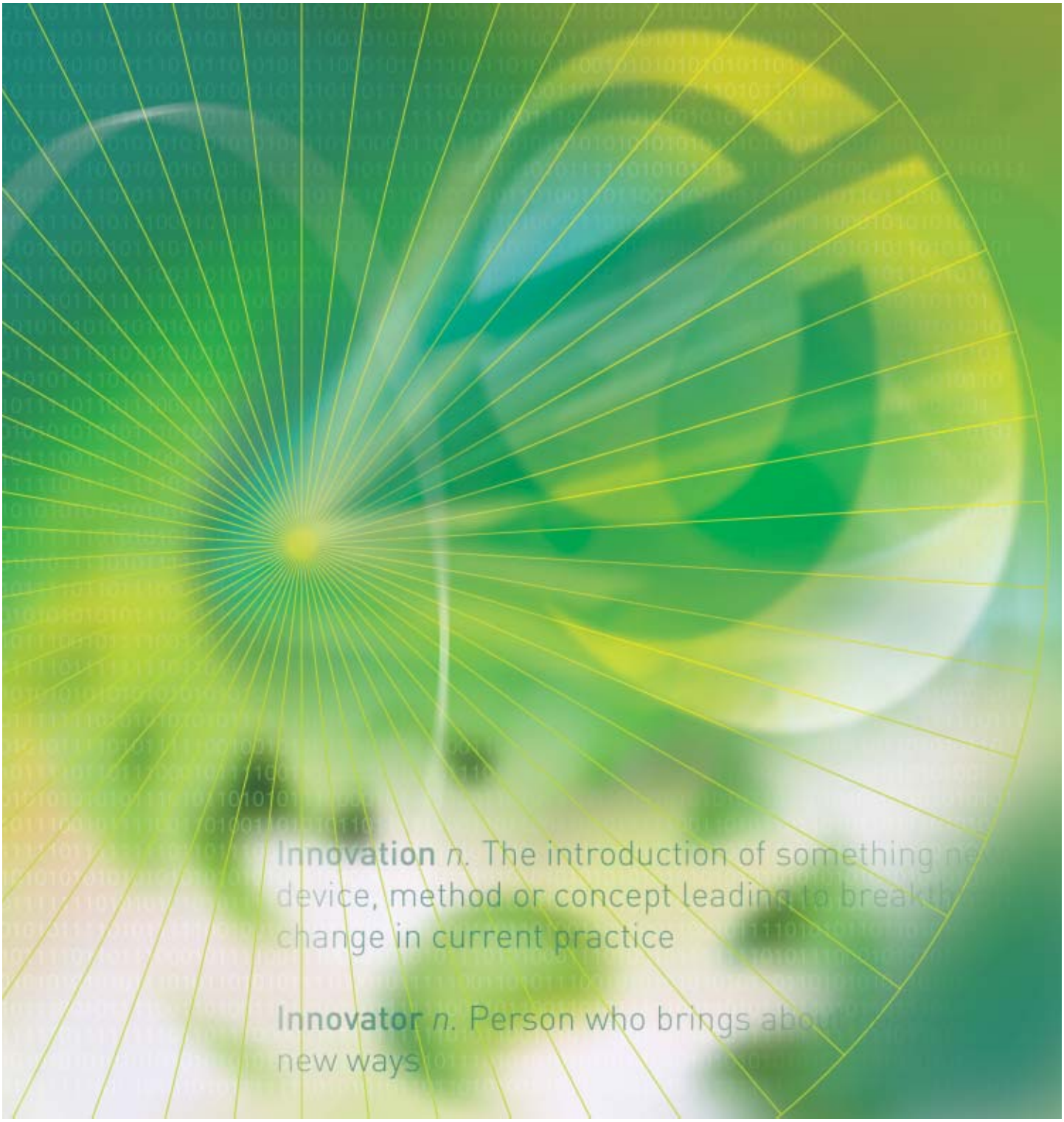
JISC

Innovative Practice with e-Learning

A good practice guide to embedding mobile and wireless technologies into everyday practice



JISC supports UK post-16 and higher education and research by providing leadership in the use of Information and Communications Technology in support of learning, teaching, research and administration. JISC is funded by all the UK post-16 and higher education funding councils.

The JISC e-Learning Programme promotes the development of national and international standards for effective e-learning in collaboration with partner agencies and national strategic bodies, and in consultation with the education and research sectors. Information about the programme can be found on the JISC e-Learning Programme website.

www.jisc.ac.uk/elearning

JISC

Innovative Practice with e-Learning

Further information

For further information about the Innovation strand of the JISC e-Learning Programme, please contact:

Sarah Knight
Programme Manager: e-Learning and Innovation
JISC Development Group
University of Bristol
2nd Floor, Beacon House
Queens Road
Bristol, BS8 1QU

Email: info@jisc.ac.uk
Tel: 0117 954 5083
URL: www.jisc.ac.uk/elearning_innovation.html

Your feedback on this publication is welcome. Please complete the evaluation form, which can be found on the e-Learning and Innovation website (www.jisc.ac.uk/eli_feedback.html).

To find out about forthcoming JISC developments, join the JISC-Announce mailing list. Send the message: 'join JISC-Announce YourFirstName YourLastName' to jiscmail@jiscmail.ac.uk.

Contents

Case studies with this symbol are also available in video format.

Acknowledgements

The JISC e-Learning and Innovation team wishes to acknowledge the support of the JISC Learning and Teaching committee and the contributions of the many individuals whose work has informed the development of this guide, in particular Agnes Kukulska-Hulme, Diane Evans, The Open University; John Traxler, University of Wolverhampton; Helen Beetham, consultant; the Media and Learning Technology Service, University of Edinburgh; Dr Rhona Sharpe, Oxford Brookes University; Adam Blackwood, JISC Regional Support Centre South East; Alistair McNaught, TechDis; David Sugden, Dewsbury College; Geoff Stead, Cambridge Training and Development Ltd (CTAD); Dan Sutch, NESTA Futurelab; Harry Brenton, Dr Roger Kneebone, Imperial College London; Dr Geoff Elliott, Pembrokeshire College; Peter Rainger, Key2Access; Ros Smith, consultant; and the staff and learners at institutions featured in the case studies:

Bishop Burton College

CETADL, University of Birmingham

City College Southampton

Dewsbury College

Ealing, Hammersmith and West London College

Gloucestershire College of Arts and Technology

North Hertfordshire College

Northumbria University

Thomas Danby College

University of Strathclyde

University of Sussex

Foreword

The JISC Learning and Teaching committee launched the e-Learning Programme in October 2003. This has four development strands which together are providing a major impetus for e-learning in UK post-16 and higher education. The programme includes the funding of projects to develop an improved technical framework, support the development of tools for e-learning, encourage regional and subject-based collaboration, and offer opportunities for experimentation with new technologies.

Dealing with pedagogical and technological issues, the e-Learning and Innovation strand of the programme explores ways in which institutions can enhance learning through the design of learning spaces and use of innovative technologies – in particular, mobile and wireless technologies such as voting devices, multimedia personal digital assistants (PDAs), mobile phones and stronger wireless networks, and gaming and 'virtual world' simulation software. The aim of the strand is to offer guidance to institutions in making effective and appropriate choices in these areas.

Innovative Practice with e-Learning focuses on mobile and wireless technologies, still relatively new to many institutions but becoming the subject of keen interest in all parts of the sector. As the principal of a college which is now almost entirely wireless-enabled, I believe that mobile and wireless technologies have the potential to transform all aspects of the institution's functions, from learning and teaching to the business and administrative processes.

Imagine how interactions in a classroom change when both practitioners and learners have in their hands, and in their control, immediate access to information, learning materials and a range of administrative and support functions. Immediate challenges to traditional classroom practice become apparent. Learners increasingly expect to have as much control over technology as they have in their everyday lives, seeking information and communicating with others as rapidly and as freely as they can outside of class time. Practitioners may need to adjust their practice to facilitate this.

The examples of innovative practice contained in the case studies in this guide demonstrate how these changes are already taking place in institutions that have taken up the challenge. They show that institutions are recognising the value of personalised and flexible access to learning and that practitioners are becoming more effective managers of learning. At the same time, they illustrate how learners are becoming more enabled and motivated to learn through their use of mobile and wireless technologies.

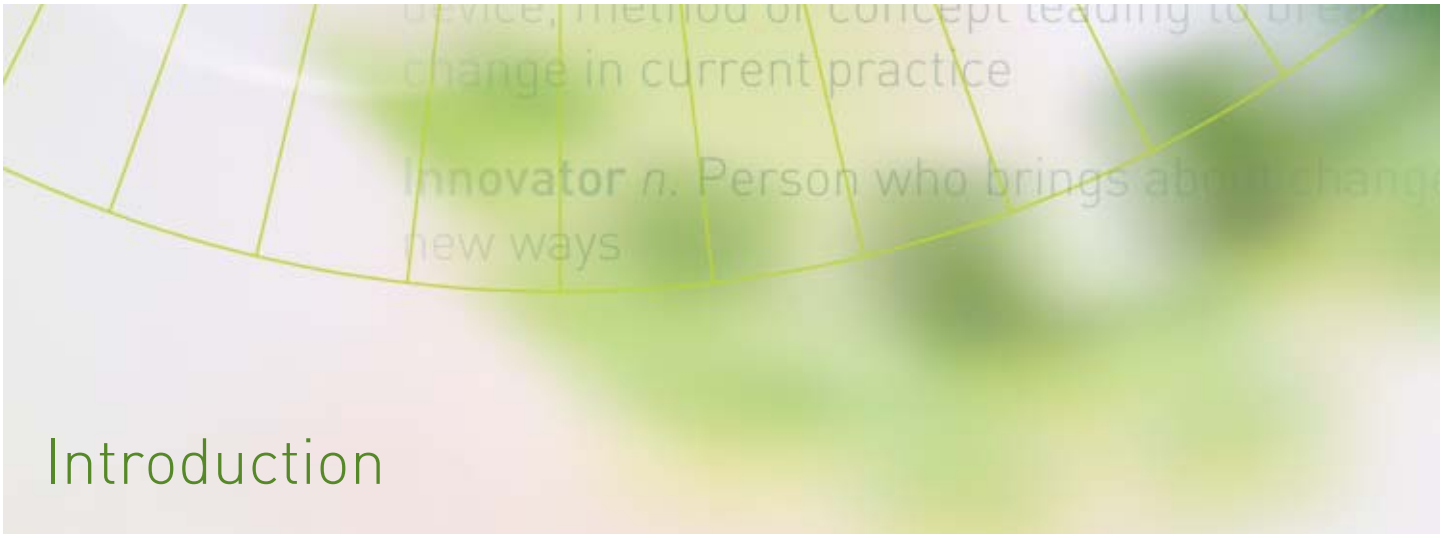
The challenge for us now is to ensure that all practitioners understand how to harness the power of these innovative technologies, and can develop confidence in the new pedagogical approaches they will introduce. I hope this guide will inspire you to innovate, whether as a practitioner in the classroom, a learning technologist supporting others in innovative practice, or as a senior manager with responsibility for meeting the fast changing needs of the 21st century learner.

John Stone

Principal, Ealing, Hammersmith and West London College, and Chair of the JISC Learning and Teaching committee

Innovation ***n.*** The introduction of something new; novel device, method or concept leading to breakthrough or change in current practice

Innovator ***n.*** Person who brings about change, adopts new ways



Introduction

***Innovative Practice with e-Learning* builds on the practice-focused approach adopted in *Effective Practice with e-Learning*, JISC (2004) and reflects the findings of reports commissioned within the Innovation strand of the JISC e-Learning Programme. Aimed at practitioners and managers in further and higher education, and adult and community learning, the purpose of this publication is to explore roles for mobile and wireless technologies in blended learning, and to establish the key principles behind their effective use.**

Mobile and wireless technologies are not yet in widespread use in post-16 and higher education despite the almost ubiquitous ownership of mobile phones by learners. As a result, the practice evolving around the use of these technologies may still be described as 'innovative' and it is yet to be established whether the pedagogies emerging around them will differ from those now being established around e-learning in general. Key benefits arising from their use, however, are identifiable in the practice illustrated in this guide: These are:

- **Portability**
- **Any time, any place connectivity**
- **Flexible and timely access to e-learning resources**
- **Immediacy of communication**
- **Empowerment and engagement of learners, particularly those in dispersed communities**
- **Active learning experiences**

Some institutions also see gains to be made in improving institutional efficiency and in communicating with an increasingly mobile body of learners in ways that can be made personal to them.

The experiences of practitioners and learners form a vital part of the publication: ten case studies, five with supporting video clips, illustrate how mobile and wireless learning has become established in a range of institutions. Key points from these detailed studies can be used together with a number of snapshots of *emerging* practice to assess an institution's potential gain from these technologies and its readiness to implement them.

How to use this guide

Innovative Practice with e-Learning could be used within an institution to evaluate current practice or to plan for the future. An accompanying CD-ROM contains additional materials for these purposes and can be uploaded to a learning platform.

The case studies represent a range of learning provision and illustrate three different perspectives: those of the learner, the practitioner and the institutional manager. Five of these have video clips, which can be found on the CD-ROM with extended versions of all ten case studies. These may be downloaded from the 'Case studies' section of the CD-ROM for use in staff development sessions. Tools to assist managers and practitioners in auditing their current situation and planning for future use of mobile and wireless technologies can be found in the 'Next steps' section of the CD-ROM.

This guide is designed to build on current practice with e-learning and to enable institutions to make appropriate uses of mobile and wireless technologies. All content is seen as indicative of current trends and is not intended to be definitive.

The reports and case studies which have informed this publication can be found online (www.jisc.ac.uk/eli_outcomes.html).

"The future we describe is already here – it is in the schools, colleges, universities, workplaces and public sector agencies that are leading the way. Our strategy is about embracing this future so that all can benefit."

Harnessing Technology, DfES (2005)

Introducing innovative practice with mobile and wireless technologies

'Innovative practice' is used in this publication to refer to pedagogies based partially or wholly on the use of mobile devices, including those without built-in connectivity, and those that offer mobile access to resources on the web and on the institution's learning platform.

The term 'mobile and wireless learning' has been adopted throughout the publication to reflect the breadth of the illustrations of practice and their implications, and should be viewed as a broad concept involving many of the same technologies and facilities as e-learning, but with access via mobile devices or wireless networks rather than cable-based networks.

The devices illustrated in the case studies in this guide are:

- Laptops
- Tablet PCs
- Mobile phones
- PDAs
- 'Smartphones' with hybrid PDA/phone functionality
- Electronic voting systems
- USB storage devices

What is revealed in the illustrations of their use is that practitioners and managers are beginning to extend e-learning provision to include these devices, finding in them solutions to everyday challenges. Equally important has been the role of these technologies in affording new ways for learners to participate in learning activities. Mobile and wireless devices have supported presentational, interactive and creative forms of learning and, when used with e-learning technologies, rich multimedia learning opportunities have resulted. This potential to enhance learning has been evidenced in different parts of the sector, including adult and community learning and further and higher education, and in support of a variety of approaches to learning.

Most of the case studies demonstrate evidence of embedded use, i.e. that which has moved, or is capable of moving, beyond the short term initiative into supported practice. In a rapidly changing environment, some examples of emerging practice also provide insights into what is on the horizon. However, the focus of this guide is to illustrate practice that is at the cutting edge, but becoming established in mainstream practice. The discussion that follows each perspective highlights benefits and issues that have emerged.

The use of mobile devices in conjunction with wireless networks opens up an additional dimension, which raises further challenges and options for the practitioner and manager of learning. As a result, the discussion of these technologies will extend beyond the use of individual devices in classroom contexts to touch on the impact they may have on libraries and learning spaces, and administration and management of learning.

In the next section, 'Opening the box', the choices and challenges presented by the devices discussed in the case studies are explored in more detail in the context of their use in post-16 and higher education.

Mobile and wireless learning can extend beyond the educational use of small screen mobile and wireless devices to include any application of technology that enables learning and its associated support to be flexible and location-free.

Opening the box: looking at the technologies

In the short space of time they have been used in education and training, mobile and wireless technologies have been fast changing and relatively unstable. As a result, they are often viewed as being 'only for the technically-minded'.

However, projects such as the m-learning project, where mobile devices have been used to target young adults aged 16–24 at risk of social exclusion, have opened up the possibilities inherent in mobile learning to the wider community. Other examples of use may require more introduction, but the vision here is one of rich new possibilities that confront institutions, practitioners and learners with choices and challenges.

The choices

The technologies illustrated in this publication have been selected by institutions and practitioners rather than by researchers and product developers. Consequently, the main case studies show practice based on the most well known technologies, for example, USB storage devices, PDAs, laptops and mobile phones. The reasons for adoption of these technologies reflect their:

- **Wide availability**
- **Ability to support a range of functions**
- **Closeness to, or use alongside, desktop functionality**
- **Ease of use by most learners**
- **Acceptance by learners as a device for learning**
- **Potential to support specific institutional and pedagogical aims**

For example, the use of a tablet PC in the classroom by a practitioner or by an individual student at university is made immediately more acceptable by the range of familiar functions it can support, its image as a desirable tool for business and learning purposes, and the relative ease with which it can support administrative functions and an active, collaborative approach to learning.

These immediate advantages have been extended by a number of services and functions associated with mobile devices. These include:

- **SMS:** Bulk purchase of SMS or 'text' messages can give learners essential information and support group and collaborative activities
- **MMS:** Video, audio files and images can also be added to text messages on MMS-enabled mobile devices
- **GPRS:** This supports functions such as web-browsing and instant messaging on a mobile phone
- **Bluetooth®:** This short-range wireless communications technology enables the beaming of data between Bluetooth-enabled devices e.g. from one PDA to another
- **Keyboard functionality:** A useful addition to third generation mobile phones, which supports wider educational use
- **GPS:** This refers to a satellite navigation system used to determine location
- **MP3 playback:** This enables audio files (voice or music recordings) to be played on a mobile device

Forthcoming developments not illustrated in this guide include fourth generation mobile phones offering TV channels and video play facilities, wearable devices that can enable computer use when engaged in other activities, increased battery life and memory, and high speed wireless networks providing transfer of data between mobile devices at broadband speed.

The technologies

Laptops

Laptops can provide portable access to full desktop and network functionality and have become an established tool in many institutions. Wireless-enabled laptops offer practitioners considerable flexibility, and mobile laptop schemes have attracted external and internal funding to widen participation by disadvantaged or hard-to-reach learners.

View use of this technology in the video case study 'Bringing technology to the learner' on the CD-ROM.

Tablet PCs

These are portable computers in the shape of a notebook or slate, which offer similar advantages to laptops, but are lighter and more supportive of collaborative classroom practice. Tablet PCs can be wireless-enabled and controlled by stylus, voice, keyboard or mouse, and so may have potential for supporting learners with disabilities. They offer students in higher education portable access to resources and collaborative learning.

View use of this technology in the video case study 'Supporting personalised learning' on the CD-ROM.

Mobile phones

Third generation mobile phone technology has converged with that of other devices, such as digital cameras, media players and PDAs, to provide a 'one stop shop' offering some or all of the following options: connectivity, games playing, email, stills camera, video camera, personal information management, keyboard, audio recording, music and video playing facilities.

The most successful educational uses of phones have been straightforward ones, for example sending course information to learners via bulk SMS text messages. They can also provide access to basic skills resources and, when used in conjunction with web technologies, can assist in the capture of information and images.

Read about use of this technology in the case study 'Any time, any place learning' in 'The learner's perspective' in this publication and on the CD-ROM.

Personal Digital Assistants (PDAs)

These are handheld devices designed for personal information management, but being relatively cheap and handy in size, have also proved valuable in supporting off-campus learning. PDAs offer pocket versions of basic office software, providing opportunities to capture information and access learning resources on the move. Wi-fi cards can allow users to connect to a college network and GPS cards can convert these devices into location-sensing tools. The addition of SIM cards can enable PDAs to work as mobile phones.

View use of this technology in the video case study 'Mobile learning and teaching with PDAs' on the CD-ROM.

Electronic voting systems

These can add a dynamic interactive element to large group teaching contexts. Learners are provided with a handset to answer multiple choice questions and responses are read by a receiver in the room. Software installed on the computer converts the responses to summaries projected as histograms or bar charts onto a whiteboard or screen.

View use of this technology in the video case study 'Active collaborative learning' on the CD-ROM.

USB storage devices

Course resources stored on one of these devices at the outset of a course can focus learners' attention on required learning goals, provide a promotional gift to learners at comparatively low cost, and form the basis for collaborative learning.

Read about the use of this technology in the case study 'Strengthening learner involvement' in 'The practitioner's perspective' in this publication and on the CD-ROM.

The vision here is one of rich new possibilities that confront practitioners and learners with choices and challenges.

The challenges

One challenge in embedding these technologies is the usability of the smaller devices. The embedding of mobile technologies into mainstream practice can be affected by a lack of familiarity with the functions of the device, the instability of software, and difficulties in reformatting or creating resources to fit a small screen.

Alongside these issues are the emotional factors which can affect the acceptance of any technology. For example, the case study 'Strengthening learner involvement' in 'The practitioner's perspective' reveals reluctance by learners to use the more sophisticated hybrid mobile phone/PDA. Resistance to the use of mobile devices by learners has not been well documented, but could be based on association of these devices with leisure and lifestyle rather than learning.

There may also be institutional factors hindering adoption of the more sophisticated mobile devices. The perception of a device as a leisure or aspirational item may argue against its use for serious purposes and the training of IT support staff and setting up of systems for booking and recharging batteries may be viewed by managers as a 'step too far'.

The perception of something as a challenge may only reflect its relatively recent development or the innovative nature of its use, suggesting that greater understanding of the potential, and firmer embedding of the practice within institutional support systems, may yet resolve the issue.

A further and more potent challenge for practitioners, however, lies in identifying when and how mobile technologies are best deployed, including the appropriate matching of devices with learners and learning outcomes in the effective design of learning activities.

Establishing the principles

The principles behind designing activities for learning in a technology-rich context have been discussed in *Effective Practice with e-Learning*, JISC (2004). For practitioners planning to use mobile and wireless learning, decision-making will still be based on the key elements of the *learner*, the *learning environment* and the *learning outcome*, and the dynamic interaction between these elements.

However, it may be the case that mobile and wireless technologies offer particular benefits in supporting learners' own personal routes to conceptual understanding or skills acquisition. This is especially the case where mobile devices can link to a wireless network or to the internet. Designing activities which provide opportunities for *personalised learning* – for example in the place, time or frequency of access to learning materials, is a challenge that practitioners now need to address. Implementation of such activities on a wider scale is a challenge for the institution as a whole.

When designing activities for mobile and wireless learning, it is important to consider whether:

- The activity, and use of technology within it, will support personal routes to learning goals
- Practitioners have understanding of learner-centred pedagogies
- Practice based on mobile technologies can be adequately supported
- Staff development in the associated technical and pedagogical skills is available, or is planned

For explanation of terms used, a glossary is provided at the back of this publication.

Taking up the challenge

The part mobile and wireless technologies will play in post-16 and higher education will continue to develop as the technologies change and mature, but the practice illustrated in this publication offers some responses to three key questions for institutions and practitioners:

- **What roles are emerging for mobile devices?**
- **How have mobile and wireless technologies changed, modified or extended current pedagogies?**
- **What is the relationship between mobile and wireless learning and current forms of e-learning?**

Practitioners, as a result of a number of factors, not least the impact of e-learning, are already shifting their practice to focus less on the transmission of knowledge and more on:

- Providing appropriate and differentiated resources to support learning
- Designing and supporting learning activities
- Monitoring learners' progress
- Encouraging reflective practices
- Providing formative assessment opportunities for learners to self-check
- Assisting learners to become part of communities of practice

Some who have taken up the challenge have found that mobile devices can accelerate this process. Mobile technologies place learning firmly in the hands of learners and so could have the potential to move established practice still further towards a model in which learners are supported by practitioners and institutions to pursue their own learning goals, navigating through a range of sources of knowledge, connecting elements to form their own interpretations, then indicating their readiness for assessment.

Evidence suggests that smaller devices have already found their niche in offering support for active learning approaches, for example through the capture of data on location or through on-the-move contact with mentors, tutors or other learners. Ideal for delivering bite-sized e-learning resources to basic skills learners, mobile devices can equally support the acquisition of higher order skills, such as evaluating alternatives, solving problems and drawing conclusions if learning resources can be taken into the workplace, field study or laboratory.

Table 1 summarises ways in which mobile and wireless technologies can support more active and personalised learning experiences within a range of approaches to learning.

Wireless learning hubs re-engage learners

Learners in Pembrokeshire aged between 16 and 24 will soon be able to work with m-learning mentors on personal and professional development. Learners who have opted out of education can develop a CV, prepare for job interviews and manage personal information using wireless PDAs to access the internet and custom-built learning resources. Tutors will guide their progress via the phone and wireless ICT hubs in outreach venues, such as youth centres. Working from the interests and strengths of each individual, the tutor will identify progression routes for each recruit, including information on appropriate training and work experience opportunities.

"Before we were concerned with controlling learners' use of computers, but now the challenge is to know how they are accessing their own technology to enhance their own learning."

John Stone, Principal, Ealing, Hammersmith and West London College

Exploring approaches to learning with mobile and wireless technologies

Perspective	Assumptions	Associated opportunities from mobile and wireless technologies
The associative perspective	**Learning as acquiring competence** Learners acquire knowledge by building associations between different concepts Learners gain skills by building progressively complex actions from component skills	**Mobile phone/PDA:** Bite-sized elements of learning develop individuals' competences **Mobile phone:** m-Mentoring through SMS messaging reinforces behaviours and provides feedback
The constructive approach (individual focus)	**Learning as achieving understanding** Learners actively construct new ideas by building and testing hypotheses	**Wireless networked campus:** 'Just-in-time' mobile access to learning resources on a VLE or portal facilitates discovery of underlying principles **Mobile devices:** Reflective and evaluative skills are developed through mobile access to e-portfolios
The constructive approach (social focus)	**Learning as achieving understanding** Learners actively construct new ideas through collaborative activities and/or through dialogue	**Electronic voting systems:** Active learning is made possible in large group contexts by discussion and voting **Mobile devices:** Can support collaborative learning and construction of meaning through information sharing and discussion **Mobile devices combined with wireless networks:** Opportunities are available for rich learning experiences in the in-situ use or capture of data, sound and images
The situative perspective	**Learning as social practice** Learners develop their identity through participation in specific communities and practices	**Laptops and PDAs:** Mobile laptop/PDA schemes support learning in dispersed communities **Mobile phones:** Ownership of a mobile device enables disaffected learners to become part of a learning community **Mobile devices:** Use of laptops, PDAs or tablet PCs enables learning in authentic contexts e.g. in laboratories, in the workplace or on field trips

Table 1: Exploring approaches to learning with mobile and wireless technologies

Good practice in designing accessible learning is about the learner's ability to engage as fully as possible with the learning experience.

Accessibility and mobile and wireless technologies

For learners with disabilities, mobile devices present both benefits and constraints. Good practice in designing accessible learning is about the learner's ability to engage as fully as possible with the learning experience – use of mobile and wireless technologies can enable that to happen, with full understanding of their potential and limitations.

Benefits

Mobile devices can offer some important advantages to learners with disabilities:

- Participation in activities that might otherwise be inaccessible
- Portable access to appropriately designed e-learning resources
- Avoidance of some of the self-image problems associated with assistive technologies
- Opportunities for self-paced use of learning resources in any context

As the range of possible disabilities is wide, individual assessment of the accessibility of any learning activity is essential; however, the potential benefits of mobile technologies include:

PDAs and mobile phones can assist learners with time management, providing calendar, clock, to-do list, alarm and notepad functions. Mind-mapping software is available for PDAs, as are handwriting recognition, word prediction and spellchecking software, portable keypads and onscreen keyboards, making the planning of assignments possible on a mobile device. Voice recording and camera facilities on some mobile devices offer further alternatives. Dyslexic learners can also benefit from the multimedia options provided by PDAs and mobile phones, such as audio clips, animations, video clips or text-to-speech options.

For many disabled learners, mobile phones really do add value, for example SMS messaging and email can help deaf learners work on collaborative tasks on an almost equal footing with their non-signing peers. The ability to beam files wirelessly between devices can also mean that collaborative tasks are made easier for many disabled learners.

Constraints

Small screen devices and the limited options for altering text sizes, colours and backgrounds do not benefit learners with visual impairment. In these cases, additional magnifying aids may be needed. Other disadvantaged groups could be learners with motor coordination problems. Many learners, but especially those with cognitive difficulties or visual impairment, may also find the non-intuitive interfaces of many mobile devices difficult to use. Alternatives should be sought wherever the accessibility of an activity for any particular learner is in question, but exploration of these technologies will ultimately benefit both practitioners and learners.

Key to the accessibility guide

Comment on the accessibility of mobile devices is given in the 'Focus on the technology' summary to be found alongside the case study featuring its use, and at the end of the extended version of the case study on the CD-ROM. Ticks and crosses indicate where use of the device as described in the case study will support or disadvantage a learner with a disability. 'Possible challenge' is used where it is advisable for practitioners to check the degree of accessibility for individual learners.

Case studies: the learner's perspective

Three case studies illustrate how the use of mobile and wireless technologies can extend learners' ability to engage with and participate in learning

Extended versions can be found in the 'The learner's perspective' section of the CD-ROM

Any time, any place learning

Multimedia learning with mobile phones

City College Southampton

Tutors on ESOL courses have pioneered the use of mobile phones and MMS messaging to support the development of language skills

Widening participation

Bringing technology to the learner

Gloucestershire College of Arts and Technology

A satellite van brings ICT literacy classes to adult learners as part of a community-based learning scheme

Personalised learning

Supporting personalised learning – the Interactive Logbook

University of Birmingham

Development of software for use on tablet PCs opens doors to collaborative learning and personal information management for higher education students

Any time, any place learning

Multimedia learning with mobile phones

City College Southampton

Background

City College Southampton has pioneered the use of mobile phones in classes in English for speakers of other languages (ESOL) with funding from the National Research and Development Centre for Adult Literacy and Numeracy (NRDC).

The challenge

The wide ethnic mix in ESOL classes in Southampton means an equally wide variation in educational experience and achievement. Activities must help learners integrate quickly into the college and wider community.

Innovative solutions

Tutors found that the use of camera phones with web publishing provided an effective way of extending learners' knowledge of the locality, at the same time as creating opportunities to develop linguistic skills in real and meaningful ways. Combined with mediaBoard, developed by Cambridge Training and Development Ltd (CTAD), the use of camera and audio recording facilities in mobile phones has enabled learners to publish project work based on their locality. O_2 XDA 2 phones were used within the project with joint funding from City College and the NRDC.

mediaBoard is a web-based multimedia message board which can receive SMS or MMS messages from mobile phones. Tutors upload an image onto the board in advance of a class activity and create zones within it. Learners working in pairs send information from each zone in the form of pictures, text messages or audio files via a dedicated email address. The mediaBoard allocates the messages to the appropriate zone on the image. In this way, a composite picture can be built up, for example of the college campus at the start of the course for newly enrolled learners. Learners can then take charge of their learning by making recourses for themselves.

Tutors have also developed wider investigations for more advanced groups, such as researching into past movements of populations in and out of Southampton. These activities have had the additional benefit of improving self-esteem and bringing isolated groups of learners into contact with the wider community.

Making it happen

Creating a mediaBoard is not difficult, but as with all new technologies users need to be prepared for some occasional breakdowns in service. MMS messages are occasionally delayed and operators may reconfigure their picture messaging format, preventing the server from picking up messages. Any camera phone or network can be used but it is advisable to check the strength of signal in the area. Involving technical support teams from the outset of the project is recommended.

Key points for successful innovation

- Guidelines on acceptable use and on personal safety while working with mobile phones will be necessary. However, experiences in City College Southampton so far have shown little evidence of misuse or theft by learners.
- Use of mobile phones by visually impaired learners is possible if they are paired with sighted learners, or provided with enlarged illustrations of keyboards.
- Practitioners will need a network of support to enable them to identify and develop pedagogically sound uses of innovative technologies such as mobile phones.

Final word

Other applications could include icebreaking activities, sharing of data from field trips, e-assessment, and research assignments linking students working in the same discipline in other countries.

"Mobile learning helps learners to improve their literacy and numeracy skills and to recognise their existing abilities."

Jill Attewell, Mobile Technologies and Learning, LSDA (2005)

Focus on the technology – Mobile phone

Learning and teaching potential

Can widen participation by hard-to-reach groups

Can enable interactive and collaborative learning

Risks

Loss of or misuse of items

Support implications

Equipment booking and battery charging system

Pedagogical and IT support for practitioners

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
✘	✓	✓	Possible Challenge	✓

Costs

Low per item; bulk purchase of messages will need to be arranged with a preferred phone and network provider

Added value

High in engaging hard-to-reach learners and in off-campus learning

Additional uses

- Dissemination of learning objects such as quizzes
- Institutional and personal development information delivered direct to learners
- Fieldwork evidence gathering

Widening participation

Bringing technology to the learner

Gloucestershire College of Arts and Technology

Background

Gloucestershire College of Arts and Technology (Gloscat) serves a diverse region including both urban and traditional rural communities. As part of the college's lifelong learning strategy, an outreach service has brought ICT classes to adult learners unable to attend college classes.

The challenge

Many adults in low income groups or rural areas remain excluded from the digital revolution, yet ICT skills can offer access to information, a means of keeping in touch with distant relatives, and even a gateway to employment. Further education colleges have offered ICT classes in community venues for some time, but difficulties with broadband connectivity have restricted the range and flexibility of provision.

Innovative solutions

In 2003, the college purchased a satellite communication van (the Satvan), capable of connecting to the internet via the Global Positioning System (GPS) from almost anywhere. The Satvan can enable hard-to-reach learners to develop new skills on internet-connected laptops in their own learning spaces – village halls, urban community centres, residential homes, and even the local pub.

A dedicated team arranges classes and plots the Satvan's route, ensuring it provides two or three classes per day over five days a week. A technician is employed to drive the van and set up the satellite communication, providing a broadband wireless link to the unit's 15 laptops.

Working in their own environment to acquire skills in word processing, spreadsheets, internet research, email and website development has proved very popular with learners. The results can also benefit the community as a whole: creating a village website can involve all age groups in researching and promoting local amenities to a wider audience. Additional value comes from the informality of the learning made possible by this scheme, for example, a local pub has doubled up as a venue for classes while a group of older learners and staff in a sheltered housing complex have worked together to create a booklet on the local town.

Making it happen

Laptops will need maintenance every six to eight weeks; allow for at least one laptop being out of service for maintenance when taking bookings. Laptops can be affected by cold or damp conditions when stored in the van and are easily damaged in transit, so robust equipment is essential. Opportunities for learners to progress on to formal qualifications will be needed, where appropriate.

SatWeb is used to provide connectivity and 24 hour technical support for the satellite equipment used on the Gloscat Satvan. A GPS handset is used to locate the satellite.

Key points for successful innovation

- Technology that works with reliable technical support.
- Team training in disability, equal opportunities and health and safety legislation.
- Promotion and publicity to involve hard-to-reach learners.
- Sources of funding to sustain administration of the scheme, maintenance of equipment, travel costs to venues and training of van drivers. (This project was originally funded by the European Social Fund).

Final word

A mobile laptop scheme can provide a means of bridging 'the digital divide' by ensuring that otherwise excluded learners feel part of a larger educational organisation. Other uses could include supporting remote rural businesses, promoting e-citizenship and capturing local knowledge to develop an oral history of an area.

"The groups most affected by the digital divide are those which are already the most excluded within society."

Digital Inclusion, The Scottish Executive (2001)

Focus on the technology – Mobile laptop scheme

Learning and teaching potential

Widens participation by hard-to-reach learners

Enables personalised learning in the community

Risks

Lack of sustainability without grant or project funding

Dependence on specialist staff

Support implications

Maintenance of equipment

Dedicated staff training

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
Possible Challenge	✓	✓	Possible Challenge	✓

Costs

High. External funding could be sought to assist with start-up costs

Added value

High in institutions serving dispersed communities and disadvantaged categories of learners

Additional uses

Targeted basic skills training in literacy and numeracy

Work-based learning

Personalised learning

Supporting personalised learning – the Interactive Logbook

University of Birmingham

Background

The Interactive Logbook was developed as a research project within the Centre for Educational Technology and Distance Learning (CETADL) at the University of Birmingham, and has received funding from JISC for further development. The Interactive Logbook is now available for UK-wide trials.

The challenge

Students working in groups on collaborative projects in higher education need access to online learning resources and to be able to create, share and amend documents in real-time. Field studies showed that existing personal information management tools offered only some of the functionality required for educational use at this level and did not always integrate well with Virtual Learning Environments (VLEs), portals, other online systems or different makes of software.

Innovative solutions

The aim was to design a flexible suite of software applications optimised for use on tablet PCs which, in conjunction with a secure wireless local area network (WLAN), could support student learning in a variety of settings: lecture theatres, libraries, common rooms, and individual workspaces. The Logbook has been developed for the Toshiba Tablet PC which runs Windows® XP. However, the Logbook software can be run on any Windows environment, including desktop computers. Current plug-ins include:

- Log-writing tool for personal development planning
- Email
- Microsoft® Office
- OpenOffice
- SharePoint® Portal client
- Multimedia notebook
- Organiser
- Chat
- File manager
- Web browser

This combination allows a user to create and manage files, view appointments, use synchronous or asynchronous communication tools, store personal notes and documents, and access learning resources via a wireless connection to the network whenever needed. The Logbook encourages a sense of ownership and control over the learning process, and enables learners to develop evidence for personal development portfolios. The open architecture allows for further software supported by the institution to be added to meet individual needs if required.

Making it happen

Induction for both students and practitioners will help to develop appropriate uses of the Logbook. Practitioners may also need to be prepared for increased demand in online learning resources. Costs of implementation may be reduced as the number of students using their own mobile devices increases. However, loan schemes will be needed for the foreseeable future.

Key points for successful innovation

- Institutions need to evaluate on a regular basis the ways in which curriculum requirements will impact on students' demand for and use of technologies.
- Physical spaces may need to be altered to accommodate mobile learning: informal group working spaces with WLAN access, data sockets and battery charging facilities will be needed, some of these within existing learning resource areas and libraries.

The Logbook may still have wider applications to be discovered. The ability to add plug-ins for additional software could enable the tool to provide support for students with disabilities.

Final word

Installed on a tablet PC, the Logbook software will support learning tasks involving discovery, problem-solving and collaborative learning. Use of the Logbook by students in lectures and seminars could also speed up their understanding of concepts and prepare the way for assessed group work.

Focus on the technology – Tablet PC

Learning and teaching potential

Enables mobile connectivity to course resources, communication and information management tools

Can support collaborative and problem-solving learning activities

Risks

Loss of or damage to devices on loan

Support implications

WLAN and battery charging facilities on all campuses

IT support and induction for learners

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
Possible Challenge	✓	✓	Possible Challenge	✓

Costs

Loan schemes will incur maintenance, replacement and staffing costs

Added value

High where collaborative group working is a course requirement

Additional uses

e-Portfolio development; personal development planning; use of blogs

Innovative practice: the learner's perspective

It is not difficult to see a synergy between the current environment for learners and wireless and mobile technologies.

Firstly, these devices have become an integral part of modern life at approximately the same time that changes in pedagogical practice have focused on the construction of understanding through collaborative and group activities. Social constructivism, in which learners actively formulate ideas through collaborative activities and/or dialogue, is widely adopted as a model of learning in all parts of the post-compulsory sector. As a result, learning and discussion are now as inextricably linked as learning and information retrieval once were.

Secondly, national agendas for widening participation and increasing participation in full time post-compulsory learning have led to an increase in non-traditional learning patterns. Furthermore, new generations of school leavers entering post-compulsory education for the first time are almost certainly daily users of a variety of mobile devices. These factors combine to support the argument that tools for learning in 21st century institutions need to reflect our changing expectations of how, when and where we learn, and that they should motivate learners to become more active and engaged in their learning.

Potential in a technology, however, does not always lead to it becoming embedded in everyday practice. Despite many claimed benefits for mobile learning, the case studies suggest that the greatest added value for learners is likely to be found in the following areas:

Any time, any place learning: Reported advantages for learners using small portable devices with internet connectivity have been:

Spontaneity	Learning activities take place when the learner feels ready, or can be used to fill 'dead time'
Immediacy	Learning becomes possible at the point of need, regardless of location
Increased access	Learning resources can be accessed from the workplace and in the field, while travelling, and during classes and lectures
Portability	Communication with peers and tutors, and the capture, storage and retrieval of information in multimedia formats are possible from one device in any location

"In ten years' time we may look back and say these [PDAs] were all a waste of time, we really don't know. But I would like to see it go down the line of personalised learning. The memory cards could hold an individual's learning needs."

David Sugden, e-Learning Development Manager, Dewsbury College

Widening participation: Taking the technology to the learner may be the only feasible option where, for reasons of distance, disengagement with learning, or social or cultural disadvantage, learners cannot participate in mainstream provision. The advantages of mobile laptop, PDA or mobile phone schemes for hard-to-reach learners have been:

Raised self-esteem	Bite-sized, easily accessed learning increases participation and may encourage progression onto mainstream courses
Targeted funding	m-Learning projects involving ICT and basic skills training have attracted project-based funding
Creation of communities of practice	Learners who are isolated or dispersed geographically or culturally can gain support from contact with wider learning communities via mobile devices
Wider reach	Provision of PDAs or 3G phones for schoolchildren or young adults can cascade skills onto older family members

Personalised learning: Handhelds used in conjunction with an online personal space can provide a sense of ownership over learning, enabling the development of self-evaluative processes. Learning can also be adjusted to individual needs in other ways:

Differentiation	Activities with handhelds can be designed to differentiate between or extend learning preferences
Accessibility	For disabled learners, specific uses of handhelds can overcome barriers found in some mainstream learning activities
e-Assessment	Mobile phones have been used to transmit and complete oral or SMS-based tests and quizzes at levels chosen by the learner
Personal information management	Immediate access to email, timetable, tasks for the day, SMS messages from tutors and peers and to-do lists can improve time management and learning potential for many learners

Innovative e-assessment

The eViva project, developed by Ultralab at Anglia Polytechnic University, has shown the potential of mobile phones and online portfolios as tools for assessment. Candidates in Key Stage 3 in ICT first produced an online portfolio of work, which they annotated and reflected on themselves.

Then for the final part of the assessment, a viva was taken on a mobile phone. The first step was to record a sound file or 'voice postcard' to verify each candidate's identity. The next step was to complete a series of 'I can' statements to find an appropriate level of questions for the viva before registering themselves as ready for the test. With their last learning milestone achieved, the candidates then gave answers to recorded questions via a mobile phone. The viva, along with the milestones, annotations and portfolio material, helped to inform the overall assessment of each candidate.

The results have been positive. Having their own learning space in the form of an online portfolio increased pupils' motivation and engagement, while teachers found they were able to work more closely with individuals.

Final word

Evidence from the m-learning project shows that hybrid PDA/mobile phones such as the O_2 XDA 2 offer learners a similar experience to using web-based learning materials on a computer – these proved successful with the majority of young learners sampled in the trials. They have also received widespread acceptance by other learners – see the case studies in 'The practitioner's perspective'. What has become clear is that the more easily the device can become the property of the learner, the more it is used by them, and where a strong educational need exists for which a mobile device has presented a viable or perhaps the only solution, the results can be powerfully indicative of the value of these technologies in learning.

Case studies: the practitioner's perspective

Three case studies from higher and further education illustrate different uses of mobile devices to enhance learning and teaching

Extended versions can be found in the 'The practitioner's perspective' section of the CD-ROM

Promoting active learning

Active collaborative learning

University of Strathclyde

The introduction of an electronic voting system transforms university lectures into collaborative learning experiences

Empowering learners

Mobile learning and teaching with PDAs

Dewsbury College, Thomas Danby College, Bishop Burton College

Practitioners at three further education colleges show how PDAs have taken e-learning beyond the confines of the campus

Strengthening learner involvement

A digital key to productive learning

University of Sussex

University students explore how course materials on USB storage devices can create opportunities for active learning

Promoting active learning

Active collaborative learning

University of Strathclyde

Background

The Department of Mechanical Engineering at Strathclyde is one of the largest in the UK with some 500 undergraduate and 80 postgraduate students.

The challenge

The first year intake in the department is normally amongst the most highly qualified at entry across the university, yet it was apparent in the mid 1990s that students were having difficulty in understanding core concepts. Attendance and retention figures were dropping, suggesting low levels of student morale. There was also a further concern – that the rise in applications for courses in the department during this period would limit the potential for interaction with students in the crucial first year of their studies.

Innovative solutions

An electronic voting system, Interwrite™ PRS (Personal Response System), was adopted to increase interactivity in lectures. Four large lecture rooms were equipped with infra-red voting devices and receivers, and seating modified to enable students to engage in group discussion while still facing the front of the theatre. Using handsets to answer questions, students could see their responses immediately collated and displayed on a screen via a receiver linked to a laptop and a data projector.

With the introduction of PRS at Strathclyde, the pedagogical approach moved towards a social constructivist perspective, focusing on establishing core concepts through questioning, discussion and debate. Students were asked questions based on background conceptual knowledge, invited to vote, and then required to defend their responses in the face of questioning by others.

Discussing conceptual questions in class with their peers has proved to be a powerful motivating force. Evaluations show that this increased interactivity has improved understanding and retention. Results from diagnostic tests provide further evidence of raised standards in the department. Allowing time for debate and reflection has prompted more active learning – students feel motivated to focus on knowledge gained during a lecture so that they can perform well in what they see as 'fun' assessment activities.

Making it happen

Other similar systems exist, but may have different features and capabilities. It is important to check that the chosen system will support the number of potential users in large group settings. Mobile PRS units will make the system more widely available, but its use will have effects on the timetable: two hour rather than one hour sessions will be needed to enable group discussions to take place. As a result, not all curricular content can be covered in class.

Key points for successful innovation

- With this system, multiple choice questions and peer-to-peer discussion can bring to life the less accessible aspects of a curriculum.
- Lecture spaces will ideally need to be reconfigured to encourage discussion. Questioning and debate engage each individual in thinking through an answer, and are vital to success.
- Workshops for practitioners are recommended to support the writing of effective questions and meaningful feedback.

Final word

The use of PRS at Strathclyde has been fully evaluated by the Department of Psychology at the University of Glasgow. This revealed that students interact with lecture content and with each other in a number of different ways when using polling devices and that the variation in techniques stimulates learning still further.

Surveys show that over 90% of students felt that concepts were learnt more effectively when they had the opportunity to discuss and question.

Focus on the technology – Electronic voting device

Learning and teaching potential

Enables learning through collaboration, questioning and discussion

Can increase lecturer-to-student interaction in large group contexts

Can increase students' motivation to learn

Risks

Impact on timetabled course delivery

Loss of handsets

Support implications

Training for staff adopting new pedagogies

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
Possible Challenge	✓	✘	Possible Challenge	✓

Costs

Low-to-medium, but adaptation of lecture theatre seating will increase costs

Added value

High in large group teaching contexts

Additional uses

Formative assessment, if results are recorded individually as well as by group

Empowering learners

Mobile learning and teaching with PDAs

Dewsbury College, Thomas Danby College, Bishop Burton College

Background

Dewsbury College of Further and Higher Education and Thomas Danby College support predominantly urban multi-cultural communities in West Yorkshire. Both colleges make extensive use of community- and work-based outreach centres. Bishop Burton College offers a range of land-based courses and is a Centre of Vocational Excellence (CoVE) in agriculture.

The challenge

All three colleges see widening access and developing personalised learning programmes as priorities. Providing access to learning resources in outreach and work-based environments pose particular problems. These contexts typically offer few opportunities to access the benefits of e-learning, for example reviewing resources at the learner's own pace, self-testing of knowledge and understanding, and sharing of data electronically. Any technology used would also have to be lightweight, strong and portable.

Innovative solutions

In response to these challenges, staff at the three colleges experimented with different approaches to producing resources for use on PDAs.

At Dewsbury College, web pages have been scaled down to fit the smaller screen of the PDA, with hyperlinks to video and audio files to support different learning preferences of learners on NVQ child care courses. At Thomas Danby College, resources in Macromedia® Flash® on the PDA have been used by basic skills learners in 'drill for skill' activities with tutor support. Audio files have also proved valuable to English for speakers of other languages (ESOL) learners in the acquisition of vocabulary and linguistic skills. Lack of familiarity with the technology did not present problems for learners – navigation with a stylus on the PDA was found to be easier for learners unused to navigating with a mouse.

Learners at Bishop Burton College have used PDAs for recording, storing and interpreting data in a vocational context. The opportunity to take pre-prepared calculations into a workshop or outdoor context has usefully combined practical and analytical skills, and introduced an element of 'cool' into work-based learning!

Making it happen

PDAs vary in cost and weight and need to be selected to suit the required use. Resources will work best if they are built for use on PDAs: the small screen size will mean adjustments are necessary to view others. Web pages, for instance, need to be 220 pixels wide to ensure functionality. PDAs are also small and can easily be lost, so booking systems with clear accountability for equipment on loan is essential, as are battery charging facilities. Batteries will need charging after 4-6 hours of continuous use.

Key points for successful innovation

- Funding will be needed for the development of resources, or for in-house technologists with knowledge of different file formats to develop or convert existing resources for use on PDAs.
- Staff champions can advise practitioners on the use of small screen devices to encourage innovative and pedagogically sound uses of PDAs.

Final word

PDAs can support dynamic group activities without internet connectivity by the use of beaming, but like all new technologies it is essential that they are not put to unsuitable uses, such as conveying large quantities of information in text format. Some learners may not be able to use small screen devices successfully. Accessibility issues should always be considered and alternative routes provided.

"With personalised learning and a wider clientele planned for both further and higher education, I think that we should at least explore the use of PDAs for our learners."

Janet Pittaway, Assistant Principal, Dewsbury College

Focus on the technology – PDA

Learning and teaching potential

Can widen participation by hard-to-reach groups

Can support fieldwork and vocational training

Can develop personal organisation skills

Can support self-paced learning

Risks

Loss of items

Difficulties in replacing single items if the technology changes

Support implications

Resource production and/or adaptation

Staff training

Equipment booking and battery charging system

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
✘	✓	Possible Challenge	✘	✓

Costs

Low per item

Added value

High in outreach and work-based learning contexts

Additional uses

Sound recording and playback

Strengthening learner involvement

A digital key to productive learning

University of Sussex

Background

The SMILE project had previously explored the use of the O2 XDA, a PDA with mobile phone features, with students on the Interactive Learning Environments course in the School of Science and Technology at the University of Sussex. Students were issued with these devices to use as their own during the project to develop and evaluate their own collaborative and interactive learning experiences.

The challenge

Adapting the XDA to an educational context proved time-consuming and costly; the start-up costs also restricted the number of devices on offer. Furthermore, students' initial enthusiasm for the device waned once the trial was underway. They found the XDA too large and complex for everyday convenience, yet too small to manage a full range of files.

Despite reservations over the suitability of the combined mobile phone/PDA as a tool for this context, tutors still aimed to encourage greater ownership of digital learning materials.

Innovative solutions

A tool which offered a cheap and unobtrusive solution was the USB storage device, also known as a 'pen drive' or a 'memory stick'. Students who were provided with a 256MB USB storage device containing course materials were required to find new resources from their own research and to upload them to a centrally shared resource bank.

While the storage device offered no access to the internet or the course website, it could act as a bridge between contexts of use. Students quickly found the flexibility of the storage device invaluable, not only in storing 'found' and newly developed resources of their own, but also in discussing their work with peers. Finding and sharing resources formed part of the course assessment: analysis of usage was recorded in a course log, resources were discussed in seminars and a snapshot of the content of each storage device revealed the extent of its use at the end of the course.

The main advantage of the storage device was that it was not seen as intruding in the learning process. The wide availability of access to IT for most students both on and off campus had diminished the value of continuous connectivity. The storage device, which is compatible with both Mac® and PC platforms, offered a 'one stop shop' for all the resources they required.

Making it happen

It is important to check if any USB ports within the institution, particularly in the learning resources area, are locked or inaccessible. Students using USB storage devices to carry important files between locations should make backup copies in case of loss. Unless devices are going to be given or sold on to students, conditions of return need to be clearly understood.

Key points for successful innovation

- Technologies need to be chosen in relation to the desired learning outcome – the focus should be on the value to the learner and not on the technology.
- Students need to be aware of intellectual property rights (IPR) that may affect the storage and transfer of others' work.
- In some cases, transfer of viruses to the network may be possible. Use of storage devices should therefore be approved by a network manager.

Final word

Students encouraged to take ownership of course resources become more confident learners and develop into more productive and innovative thinkers. The USB storage device offered an effective way of achieving this.

"The students were fairly unexcited about being given the pen drives, but very reluctant to give them back."

Diane Brewster, course tutor, Interactive Learning Environments, University of Sussex

Focus on the technology – USB storage device

Learning and teaching potential

Can encourage student ownership of digital course materials

Can support collaborative activities

Enables continuity of work across different locations

Risks

Loss of devices

Network security clearance needed in some cases

Support implications

None

Accessibility summary

Motor	Mobility	Hearing	Vision	Cognitive
✘	✓	✓	Possible Challenge	✓

Costs

Low per item

Added value

Encourages personal ownership of learning

Additional uses

- Summative assessment
- e-Portfolio development
- Promotional item for courses
- MP3 playback and recording facilities and browser available on some models

Innovative practice: the practitioner's perspective

The same key principles apply when designing learning activities with mobile and wireless technologies as when designing any learning activity.

Decisions made by practitioners will be formulated around the interaction between three elements – the learners, the learning environment and the learning outcomes – to produce the most effective learning experience. The evidence here suggests that mobile and wireless technologies can be viewed as extending the options available to the practitioner, especially in specific contexts or niche activities. Such technologies could also support more innovative learner-centred pedagogies.

Mobile devices *extend* the range of contexts in which these activities can be offered and, coupled with a wireless network, can enable learners to take part in dynamic interactive or immersive learning, generating learning resources as part of their own collaborative investigations. This increase in the reach and diversity of activity can be found across all approaches to learning design – see Table 1 (page 15).

Case studies in 'The institutional perspective' offer more information on the role of wireless networks in mobile and wireless learning. However, it is worth noting here that a wireless network offers practitioners arguably the most flexible access to options around which to construct pathways to learning, including:

- Online resource-based or problem-solving activities
- Collaborative activities based on synchronous and asynchronous communication
- Opportunities for reflective practice and assessment
- Enhanced ways of delivering face-to-face learning
- Immersive learning experiences

The potential advantages to practitioners from these developments have been divided here into four areas; each could take the adoption of mobile and wireless learning beyond localised projects.

Promoting active learning: Use of various mobile devices has been found to promote active and collaborative learning, as can be found in the case studies attached to this and other sections. The key benefits recorded are:

Spontaneity	Opportunities are available to instantly test knowledge and understanding via electronic voting systems in class and quizzes transmitted via mobile phones
Immediacy	The recording and transmitting of multimedia learning content from the field can create a personal learning journey or build resources for others
Interactivity	Wireless connectivity or use of SMS messaging can enable peer-to-peer and learner-to-tutor communication as and when needed
Self-evaluation	Discussion of work on location can occur from a handheld device via email or blogging

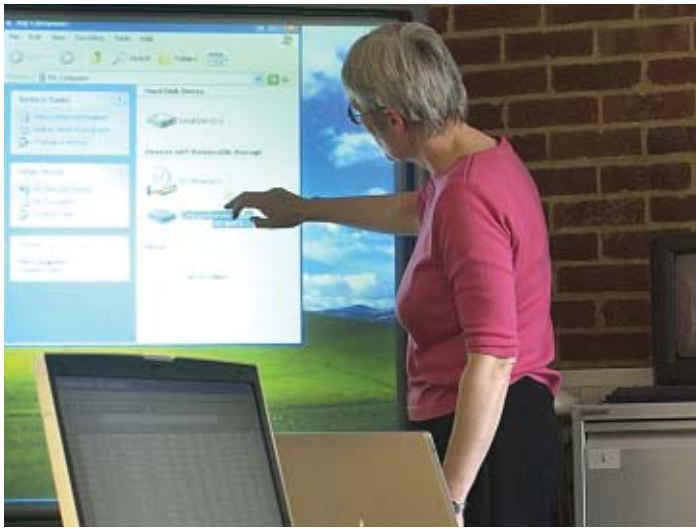
Empowering learners: The smallness of the mobile device can place learning activities quite literally in the learners' hands. The spontaneity of activity that use of a pocket-sized device can offer means that learning can be unobtrusive and convenient. This can be a powerful motivator for disaffected or less experienced learners. Other benefits include:

"If you want a new idea, look at a different view." Anon

Motivation	Bite-sized resources delivered via a small screen can encourage participation in learning
Control	Opportunities are available to revisit content, add to e-portfolios or test knowledge in learners' own time and chosen location
Portability	Can be used in a range of contexts, including work-based, community and family learning
Recording achievement	Learners' achievements can be recorded via audio, video or stills images by learners themselves

Strengthening learner involvement: Mobile devices have proved their worth in maintaining contact with learners, strengthening the links between them and course leaders, or with the institution itself. Reported benefits include:

Just-in-time information	Alerting/reminding learners of essential course or health and safety information via SMS messages maintains contact with learners
Ownership of learning	Learners' sense of ownership of the learning process can be developed by providing learning materials on a personal mobile device, e.g. USB storage device
Mentor/ tutor support	Rapid responses via text and email can strengthen learners' involvement in course activities



Enhancing the learning experience: An immersive learning experience is described in 'Mudlarking in Deptford' and may offer a new form of learning activity with more complex pedagogies required to extract the full advantage. However, the use of mobile devices as part of a longer blended learning activity or sequence of activities may afford a similar sense of novelty and engagement.

Informal learning	Learning can be enhanced by games and quizzes transmitted via small mobile devices or by taking place in familiar settings
Portability	The potential of group learning is extended by the greater variety of activities and locations made possible by the use of mobile phones or PDAs
Accessibility	Alternative learning experiences can be provided for learners with disabilities
Context awareness	'Just-in-time' information can be available in external locations to create an immersive learning experience

Mudlarking in Deptford

Key Stage 3 learners in the NESTA Futurelab's 'Mudlarking in Deptford' project in South East London are using handheld devices with GPS capability to explore the muddy banks of the River Thames and surrounding area to piece together the past, present and future uses of the site. The technology designed to support this project gives location-sensitive information via the handheld device, triggered when the user walks into designated node areas. Participants can also create new 'triggers': whenever information comes to light in the form of finds in the mud, memories from local residents, visions of how the area could develop, or discoveries of how it once was, learners capture the information to add to a virtual tour via a wireless connection.

A web-based forum has furthered the potential of this project by providing opportunities to discuss and develop learners' thinking in conjunction with their peers and a range of experts, making them the designers, creators and evaluators of a unique historical and environmental study. The learning process can then become an outcome to share with others.

Final word

The attributes of mobile technologies have lent themselves especially well to motivating learners with low basic skills or little sense of belonging to traditional learning communities. The role of these technologies in wider practice is still being explored, but the potential of immersive learning experiences within mainstream courses is of real interest. Currently, such activities are restricted to contexts such as museums and tourist attractions, but some examples point the way to considerably enhanced learning opportunities in mainstream education.

Case studies: the institutional perspective

Four case studies look at the wider implications for the institution of using mobile and wireless technologies. The concluding case study offers a glimpse into the imaginary day to day life of a student in a 21st century university

Extended versions can be found in 'The institutional perspective' section of the CD-ROM

Vision and infrastructure

Changing to a wireless world

Ealing, Hammersmith and West London College

Wireless connectivity transforms teaching and management of learning in a large further education college in West London

Supporting learners

Designing flexible learning spaces

Northumbria University

Changing pedagogical and assessment practices in a university have increased demand for hybrid learning spaces and mobile learning

Changing culture

Building the 21st century college

North Hertfordshire College of Further Education

A new build offers an opportunity to embed mobile and wireless technologies into all aspects of practice in a further education college

Looking to the future

Learning without boundaries

A university for the 21st century

A day in the life of a future university student

Vision and infrastructure

Changing to a wireless world

Ealing, Hammersmith and West London College

Background

Mobile and wireless technologies are seen as an important part of a long term ILT strategy at Ealing, Hammersmith and West London College (EHWLC). The strategy includes the use of a Managed Learning Environment (MLE) by all learners and staff and daily use of tablet PCs by classroom practitioners. By the end of the three year programme, all sites will have wireless connectivity.

The challenge

The college offers over 500 courses to 25,000 learners over four main campus sites. With such widely dispersed learners, the management of retention and achievement presented challenges. Immediate feedback to learners became essential to tackle poor attendance and under achievement. At the same time, there was a need to revitalise learning and teaching to encourage learners to attend. Both the VLE and the Management Information System (MIS) had been developed in-house over several years; both needed to be extended to form a Managed Learning Environment (MLE) that was routinely used by all staff and learners.

Innovative solutions

Practitioners at EHWLC have been issued with wireless tablet PCs to record attendance in class and immediately update central records using the wireless network. Support officers can then telephone students within ten minutes of the registers being marked. The college's online register system is web-based and easily accessible from the four main sites and from the college's off-campus locations. To monitor overall patterns of attendance and achievement, tutors can access the database and take appropriate action. As a result of this initiative, attendance by learners has improved by 10% and figures for retention are up 7% on the previous year. The system also provides up to date summary reports for a variety of management requirements.

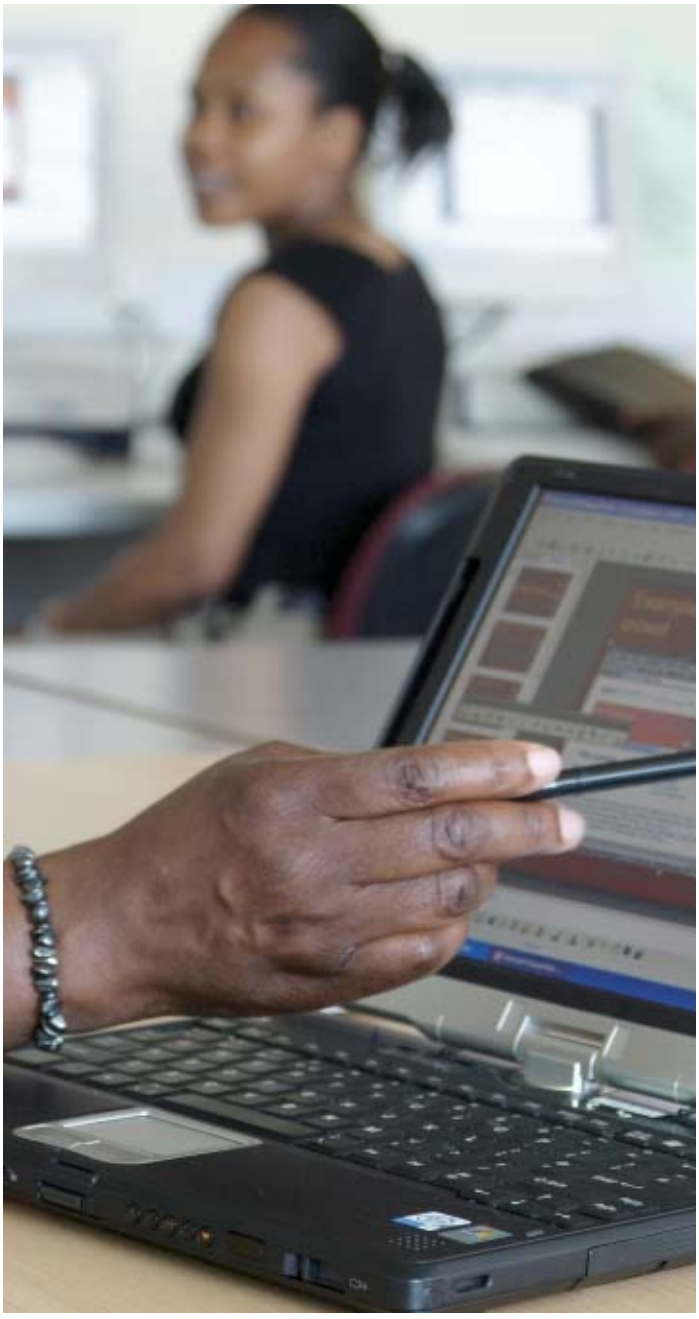
Tablet PCs are also proving their worth as learning and teaching tools. Issued with their own tablet, practitioners have been able to take ownership of the new technology and explore its potential for changing the dynamics in the classroom – for example by developing activities based around learners generating or editing a resource using a shared tablet linked to a data projector.

Making it happen

Wireless connectivity will need to be available as widely as possible throughout the institution. In some buildings and contexts, the signal may be weak – ongoing improvements are therefore needed to the network. Battery charging points will be required in staff rooms to enable practitioners who use tablets routinely for e-registration to gain confidence in using them in more innovative ways. Encouraging the sharing of resources via a VLE or intranet will make efficient use of practitioners' time and help to create a community of practice amongst staff.

"A strategic shift is happening in the role of management information systems: their role will be to support learners and enable learning. Data and information will flow out from them, but that will not be their primary purpose."

John Stone, Principal, EHWLC



Key points for successful innovation

- Boost support for practitioners developing resources for mobile and wireless technologies in order to develop a critical mass in favour of culture change.
- To give learners a similar sense of ownership over their progress, a personalised homepage for each learner on the MLE or VLE can provide access to timetable, attendance record, details of completed and ongoing assignments, schemes of work and learning resources. This information can then be accessed anywhere via the learners' own mobile devices.

Final word

Use of the tablets has helped to build staff confidence in the use of e-learning in general at EHWLC, and practitioners are now committed to their use. The key advantages are convenience and flexibility: the devices are highly portable, can be taken home, to meetings, to the canteen and into the classroom with relative ease.

Mobile tablet PCs or laptops make computer use possible in any teaching environment. They are capable of wireless connectivity, and their relatively small size means that they leave more personal space on a desk. Information on the MLE is kept up to date and can be shared easily in meetings. The technology thus alleviates the requirement to anticipate information needs for staff meetings or classroom interactions.

Supporting learners

Designing flexible learning spaces

Northumbria University

Background

The University Library and Learning Services at Northumbria University are responsible for library and learning support services on two campuses. The City Campus Library, situated at the heart of the city, is the larger of two libraries, with approximately 1.1 million visits per year.

The challenge

The City Campus Library, opened in 1978, had received little investment in buildings or infrastructure. However, student demand for access to IT had been rising significantly by 2004. Facilities were being used at full capacity during opening hours, with queues forming regularly at peak periods.

Changes in assessment procedures and pedagogical approaches were clearly having an impact on students' use of learning materials. Increasingly, students were seeking access to resources on the VLE, to web pages, e-journals, e-books and databases alongside print-based materials. User surveys had shown that the use of print and online resources had continued to increase at an equal rate, demonstrating that they complement rather than exclude one another and should be offered in combination.

Innovative solutions

Factors such as these have led the Library and Learning Services team to redefine the library in terms of a hybrid learning space. Accommodation in the library basement has been reconfigured to provide a mix of resources and attractive areas for relaxation, individual study and group discussion. The result is the 'Learning Café'. The aim has been to use the widest possible application of technology to support 21st century learning and teaching.

Thirty wireless laptops are available on a loan system from the café for use anywhere within the City Campus building. All work areas have access to power and to a standard desktop via a wireless virtual local area network (VLAN). With no rules prohibiting food and drink, the result is a social learning area which extends options for students.

City Campus Library has also now gained, overall, 130 open access workspaces which allow integrated access to print and online resources alongside desktop software and courseware. Although Floor One is mostly given over to study space with IT access, the design of the space and the use of furniture allows the IT to be used in a flexible manner i.e. within groups or individually, as an IT-only activity, or in conjunction with printed materials. A new learner support team provides help with IT and library enquiries in an integrated one stop support facility for students.

Making it happen

It is important to ensure that utilisation of space is kept as flexible as possible in order to 'future proof' the infrastructure. By involving academic staff and students in the design of learning spaces, this helps to ensure the effectiveness of the design. Decisions taken by other institutions can be reviewed, which may help to determine what to implement and what to avoid.

Key points for successful innovation

- It is possible to reconfigure and refurbish existing learning spaces without incurring crippling costs. Careful uses of IT facilities will enable institutions to respond flexibly to changes in pedagogy and learner needs.
- Consideration of non-pedagogical factors within the learning environment, such as levels of noise, lighting and heat, is essential to students' ability to focus on higher order tasks.
- Offering students a varied range of IT opportunities, including loan of laptops on a short term basis or use of their own equipment, will increase their learning potential.

"Talk to and observe your learners. In a library, watch how students use resources, even down to where chairs are left at night. Build an evidence base against which to check your understanding and evaluate new developments by means of user surveys."

Jane Core, Director of Learning Resources, Northumbria University

Final word

A learning space design that is supportive of group work and informal learning is beneficial to students – a choice between types of learning spaces with different functions will enable students to respond more effectively to changing study and assessment requirements. Monitoring changes in students' needs and use of facilities is always of paramount importance in the management of learning accommodation to ensure that appropriate options can be provided. Personal use of IT by students, for example, may now need to be considered in library and IT provision.

User surveys at Northumbria University provided evidence that academic tasks were being compromised by use of open access IT facilities for activities such as checking e-mail, web-browsing or online shopping. The Library and Learning Services staff believe that such activities are legitimate and must be supported, but not at the expense of other academic users. As a result, the concept of casual access points was introduced to meet this demand. These are positioned on a high desk so that users stand to access the IT, or sit at high benches for short periods of use.

Changing culture

Building the 21st century college

North Hertfordshire College of Further Education

Background

The Stevenage Centre, North Hertfordshire College, was opened in 2003 to provide a new learning environment for the local community. The main entrance, or Atrium, functions as a multi-purpose reception area which houses an internet café, a learning shop, and guidance services.

The challenge

In the mid-to-late 1990s, demand grew for a technologically skilled workforce in the area. To contribute to a new vision for the town, a new build was planned which would offer a technologically sophisticated environment to enhance learning and teaching and improve the efficiency of course management.

Innovative solutions

The aim has been to use the widest possible application of technology in support of 21st century learning and teaching. All courses are now supported by flexible IT support options, including hubs of computers within a 'learning shop' for independent learning, computers arranged in suites for class use, and a mock office. Open access IT areas within the internet café provide casual access to learning resources. Computers, printers, scanners and a laptop loan service are available in the learning resource centre.

Teaching rooms are uniformly 'hi-tech' with interactive whiteboards, video data projectors and computers with DVD players and digital cameras as standard equipment. To maximise the use of Blackboard®, the college's VLE, and of other web-based and e-learning resources in classes, access to the intranet and internet is given in each teaching room. In order to offer the most flexible and responsive learning space, the college is now implementing a wireless network.

The guidance service has found that mobile technologies can improve the reach and immediacy of its provision. Wireless-enabled laptops in discreet, screened off interview areas are enabling guidance staff to provide access to essential support for learners as they enter or leave the building.

However, new builds are costly. The efficiency of course management becomes a priority as a result. A business process management system, Ultimus®, has been introduced which allows mobile processing of information; staff can act on business processes wherever they have access to a computer on any of the four campus sites. The software also provides transparent measurement of processes for departmental managers. North Hertfordshire College has seen an 11% growth in student intake since the opening of the new centre and statistics show a significant increase in the use of the VLE.

Making it happen

Administration and registration processes need to be efficient and effective to maximise return on investment. Business process management software can facilitate this and should be considered. In order to fully adapt to teaching with technology, practitioners need to be confident in the reliability of the equipment and infrastructure. Technical support staff and training are, therefore, key to the success of a venture such as this – ongoing staff development in the use of IT including mobile and wireless technologies is vital.

Key points for successful innovation

- Business plans must address the sustainability as well as the start-up costs of introducing technology into practice and administration.
- Sustainability could be achieved by creating new markets and aiming for greater efficiency in management, administration and support of students. However, the revenue support necessary to adopt IT effectively must not be under estimated.
- Phased introduction of a WLAN is sometimes necessary. Use this as an opportunity to implement a rolling programme of staff development in mobile and wireless learning.

"The college is not just a set of buildings with technology; it is the opportunity to do something extraordinary."

Roger Gochin, Principal, North Hertfordshire College

Final word

A future aim is to provide every enrolled learner with a mobile device to access both in-house and external resources to support their learning, and to extend the use of SMS messaging. In time, it may be possible to send small learning objects and website links to learners' mobile phones to add value to what takes place in the classroom.

"A 21st century college has got to allow its staff greater freedom and to accept greater responsibility for what goes on in the classroom and beyond. What you are trying to create first is independent staff within a supported framework, who are creative and innovative, and then you try, through interactive and open access delivery, to create the same spirit of self-reliance, self-awareness...in the students." Roger Gochin, Principal, North Hertfordshire College

Looking to the future

Learning without boundaries

A university for the 21st century

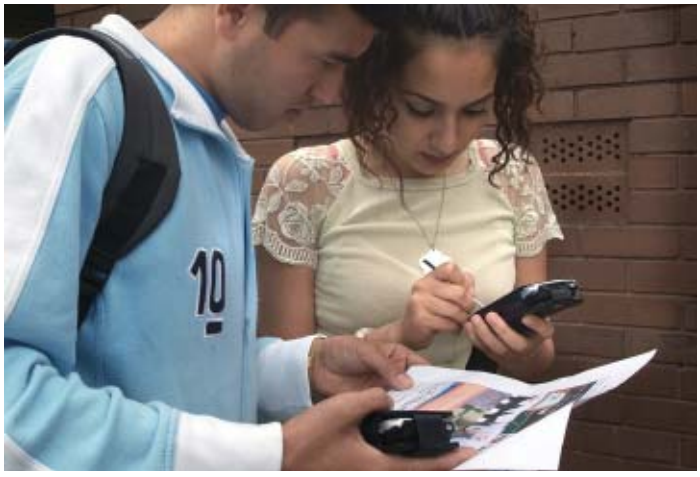
Background

For at least the next decade, most universities will continue to be a mixture of old and new buildings, often scattered and overcrowded. The continued volatility of global markets, funding shortfalls and the introduction of new academic subjects will force them to develop resources in relatively short timescales.

The challenge

Universities and colleges will continue to work in fiercely competitive markets, regionally, nationally and globally and will have to exploit innovative mobile technologies within their corporate strategies.

Efficiency will be a major driver for the continued implementation of large scale technology-supported learning. The agenda to widen participation will increase diversity amongst the student population. More students will enter higher education without formal qualifications and increasingly they will have substantial part time jobs in order to fund their education. The issue of retention will consequently be significant and technology-based solutions will be required to deliver learning and support to wherever students are, whenever they want it.



Imagine mobile and wireless learning for a student in a few years' time:

Start of the day	Woken up by handheld which also reminds about library recalls, assessment deadlines, field trip dates Use this to check weather and bus times
Travelling in	Alerted by SMS message to a rescheduled seminar Review last week's learning objects and complete a diagnostic quiz Catch some local and student union news on digital TV via handheld
On campus	*The campus has high bandwidth network, wireless LAN and Bluetooth® to support a wide range of courses* Download some learning objects Book out university laptop and go to a café in town with a WLAN access point

"Universities will need to become more technologically responsive and sophisticated, incorporating mobile and wireless learning at the core of their provision."

John Traxler, Learning and Teaching Research Fellow, University of Wolverhampton

Group meeting with tutors	Tutor recommends some learning objects on VLE Plan future group work with friends using shared organiser tools Beam notes to other students from handheld
Fieldwork	Collect and record data which is validated and processed in real-time Beam results to other students and merge results into a spreadsheet
Travelling home	Work on self-evaluation in e-portfolio via handheld Access personal mobile learning environment portal to check postings
Part time work (during break)	Listen to podcast of missed lecture on handheld Check football scores and play MP3 files
Later on	Take video call Back up data, synchronise handheld with laptop, and recharge overnight

Key points for successful innovation

The introduction of large scale sustained mobile and wireless learning will have both benefits and risks for universities. The benefits could include:

- A greater capacity to compete and deliver credible, stimulating and relevant learning in a mobile and wireless world.
- The opportunity to create an entirely personalised mode of learning and support based around the portability, privacy, spontaneity and connectivity of mobile and wireless technologies.
- Support for the full range of approaches to teaching and styles of learning, with unique opportunities for situated and authentic learning, and spontaneous communication.
- Increased capacity to reach, connect and support a greater variety of learners in more diverse ways.

The potential risks of mobile and wireless learning could include:

- Increasing disadvantage for students less able to bear the costs of updating personal wireless and mobile technologies for learning.
- Increased technical support costs due to the diversity and volatility of systems, devices and standards.
- Marginalisation of curriculum areas less amenable to the introduction of mobile and wireless formats.

Final word

Students view mobile technologies as an integral part of their culture. However, the skills they require for mobile and wireless learning could be different to those currently prioritised. Mobile and wireless technologies could transform the concept of learning, by shifting the focus from knowing about something to knowing how to find things out. Skills of information literacy could be more vital than factual knowledge for the 21st century learner.

Innovative practice: the institutional perspective

Building a 21st century model of learning involves all members of the institution in a process of change that requires more than short term, small scale projects. The goal has to be a learning environment that can support individuals in ways that are beneficial to learners and on a scale that is beneficial to the institution.

The evidence here suggests that a wireless network can be used to unite all the functions of a learning institution, connecting all campus sites to learning materials on a VLE, to resources generated by partner institutions, and via the internet to wider sources of information. Managers and practitioners can then in an ideal scenario have instant access to course and student data and learners to personalised course information and sources of support and guidance.

Learning space design is now blurring the division between formal and informal, learner- and group-focused learning activities. Learning resource centres and libraries are being reorganised to allow a variety of learning approaches to be supported, including collaborative group activities alongside refreshments in internet cafés. Guidance and learning support teams can also take advantage of wireless-enabled campuses by following learners, who themselves can access their timetable, pick up messages from their tutor and use resources via a handheld. This wireless-enabled *'hub of learning'* is able to enter a wider marketplace, drawing in different categories of learner, some of whom cannot attend classes regularly, but can be supported by course materials and tutorial support through external access to a learning environment from their own personal handheld device.

The achievability of this vision has to be assessed by each individual institution against:

- Its current strategic aims
- The stage it has reached with implementation of e-learning
- The availability of resources, both financial and human
- The prevailing teaching and learning culture
- Its self-evaluation against external measures of achievement, such as reviews, inspection reports and benchmarking data

"Learning has always been and always will be a personalised experience. It is the organisation of education that has been impersonal...Technology is making personalisation achievable at scale."

Chris Yapp, Head of Public Sector Innovation, Microsoft

A model of implementation for mobile and wireless learning

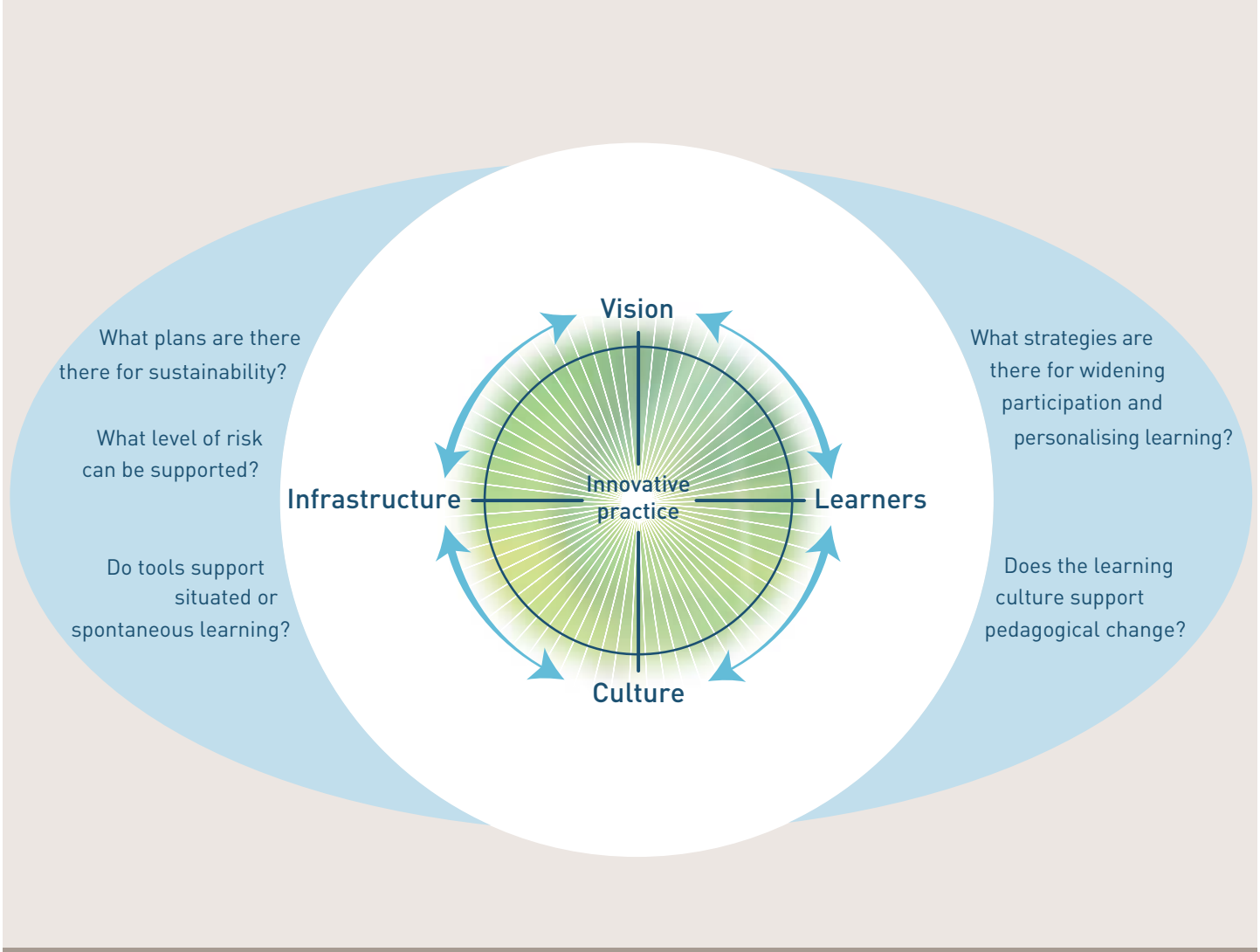


Figure 1: A model of implementation for mobile and wireless learning

A model of implementation for mobile and wireless learning is given in Fig. 1. The four areas of key importance in this model of implementation are:

Vision: An overarching vision for personalised and differentiated learning will need in most cases to build on previous investment in e-learning. Mobile and wireless technologies will extend the reach of that investment and foster increasingly personalised learning approaches. The vision should be linked to:

National strategies	Mobile technologies can be deployed effectively to widen participation, embed basic skills, including ICT, and to address the priorities in national e-learning strategies
Internal strategies	Use of mobile and wireless technologies can be linked to benchmarking data, to internal self-assessment reviews, and to institutional strategic aims in order to establish appropriate targets for departments, faculties or sections
Resource development and management	The development of a learning-rich institution will require the generation or redirection of financial and human resources into supporting technology-mediated learning. On a smaller scale, IT or network management policies will need to address the balance between network security and access to learning resources via personal mobile devices

Infrastructure: Mobile and wireless technologies bring clear benefits to an institution, but there are also elements of risk to be found in the instability of emergent technologies and in planning for innovative practices in a rapidly changing technological environment. Developments in infrastructure should be based on an audit of current uses of e-learning technologies to identify and address issues such as:

Sustainability	Use of mobile technologies and wireless networks may be advantageous to an institution aiming to increase learner numbers. More widespread personal ownership of 3G mobile phones, PDAs or tablet PCs could also transfer purchase and maintenance costs from institutions to learners. Mobile devices are rapidly superseded, but sustainable pedagogies do not always require the most sophisticated devices
Scale	Wireless and mobile technologies can first be deployed in niche areas, where the gains and drawbacks can be experienced with less impact. Subsequent wider implementation will involve senior management in coordinating a drive towards innovative practice. Institutional managers need to assess the degree of innovation that can be supported
Implementation	IT and network managers, who have responsibility for network security, procurement, interoperability and maintenance of software and hardware, are key players in a holistic plan. Others who need to be involved in an 'action-force' approach are learning technologists, ILT/e-learning development coordinators, advanced practitioners and those with responsibility for learning resources and estates

Learners: Institutions are legally obliged to assess the needs of individual learners. Judgements of an institution's success are based on how well those needs are met. Consider:

Changing pedagogies	Institutions have to be responsive to changing pedagogies which have increasingly focused on situative, exploratory and social forms of learning. Managers have to determine whether the potential of mobile and wireless learning has been recognised and exploited to support the changing lifestyles and individual needs of learners. Wider use of mobile and wireless technologies will need to be reflected in the design and management of learning spaces within the institution
Legal obligations	Legislation regarding equal opportunities, data protection and accessibility may need to be addressed in any plans to implement a personalised learning environment with mobile and wireless technologies
Staff development	To embed new technologies 'just-in-time' and 'just-in-case' staff development opportunities will be required to enable practitioners to support learners effectively. It is expected that wider personal and social use of handhelds will reduce training needs over time, but staff development must also focus on identifying pedagogically sound uses of new technologies, in particular those that support active and personalised forms of learning

Culture: The embedding of mobile and wireless technologies into wider established practice (as opposed to localised small scale projects) requires a readiness-for-change culture to be established throughout the institution. This will include a willingness to take calculated risks where benefits to learners outweigh possible disadvantages. Consider:

Practices and norms	Could more use be made of mobile and wireless learning to embed learner-centred practices? Have pedagogies developing around these been disseminated between teams and departments for evaluation and adaptation?
Quality	Reflection and review should form an integral part of any team's planning cycle. Do quality assurance procedures encompass mobile as well as e-learning provision?

Final word

The introduction of mobile and wireless technologies in a phased process, starting with the development of resources on a learning platform and moving on to policies to ensure secure network access from handheld devices, is more effective than uncoordinated experimentation. Implementation of mobile and wireless learning will involve long term planning and will be ideally linked to teaching and learning strategies, audits of current infrastructure and e-learning provision, knowledge derived from pilot studies and student perception surveys, and an understanding of the pedagogical gains that can be achieved.

A review of current practice suggests that mobile and wireless learning is the natural next step wherever institutions and practitioners have already adopted e-learning.

Embedding mobile and wireless learning

'Innovative practice' has been defined here as practice with mobile and wireless technologies which has added value to established ways of facilitating learning (including the more widely used aspects of e-learning). What is not yet clear is how mobile and wireless learning will interact with established forms of e-learning, whether it merely offers an extension to the benefits afforded by e-learning or whether it is capable of more widespread use in its own right. In short, what does *e-learning plus mobile and wireless learning* add up to?

Mobile devices can extend the reach of e-learning and open up a greater variety of learning activities

e-Learning has been shown to have particular value in engaging and motivating learners. Add to that the medium of a mobile device, and the cultural barriers that can divide practitioners from younger learners, and learners from non-learners, can be more effectively challenged.

A powerful benefit of mobile learning is that learners do not have to be separated from their day to day commitments. As learning becomes situated in a wider variety of locations, the potential for cross-fertilisation of ideas and values increases, as does the potential for learning to become an attractive pastime for a greater number of people.

From the pedagogical point of view, connectivity on location enables more emphasis on discovery-based, problem-solving and collaborative learning. In this respect, e-learning plus mobile and wireless learning could foster more innovative pedagogies combining the use of a mobile device with new developments in software and web-based technologies to develop participatory, dynamic and immersive forms of learning. More immediately available applications can be found in the use of PDAs or 'smartphones' to collect or access information for activities across a range of disciplines.

Despite extending the reach of e-learning, the potential of handhelds as tools for delivering learning in their own right (as opposed to an element in a longer sequence of more dominant practices) is limited by small screen size, by the bite-sized nature of content and by the limited amount and variety of pre-configured resources. The ubiquity of mobile devices does not necessarily mean that they can support a full range of learning activities, nor that all learners will find them accessible.

Use of e-learning content with the mobile device as the dominant or sole medium may well remain small scale and niche in nature for some time, yet still of great value. An example would be the use of reinforcement exercises in the learning of basic skills.

Mobile and wireless learning can mean e-learning on the move

Use of handhelds such as PDAs for the capture of information in different formats, and mobile phones for games and quizzes, along with mobile laptop schemes, are currently bringing e-learning to a wider variety of locations. As a result, e-learning can and is being fitted into small intervals of spare time and is occurring in otherwise inaccessible places. Particular benefits have become evident where resources have been purpose-built for the device and offer different or alternative ways by which learners can engage with the content of a curriculum away from the institution.

In higher education, it could become an established norm to provide learners with a tailored suite of applications for a mobile device, such as a tablet PC, (either owned by learners themselves or loaned by the institution), to ensure that learners enter more effectively into collaborative learning activities, even when physically dispersed. In cases such as this, the synergy between the needs of institutions (to retain students and support established approaches to learning) and the needs of individual learners ('just-in-time' information and easy access to learning resources) combine powerfully in favour of mobile access to e-learning.

Embedded use of e-learning and mobile and wireless technologies can enable an institution to become a wireless hub of learning

Mobile devices used within a wireless network can substantially increase the range and immediacy of learning-related activities and assist institutions in more efficient management of learning. Increasing availability of local wireless networks in public places and personal wireless networks in the home will make e-learning resources more widely and easily available. This increased flexibility of access will need to be reflected in the institution itself.

The case study 'Vision and infrastructure' shows how an institution can begin to transform its relationship with its learners through the use of wireless technologies in the management of learning. Where managers of library and learning resource centres have also adopted flexible, learner-centred policies, the institution is further enabled to meet changes in pedagogy and learners' expectations as shown in the case study 'Supporting learners'.

Learning can be made more personal to the individual learner with effective use of e-learning and mobile and wireless technologies

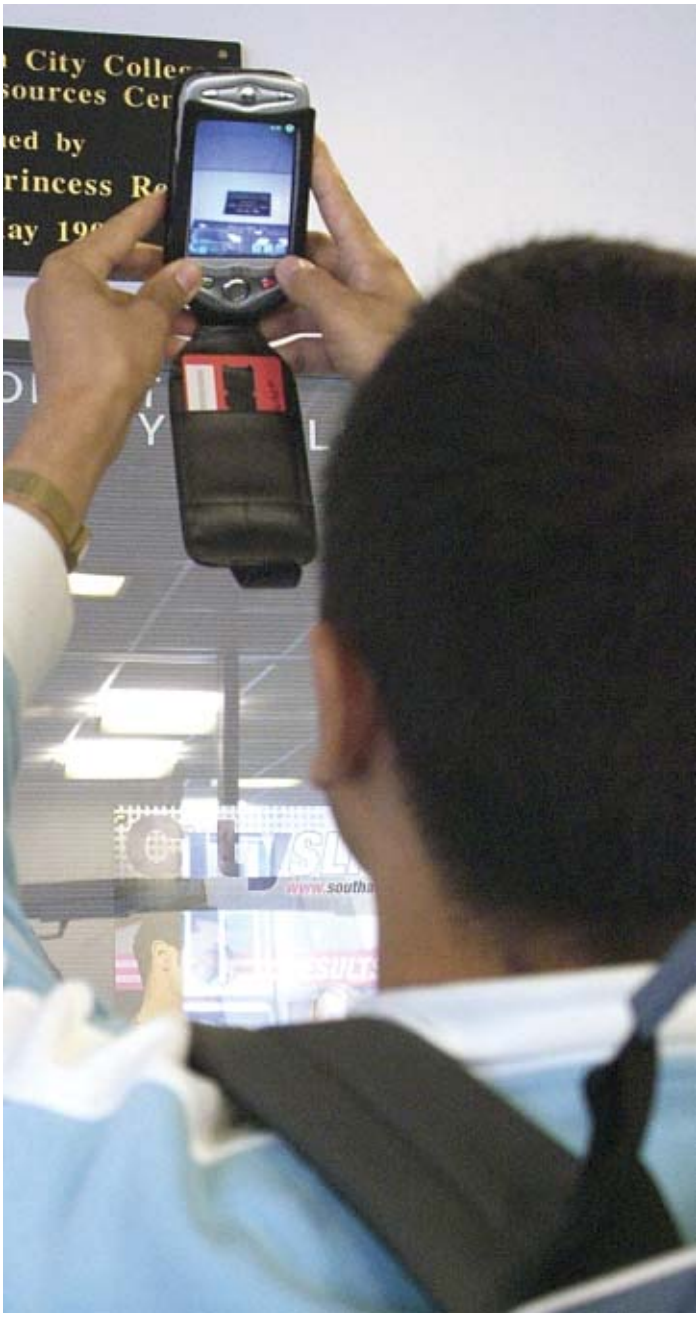
Evidence from the case studies suggests that mobile devices can increase learners' sense of control over their learning. Spontaneity of access to e-learning content and communication tools can enable individuals to decide when and where certain aspects of learning can take place and, with access to the internet, even to define the parameters of that learning for themselves.

This in turn will pose challenges for institutions and practitioners in assuring the quality of learning that can be delivered via mobile as well as e-learning. Policies regarding access to the network from handheld devices owned by learners and practitioners and software and hardware that can be supported by the institution are further decisions that mobile and wireless access to e-learning will necessitate.

Conclusion

A review of current practice suggests that mobile and wireless learning is a natural next step wherever institutions and practitioners have already adopted e-learning, but that its implementation will require careful planning.

Innovation means working at the cutting edge, away from the security of established, proven ways and means, determining through experimentation where the real barriers are and how they can be overcome. When competitive forces and strategic pressures combine with the energy and enthusiasm of practitioners to seek ways of widening access and enabling more relevant and engaging learning, then 'innovative' practice comprising mobile and conventional forms of e-learning could become tomorrow's established norms.



PDAs for PSPs

PDAs have been introduced into medical training in the Perioperative Specialist Practitioner (PSP) project conducted by Imperial College London. The purpose of perioperative specialist practitioners is to support doctors on the wards by providing continuity of care for patients from pre-operative assessment through to discharge.

Using purpose-built software for PDAs, trainees were able to make on the spot records, seek essential information, and update their logs wherever they were located. Adaptation of resources and technical support for users was found to be necessary, and the project was supported by learning technologists at Imperial College London. However, there were key advantages to be found in using PDAs in this context. They proved an inexpensive support to learning, could be password-protected, and fitted comfortably into a pocket. With adjustments to the purpose-built software to provide easier logging of activities, access to medical reference texts and a supporting area on the VLE, PSPs were able to make on-the-spot records, seek essential information, and update their logs wherever they were located.

Each institution is at a different stage in a journey towards embedding aspects of technology-mediated learning into practice. Mobile and wireless technologies represent a further stage on that journey.

Next steps

Each institution is at a different stage in a journey towards embedding aspects of technology-mediated learning into practice. Mobile and wireless technologies represent a further stage on that journey. Whatever stage your institution has reached, ensure that the technology alone, is not driving the decision-making. Not all subject disciplines or categories of learner will benefit from the use of mobile and wireless technologies.

To determine your institution's next steps and to ensure effective and appropriate decision-making, an institutional audit tool and three planning tools can be downloaded from the CD-ROM.

Planning tools

An institutional audit tool for mobile and wireless and other forms of e-learning

If you are a senior manager, the audit tool invites you to take a snapshot of your current situation and assess your institution's readiness to move on to mobile and wireless technologies. It is recommended that the audit tool is used prior to specific planning for mobile and wireless learning, to enable underlying issues to be fully addressed. By returning to use the tool at a later stage, it will be possible to measure the distance travelled.

A manager's planning tool for use of mobile and wireless technologies

If you are a curriculum or institutional manager, this tool invites reflection on the issues that will assist or impede the embedding of mobile and wireless learning in wider institutional practice. It can be used to review plans for implementation in the light of your institution's strategic aims, infrastructure and support systems.

A practitioner's planning tool for use of mobile and wireless technologies

If you are a classroom practitioner, this tool covers the steps you will need to take to implement mobile and wireless technologies in learning and teaching.

An e-learning manager's planning tool for use of mobile and wireless technologies

If you are an e-learning manager/coordinator, or learning technologist, this tool can be used to plan for pedagogically sound and technologically appropriate applications of mobile and wireless technologies, in conjunction with network managers and curriculum teams.

These tools can be used together with the extended versions of the case studies on the CD-ROM to crystallise thinking around some of the challenges and solutions found by others. The tools and case studies could be used in discussions between technical, managerial and curriculum staff in preparation for the introduction of mobile and wireless technologies.
All tools are available as Microsoft® Word documents and can be downloaded from the 'Next steps' section of the CD-ROM and adapted to suit individual contexts.

Keep informed

To subscribe to a quarterly news update giving information about *Innovative Practice with e-Learning* and other projects in the e-Learning and Innovation and e-Learning and Pedagogy strands, join the e-Learning and Pedagogy mailing list (www.jiscmail.ac.uk/lists/EPED-INFO.html). This is an open list, and anyone interested in the work undertaken in these two strands may join.

Glossary of terms used in this publication

Accessibility: The process of ensuring that all learners, including those with disabilities and learning difficulties, can access places of learning and learning resources, including e-learning content.

Authentic learning: Learning which comes from direct experience or via simulations that mirror real situations.

Blog: Wikipedia defines 'blog' as a shortened form of 'web log' – a web page containing periodic entries compiled by either an individual author, or as a collaborative exercise by a group within a community of practice. For further information: http://en.wikipedia.org/wiki/Weblog

Bluetooth®: Bluetooth enables handheld devices to exchange information via short range radio frequency communications.

Chat: A multi-person online communication tool, usually instant messaging via a web browser.

Community of practice: A form of social learning that occurs when people with a common interest in a subject collaborate to communicate ideas, find solutions to problems and define principles and terms relating to that subject.

e-Portfolio: A repository of information stored electronically about a learner. This may have been provided by the learner and/or by other people and organisations, and include assessment achievements.

ESOL: Abbreviation for 'English for speakers of other languages'.

GPS: Abbreviation for 'Global Positioning System', a satellite-linked navigation tool capable of pinpointing an exact location. It can be used free of charge. GPS receivers can be purchased as separate handsets or built into other devices.

GPRS: Abbreviation for 'General Packet Radio Service'. Available on some mobile phones, GPRS provides medium speed data transfer, which allows email messages to be sent and received, and can enable web browsing by allocating unused bandwidth to transmit data.

Handheld: Generic term for a mobile wireless computing device that fits into one hand. Examples include PDAs, 'smartphones', games players and personal media players.

HTML: Abbreviation for 'Hyper Text Markup Language', the language used to create text for web pages.

ILT: An abbreviation for 'Information and Learning Technology', the term commonly used in further education to refer to the application of technology to all aspects of an institution's core functions.

Immersive learning: A form of learning in which learners are physically placed in a context to 'immerse' them in a learning experience. Simulations can also replicate such a context.

Learning platform: A generic term covering a variety of ICT systems that support online learning.

MLE: Abbreviation for 'Managed Learning Environment', a term used to include the whole range of computerised information systems and processes in an institution (including a VLE).

MMS: Abbreviation for 'Multimedia Messaging Service'. MMS-enabled mobile phones can send and receive messages containing digital images, audio and video files. For further information: http://en.wikipedia.org/wiki/Multimedia_Messaging_System

MP3: A high-compression file format, popular for downloads of music from the internet.

NVQ: Abbreviation for 'National Vocational Qualification', a certificate of vocational education with five levels.

Open architecture: An 'architecture' is a design, specifically that of hardware or software. The specification of open architecture software is publicly available, and such products may therefore be adapted, or add-ons may be created.

PDA: Abbreviation for 'Personal Digital Assistant', a handheld computer originally designed for personal information management, now converging with mobile phone technology in the third generation (3G) phones or 'smartphones'.

PRS: Abbreviation for 'Personal Response System', a system for wireless communication using infra-red signals to collate and display multiple responses to questions, for example by students in a lecture or class. A PRS system requires three elements: individual handheld voting devices, a receiver and a computer with PRS software uploaded.

Plug-in: A computer program that interacts with another program to provide specific additional functionality.

Podcasting: The publishing of sound files on the internet. Users subscribe to podcasting via designated software.

Portal: An online gateway to other web pages.

SIM card: A microcomputer within a mobile phone, which performs all necessary operations based on information stored inside it.

Situated learning: Learning which takes place in the context where it will eventually be applied, for example, the training of medical staff on hospital wards.

SMS: Abbreviation for 'Short Messaging Service'. SMS messages are sent as text via mobile phones or other handheld devices.

Smartphone: Wikipedia defines 'smartphone' as any handheld device that integrates personal information management functions, e.g. calendar, clock, diary and email functions, and mobile phone capabilities in the same device.

Synchronise: To coordinate the data on different devices.

Thin client: An especially small software application that runs on a PC or workstation, with most of the data processing occurring on a server.

Third generation (3G) mobile devices: See entries for smartphone and PDA.

USB: Abbreviation for 'Universal Serial Bus', a standard connection on a computer to peripheral devices, such as a digital camera or a data storage device, also known as a Memory Stick™ or Pen Drive®.

VLAN: Abbreviation for 'Virtual Local Area Network', a network of computers that behave as if they were connected to the same wire even though they may be physically located on different segments of a LAN.

VLE: Abbreviation for 'Virtual Learning Environment', an integrated software tool for the management and delivery of online learning, which typically includes tracking and communication tools and learning content.

Web browser: A software application that enables a user to read and work with HTML documents.

Wi-fi: An abbreviation for 'wireless fidelity', a set of product compatibility standards for wireless local area networks (WLAN).

Wireless network: A network of computers using radio waves rather than cables to transmit data.

WLAN: Abbreviation for 'Wireless Local Area Network', a wireless computer network within a localised area such as a college or university, or the home.

References and wider reading

JISC

The e-Learning Programme
For further information about the JISC e-Learning Programme **www.jisc.ac.uk/elearning**

The e-Learning and Innovation Strand
For further information about the e-Learning and Innovation Strand **www.jisc.ac.uk/elearning_innovation.html**

The e-Learning and Pedagogy Strand
For further information about the e-Learning and Pedagogy Strand **www.jisc.ac.uk/elearning_pedagogy.html**

'Landscape Study on the Use of Mobile and Wireless Technologies for Teaching and Learning in the Post-16 Sector', Kukulska-Hulme, A., Evans, D. & Traxler, J. (2005) **www.jisc.ac.uk/eli_outcomes.html**

'Case Studies of Innovative e-Learning Practice', Kukulska-Hulme, A. et al (2005) **www.jisc.ac.uk/eli_oucasestudies.html**

JISC TechWatch Reports:

'Mobile and PDA technologies and their future use in education', Anderson, P. & Blackwood, A. (2004) **www.jisc.ac.uk/index.cfm?name=techwatch_reports_0403**

'Evaluating the development of wearable devices, personal data assistants and the use of other mobile devices in further and higher education institutions', De Freitas, S. & Levene, M. (2003) **www.jisc.ac.uk/index.cfm?name=techwatch_report_0305**

TechDis
For further information about accessibility and technology **www.techdis.ac.uk**

Institutions featured in the case studies

Bishop Burton College **www.bishopburton.ac.uk**

CETADL, University of Birmingham **www.cetadl.bham.ac.uk**

City College Southampton **www.southampton-city.ac.uk**

Dewsbury College **www.dewsbury.ac.uk**

Ealing, Hammersmith and West London College **www.hwlc.ac.uk**

Gloucestershire College of Arts and Technology **www.gloscat.ac.uk**

North Hertfordshire College **www.nhc.ac.uk**

Northumbria University **www.northumbria.ac.uk**

Thomas Danby College **www.thomasdanby.ac.uk**

University of Strathclyde **www.strath.ac.uk**

University of Sussex **www.sussex.ac.uk**

Organisations referred to in the publication

Cambridge Training and Development Ltd (CTAD) **www.ctad.co.uk**

National Research and Development Centre for Adult Literacy and Numeracy (NRDC) **www.nrdc.org.uk**

NESTA Futurelab **www.nestafuturelab.org**

Ultralab at Anglia Polytechnic University **www.ultralab.net**

Technologies and software relevant to the case studies

Electronic voting devices
Interwrite™ PRS **www.gtcocalcomp.com/interwriteprs.htm**

Mobile laptop scheme
Satweb **www.satweb.co.uk**

Faronics™ Deepfreeze
www.faronics.com/html/deepfreeze.asp

Mobile phone
mediaBoard **www.mboard.org.uk**

PDAs
MARGI Presenter-to-Go **www.margi.com**

Maromedia® Flash® **www.macromedia.com/software/flash**

Microsoft® ActiveSync® **www.microsoft.com/windowsmobile/downloads/activesync38.mspx**

Mobile Systems **www.mobi-systems.com**

Mobipocket **www.mobipocket.com**

Tablet PC
Interactive Logbook **www.il.bham.ac.uk**

Microsoft Office **http://office.microsoft.com**

Microsoft SharePoint® **www.microsoft.com/sharepoint**

OpenOffice **www.openoffice.org**

Web-based resources for further research into mobile and wireless learning

AClearn
What is mobile learning?
www.aclearn.net/display.cfm?page=958

ALT
'Exploring the frontiers of e-learning. The use of PDAs in outreach centres', Sugden, D. (2005) **www.alt.ac.uk/altc2005/timetable/abstract.php?abstract_id=431**

Becta
'What the research says about portable ICT devices in teaching and learning' **www.becta.org.uk/page_documents/research/wtrs_porticts.pdf**

e-Learning Centre
www.e-learningcentre.co.uk/eclipse/vendors/pdatools.htm

Ferl
'Introduction to mobile learning (m-learning)', Wood, K. (2003)
http://ferl.becta.org.uk/display.cfm?resID=5194

'Engaging students through SMS messaging', Soon, L. & Sugden, D. (2003)
http://ferl.becta.org.uk/display.cfm?resID=6432

Handheld Learning
www.handheldlearning.co.uk

LSDA
'Mobile technologies and learning', Attewell, J., LSDA (2005)
www.lsda.org.uk/files/pdf/041923RS.pdf

MOBilearn
www.mobilearn.org

Projects

eViva **www.eviva.tv**

Interactive Logbook **www.il.bham.ac.uk**

m-learning **www.m-learning.org**

Pembrokeshire wireless learning hubs
www.pembrokeshire.ac.uk

Perioperative specialist practitioner project, Imperial College London **www.ic.ac.uk**

Publications

Mobile Learning: A Handbook for Educators and Trainers, Kukulska-Hulme, A. & Traxler, J. (eds), Routledge (2005)

Innovative Practice with e-Learning CD-ROM

The content of the CD-ROM is structured into the following sections:

Foreword	
Starting point	Introducing innovative practice, Moving on to mobile and wireless learning and Opening the box
Taking up the challenge	Choices and challenges, Establishing principles, Approaches to learning, Accessibility and A glimpse of the future
The learner's perspective	Any time, any place learning, Widening participation, Personalised learning, Final word and A glimpse of the future
The practitioner's perspective	Promoting active learning, Empowering learners, Strengthening learner involvement, Final word and A glimpse of the future
The institutional perspective	Vision and infrastructure, Supporting learners, Changing culture, Looking to the future, Final word, A model of implementation and A glimpse of the future
Next steps	Embedding mobile and wireless learning, Planning tools
Case studies Video case studies	Microsoft® Word and PDF versions QuickTime® and Windows Media® Player versions and transcripts in Microsoft® Word
Glossary	
Wider reading	
JISC e-Learning Programme	
Acknowledgements	
Feedback	
Help	Playing the CD-ROM, Accessibility information, Viewing video case studies, Downloading files, Copyright
Site map	

This CD-ROM utilises the auto-run feature in Microsoft Windows®. To view, place the CD-ROM in the CD drive of the computer. The Internet browser will automatically open, allowing the CD to auto-run. Alternatively, click Start > My computer and select the JISC icon. To play the CD-ROM on a Mac® operating system, double click on the CD-ROM icon and then double click on Run.htm.

Innovative Practice with e-Learning

Further information:
Web: www.jisc.ac.uk
Email: info@jisc.ac.uk
Tel: 0117 954 5083

hefce Higher Education Funding Council for England
Learning+Skills Council
Scottish higher education funding council
Scottish further education funding council
Cyngor Cyllido Addysg Uwch Cymru hefcw Higher Education Funding Council for Wales
Dysgu ac Addysgu Cymru ELWa Education and Learning Wales