



MOBILE LEARNING

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This is the fifth in a series of occasional papers produced by 3T Productions that highlight and discuss issues facing Post 14 Education and Training. If you would like to be placed on the mailing list to receive further papers please e-mail blockitt@3t.co.uk.

We would like to receive feedback on the papers so if you would like to comment ,or have a topic you think would make an interesting paper, please e-mail blockitt@3t.co.uk.

Introduction

During the past decade every area of education and training has been affected by the introduction and use of technology. Word processing packages, and the introduction of laser printers, significantly increased the quantity and print quality (not necessarily the quality of the content) of the written word and opened up a new world for those with learning difficulties. Simple presentation software has enhanced the delivery of information and, if used innovatively, stimulated different learning styles, enabling the individual to be fully involved in the learning process. The introduction of the CD-ROM/DVD provided a mechanism by which true 'multi-media' materials could be developed and used to deliver even the most complex, or boring, subjects to learners within a range of supported, and unsupported, learning environments. The technology then moved on, things became more sophisticated, compact and cheaper. The Internet, World Wide Web and e-mail have now become essential sources of information and communication, within all levels of education and training, throughout the world. The Internet in particular provides an 'expert' at the click of a mouse, twenty-four hours a day, seven days a week (although the quality of that 'expert' may need to be assured). If we are to believe the advertising, and tentative research findings, the next revolution in technology to affect education and training will be mobile communication devices and palmtop/handheld computers. Are we really on the verge of a revolution in portable learning, or is this just another way to sell more technology? This paper looks at some of the research currently available, the claims made by the manufacturers for their products, and tries to open up the debate regarding the intelligent use of handheld devices for the delivery, management and assessment of education and training in the post 14 sector. This paper will only touch briefly on existing or evolving technology, the debate regarding what constitutes a handheld and issues regarding different forms of connectivity. All of these issues have been researched, and reports produced and published by BECTA (British Educational Communications and Technology Agency), JISC (Joint Information Systems Committee), LSDA (Learning and Skills Development Agency) and others (see references).

This paper will deal mainly with issues affecting education/training and how, handheld computers in particular, could be used to assist the 14-19 curriculum reforms and post 14 education and training in general.

Do we really need instant access to technology and communications?

We are increasingly living in a society where immediacy is not only expected but taken for granted. Listening to music, watching films, shopping, communication and a range of other activities can all be undertaken on the Internet and the results are often immediate. Within education and training there is an increasing expectation for immediate feedback from assessments, instant communication with teachers/tutors and access to learning materials on demand. When thinking about the need for instant access to technology and communication systems your answer will probably depend upon your role within the learning process. You are likely to take a different stance if you are a learner, teacher, tutor, work-based assessor, or senior manager, to mention just a few of the people who may have a vested interest.

There will probably be as many answers to this question as the number of individuals that answer it, below are a few examples.

The case for the learner

As a learner the mobile telephone has become an essential piece of technology and many people, both young and old, would say they are unable to function without it. The use of text messaging is now accepted as part of the 'youth' culture. As the price of mobile communication technology falls, and the functionality increases, to include digital cameras, video and sound recording, conferencing, MP3 players, Internet access etc their popularity is set to increase. It is not clear, at this point in time, how much education can be attributed to the use of mobile devices but they have certainly been effective with regard to the introduction, and use, of sophisticated technology by young people between the ages of 10 and 30 years old. There is tentative research to indicate that even people with poor literacy skills make effective use of text messaging and are in regular communication with peers.

The reforms to the 14 to 19 curriculum, as outlined by Mike Tomlinson in October 2004, may necessitate the increased use of handheld computers as the learners will be moving between School, work-place and College environments and handhelds would enable them to access their learning records, register attendance, download relevant learning materials, keep in touch with subject and specialist tutors/teachers and a wide range of other administrative and learning tasks.

The case for the teacher/tutor

Feedback from teachers and tutors who have used handheld devices with learners highlights the increased flexibility they offer and the opportunities for interaction between teacher/pupil and pupil/pupil. However, the cost of the equipment and connectivity can be a disadvantage. The reform of the 14-19 curriculum will mean that teachers will require 'virtual' access to learners during the school day as they may not be within the

school environment and need to be tracked. The marking of assignments, checking attendance, diary meetings and other essential functions that would, in the past, have been done face-to-face within the school environment could be achieved using handheld computer devices.

Providing management information, giving demonstrations, modelling and undertaking 'real time' statistical analysis, assessment, learning modules, timetables, diaries, events calendar and many other functions could be undertaken by the teacher/tutor and significantly improve the effectiveness and quality of the learning process as well as reducing the bureaucratic burden on the tutor/teacher involved.

The case for the manager

A number of managers using handheld devices have highlighted the ability to send and receive e-mails remotely, the ability to manage their diary in 'real-time' and access to fully functional software packages, compatible with their main computer, as essential features of handhelds. For those who have the facility access to the Internet is also a feature regularly used by managers.

The case for the vocational/work based assessor

There will be an increased role for the work based or peripatetic vocational assessor if the 14-19 reforms are implemented. A large number of 14-19 year olds will be spending an increasing amount of time in the workplace and the assessment and monitoring of their progress will require an increase in the number, and quality, of work based and peripatetic vocational assessors. If the increase in the numbers of vocational learners is to be managed effectively there will be a need to reduce the amount of bureaucratic assessment and recording of achievement. This could be achieved by using handheld computers, linked directly to learner records, so that information on each learner could be uploaded immediately as the assessment/ observation takes place. If this information were then linked to the awarding body database vocational certificates could be issued immediately a unit is completed.

Managing expectations

When introducing technology into education and training it is advisable to keep the following seven key words at the back of your mind, *Who, What, When, Where, How, Why and Cost*. Just because the technology is available it does not mean that there is an overriding educational reason to use it. Managing the expectations of managers, staff and learners can take some time but if the justification to purchase, or not, is well founded most people will understand and appreciate the reasons put forward.

One way of assessing the need for handheld computers is shown in example 1 and 2. I have used the rating scale 1-10 to provide a numerical assessment of the benefits. For example there are 7 questions so the maximum score is 70. You could make a judgement that anything under 35 is discounted as not

educationally/cost effective, anything between 36 and 55 should be evaluated further and that anything over 56 should be given serious consideration. Obviously the scoring is subjective and needs careful management and analysis. As a manager I should say that example 2 has far more educational merit than example 1 as the scenario in example 1 could be catered for by using conventional technology or even pen and paper.

Example 1

1=low priority 10=high priority

Key questions	Example answer	Rating 1-10	
<i>WHO</i>	Who will be using the device?	Three groups of ten learners in a range of curriculum areas.	6
<i>WHAT</i>	What will it be used for?	Taking notes.	2
<i>WHEN</i>	How often will it be used?	Three to four times per week. One hour per session.	4
<i>WHERE</i>	Where will it be used?	Within the College grounds.	1
<i>HOW</i>	How will it be used?	As an electronic note pad.	1
<i>WHY</i>	Why use this technology rather than another (or non)	No overriding reason.	1
<i>The cost versus benefit</i>	Is there a cost saving or educational benefit? If there is a benefit does this outweigh the cost?	No overriding educational benefit. At least ten devices required at £175 each plus cost of connectivity (£45 per month) per device	2
Overall judgement: Purchase: <input type="checkbox"/> More information required: <input type="checkbox"/> Do not take forward: <input type="checkbox"/>		Total	17

Example 2

1=low priority 10=high priority

Key questions	Example answer	Rating 1-10	
<i>WHO</i>	Who will be using the device?	Up to 30 individuals following the new 14-19 curriculum	8
<i>WHAT</i>	What will it be used for?	<ul style="list-style-type: none"> ➤ Updating information to the e-portfolio; ➤ Downloading learning modules; ➤ Communication between pupil and teacher at remote locations; ➤ Communication between teacher and College tutor/Work-Based mentor; ➤ Assessment of coursework and module assignments; ➤ Appointment and calendar entry; ➤ Group discussion; ➤ Photographic recording of evidence for the e-portfolio; ➤ Help advice and guidance. 	9
<i>WHEN</i>	How often will it be used?	Each individual will use the device at least two days per week	8

WHERE	Where will it be used?	Within School, College, Work-Based and home environments	8
HOW	How will it be used?	Will be used for learning, assessment, e-portfolio building, remote communication with the teacher, mentor and peer to peer.	9
WHY	Why use this technology rather than another (or non)	The device is small, portable, battery operated and has full connectivity.	9
The cost versus benefit	Is there a cost saving or educational benefit? If there is a benefit does this outweigh the cost?	Not all learners would require the device at the same time and it is anticipated that 15 devices could be used on a rota system. 15 devices at £175 each plus cost of connectivity (£45 per month) per device. After initial assessment, advice and guidance additional memory sticks will be pre loaded with learning and assessment material relevant to individual learner requirements. Cost of memory sticks £35 each (35 in total). There would be a significant educational benefit.	9
Overall judgement: Purchase: <input type="checkbox"/> More information required: <input type="checkbox"/> Do not take forward: <input type="checkbox"/>		Total	60

What is a handheld computer?

Handheld computers are normally defined as any small/mobile device that uses computing and information storage and retrieval. They are often described as personal digital assistants (PDAs) and one advantage over desk/laptop computers is that they can be used instantly, with little or no boot up time. They are normally small enough to fit in the palm of the hand and can be carried in a pocket. They have a long battery life and can be used in remote locations for a considerable length of time. Many of the early handhelds used a stylus and touch screen to input data but small keyboards are now becoming common. The majority of modern handheld computers have a performance capability in excess of that of a desk/laptop computer two to three years ago. However, when you take into consideration that they can also take photographs, act as a video/voice recorder, MP3 player, telephone and have, if you can afford it, constant access to the Internet you can begin to see the advantages handheld computers have over their desk bound relatives. Even with all this computing power and flexibility handheld computers, in many cases, are still seen as an extension of, rather than a replacement for, desk/laptop computers. The normal mode of operation, at this present moment in time, is to connect the handheld to the desk/laptop and synchronise the information that has

been updated during the day/week. With handheld computers that are permanently linked to the Internet the updating of information can be done automatically, even as the data is being entered.

Although a full range of software is now available on most modern handheld computers the main uses are:

- E-mail
- Internet
- Diary
- Calendar
- Notepad
- Address/contact lists

However, increasingly handhelds are being used for other things such as word processing, spreadsheets, telephone calls, taking photographs/video, listening to music and making presentations via PowerPoint. With connection to the Internet now commonly available they can also be used as global tracking devices both in and out of the car.

A new generation of computers is just starting to make an impact on the market, referred to as *ultraportables*. Ultraportables are as small as handheld computers but the main difference is that they use a full version of the operating system, such as Windows XP, and can run full applications rather than those made for handhelds. They are more similar in performance, specification and price to desk/laptop computers but have the added advantage of continuous Internet connection and those features described above for handhelds. Due to their cost, the ability to run conventional software and the ability to connect full size keyboards and monitors, ultraportables could, in the future, be the only computer the individual owns.

The barriers to using handhelds

The cost – cost of handheld computers is now falling and those that are used mainly as telecommunication devices may be available free, or at a reduced cost, if the customer signs up to a network package.

Limited functionality – this again is not such an issue on newer handheld devices and many now come with software that is fully functional and compatible with desk/laptop computers. The introduction of ultraportables will deliver full functionality equivalent to desk/laptop computers.

Cost of connectivity – this is still a limiting factor and the individual or organisational costs involved can be considerable. The costs can be exaggerated when ‘pay to use’ tariffs are employed as the user is unaware of the total cost until the invoice arrives and by this time it is too late to do anything. Set cost packages enable the users, and organisation, to manage their finances and give some comfort to organisations that have a number of these devices being used by a range of individuals.

Limited keyboard – again this can normally be overcome by using an additional keyboard and a number of portable solutions are now available. This limitation does not appear to affect the ‘younger’ user, in particular those frequent users of mobile telephones.

Small screen size – Due to their compactness the screen size of handheld computers is limited. However, advances made recently regarding flexible LCD screens (even spray on LCD screens) may overcome this limitation in the very near future.

Future proofing – Updating the software on handheld computers is difficult and expensive, they can become out-of-date very quickly. However, the ultraportable, by virtue of its full operating system and the fact that it uses full versions of commercial software, can be updated as you would any desk/laptop computer as required.

The opportunities of using handhelds

Portability – the ability to have a sophisticated computer with instant access to commercial software, Internet/e-mail access and a range of other useful features including video recording, photographs and diary entry make the use of handheld computers attractive within education/training environments.

Space saving – handheld computers are small and lightweight, they therefore take up little desk space and can easily be moved from one room to another. The long battery life means that they do not have to be connected to the mains supply and can therefore be used for days between charging.

Connectivity – instant access to the Internet, e-mail and electronic diary are all highly rated facilities by learners, tutors and managers.

Functionality – modern handheld devices offer nearly all of the functionality of traditional desk/laptop computers plus the option of instant connectivity to e-mail and the Internet as standard. Ultraportables will offer full functionality plus the additional applications normally associated with mobile communication devices.

Instant on – most handhelds are operational instantly, unlike desk/laptop computers.

Long battery life – within learning/working environments it is advantageous to have computers that do not require mains connection. The battery life of the handheld far exceeds that of laptop computers.

Cost – the majority of handheld computers cost less than desk/laptop computers. However, other charges are incurred and this could make them significantly more expensive if connectivity is included. The cost of ultraportables is equivalent to that of desk/laptop computers but offer additional functionality and could replace the desk/laptop computer.

Recording and processing information – the use of desk/laptop computers within a classroom environment requires them to be either connected to the mains supply or charged up. Handheld computers give learners the flexibility to move round the environment and still continue to use the available resources. If the handheld devices are connected to the network via wireless technology they can also send and receive information and feedback instantly.

Inputting data and automated data gathering – handheld computers can be used indoors or outdoors during the learning session. Data can be gathered, analysed, evaluated and presented as the session takes place. Feedback from the tutor, learning materials and other research information can also be received as the learning session is taking place.

Manipulating and interpreting text and shared writing – files and information can be transferred between learners and tutors quickly and learners can produce individual/team work easily and effectively.

Inclusiveness – learners who are unable to attend a learning session could still take part via handheld computers connected to the network. Learners who also need special support, or are not able to attend due to illness or physical disability could be involved in the learning session.

Group/teamwork – The handheld computer enables learners to interact with each other more effectively as they do not have to sit in front of a monitor at a desk.

What are the advantages of using handheld computers in education and training?

- They are small and lightweight
- can be used anywhere
- take up little space in the learning environment
- long battery life

- instant access (no boot up time)
- automatic saving of work
- most handheld computers cost less than desk/laptop computers

Limitations of handhelds

- Small screen (new models can be linked to full size)
- Small keyboard (new models can be linked to full size)
- Some have limited functionality (not new models)
- Not a replacement for desk/laptop computers (not new models)
- Not very robust
- Easy to lose
- Hard to expand and upgrade (not the software on new models)
- Connectivity can be expensive and costs are not always known upfront

Handheld computers and the 14-19 curriculum

The reforms put forward by Mike Tomlinson and the 14-19 working group highlight the need for flexibility of delivery, assessment, support and guidance. Such flexibility could be delivered using handheld computers. Take for example a typical 15-year-old learner of the future. Two days a week is spent in the workplace following an apprenticeship; one day a week is spent in college studying the theory of the chosen vocation; two days a week are spent in school following foundation, core and specialist subjects. The learner also has a part-time Saturday job and does some work with a local charity during the evenings and at weekends. The learner has already completed the foundation degree modules, a number of the intermediate modules and is taking the extended level qualification in several specialist subjects.

The above example highlights the flexibility and diversity of the 14-19 reforms, it also highlights some of the issues that will have to be resolved if this scenario is to become reality. If the learner spends so much time out of the 'normal' school environment how are their achievements to be recognised without the need to introduce a 'paper mountain' of evidence and assessment statements from the vocational workplace, college, home, part-time workplace etc? One answer could be the intelligent use of handheld computers. If learners have access to these devices they can record and communicate their achievements, download learning modules, receive communications from tutors/teachers/peers, and update their personal records and on-line diary instantaneously.

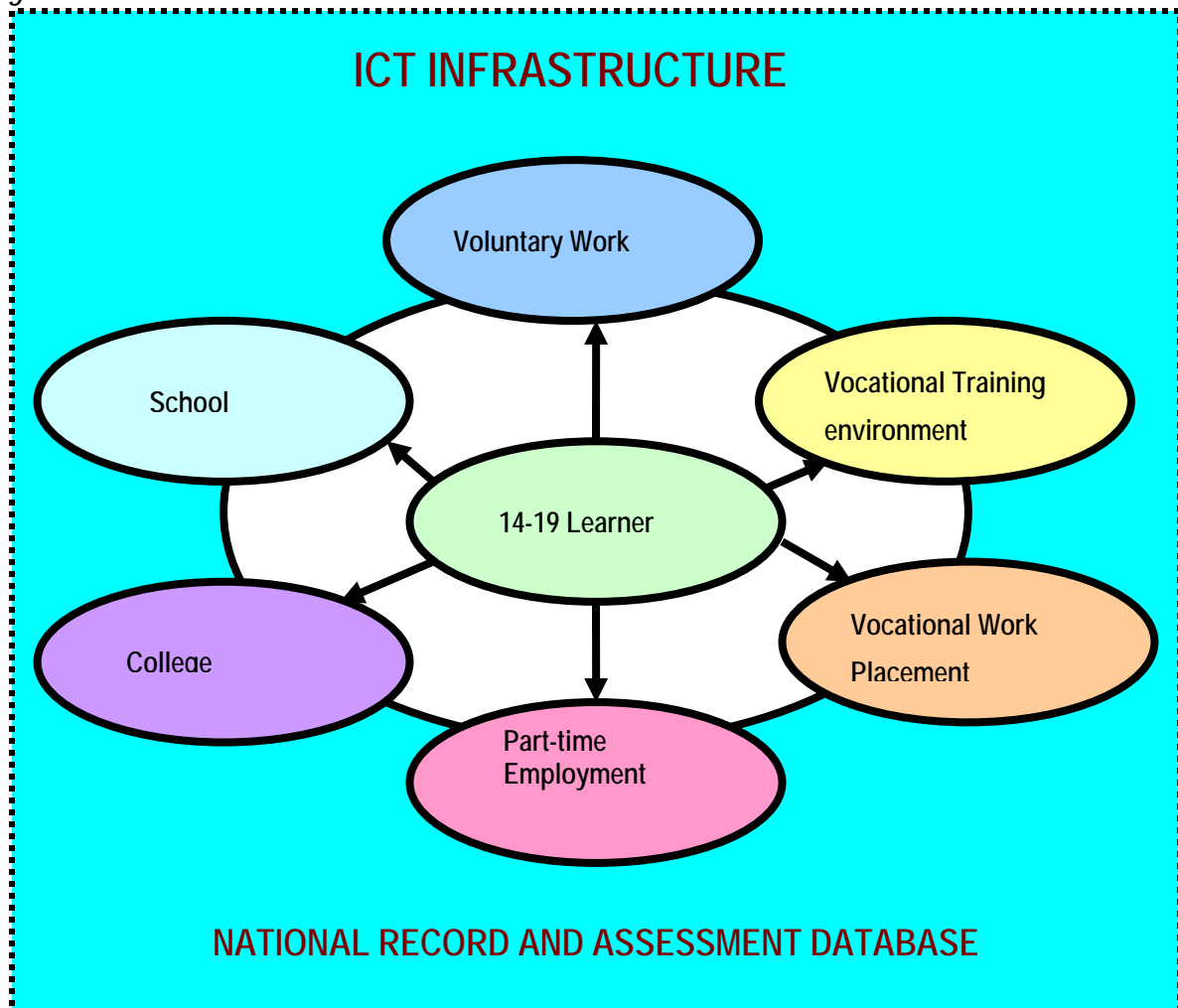
Figure 1 highlights just some of the tasks a 14-19 year old learner could be undertaking during a typical week. If this flexibility is to be supported effectively a regional (preferably national) coordinated ICT based infrastructure needs to be in place.

The system would need to incorporate:

- a national learners registration number;
- e-portfolio;
- learner management system;
- learner tracking;
- on-line assessment and feedback;
- subject specific and general support;
- communication systems;
- learning modules;

As discussed in previous 3T papers there are a number of issues that need to be resolved if the 14-19 curriculum reforms are to be effective. However, the use of handheld computers, together with a comprehensive learner management system, could help to bring all the necessary support, assessment and learning delivery together within a flexible delivery framework.

Figure 1



JUST IN TIME LEARNING OPPORTUNITIES

The delivery of education and training within the suggested 14-19 curriculum framework will, by necessity, lead to more independent learning taking place as the learner will no longer be spending five days per week within formal educational environments. If the learner is taking part in vocational training there will also be a requirement for 'just in time learning (JITL)' to be delivered 'on the job'. In the past this training will have been delivered to the 'apprentice' by an expert within the organisation on a one-to-one basis whilst the job was taking place. However, due to the possible numbers involved and the likelihood that quality work placements may be at a premium some method of alternative support will have to be provided. Handheld computers may be able to provide some alternative support where face to face training is limited.

Take the following scenario:

Mary is 15 years old and spends two days a week in a local company learning to be a plumber. Although she can remember being shown how to solder copper joints during her vocational training day at College this is the first time she has had to do it on her own and she wants to make a good job of it as it is the last element in the current module she is following. She knows there is a short video and step-by-step instruction sheet about soldering on the School's extranet so she decides to download it to the handheld computer she has on loan from School. After watching the video a couple of times she decides to save it to her personal file on the removable memory stick in case she needs it again. Mary photographs the job to be done and then solders the lengths of copper pipe together. She then photographs the completed job as evidence for her e-learning portfolio, saves this to her personal file and e-mails it to her tutor. If someone had been there she would have asked them to video her completing the job and verify the quality of the finished product. Over lunch Mary completes the assessment test associated with this section of her vocational course on her handheld and submits this for computerised marking. A few minutes later the results are automatically e-mailed to Mary, her teacher, vocational supervisor and logged into her e-portfolio on the national database. Mary is pleasantly surprised to find that she achieved 89% in the test and is determined to complete the next section of the course by next week. Mary receives an e-mail from her teacher congratulating her on the result of the test and booking an appointment with her, via her electronic diary, to go through her personal action plan when she is next in School.

The above scenario highlights just a few of the things the learner could have done using the handheld computer but does illustrate the need for JITL if learners are to be able to manage their own learning within a range of learning environments.

JITL will require the development of a range of quality learning modules that can be delivered within both supported and unsupported learning and vocational environments.

Please note that JITL will be the subject of a future 3T paper.

The future of 'Mobile Computing'

It would be ambitious, if not foolhardy, to try and predict what specific technology or manufacturer will develop the leading handheld computers of the future. However, there are a few general assumptions that can be made with regard to the future of mobile computing.

Handhelds – will be as common as the mobile telephone is today and, to the majority of people, be the only 'computer' they own rather than an addition to a desk/laptop computer.

Cost – as with all electronic devices the cost will fall as demand rises, handheld computers that cost £200 today will probably be available for between £20 to £100 in the very near future.

Battery life – battery technology is becoming increasingly sophisticated and significant improvements have already been made. In the future handhelds will be able to function for significant periods of time between conventional charging. New methods of charging will be developed and incorporate solar, 'wind up' and piezo-electric technology

Memory – the memory storage capability of handhelds in the future will be equal to that of desk/ laptop computers. As the cost of memory falls and technology improves the memory capability will become significantly greater, whilst the physical size of the memory will be significantly reduced. Additional 'plug in' memory sticks will also be available so that data can be easily stored and transferred. Remote memory storage will also be available via the Internet and large amounts of data will be able to be transferred from the handheld to individual, or centrally managed, storage facilities.

Connectivity – either by using local or national networks handhelds will be constantly connected to the Internet and telecommunications network. The initial cost of this 'always on' connection may be high at first but will fall as take-up increases. Some form of 'global' charging system will need to be devised to avoid customer confusion over the charges being levied by individual service providers.

Functionality – as with all computer devices manufacturers will increase the functionality of handheld devices as the cost for basic unit falls. High definition TV, on-line films, digital radio and global tracking systems are already being developed for future models.

Video – some mobile devices already have the capability of storing over 60 minutes of video information. Due to additional memory and sophisticated software the recording and distribution of large amounts of video information will be commonplace.

High definition TV – anywhere, anytime high definition TV, that could include education/training materials, is already being piloted and will be available shortly

Digital radio – the addition of digital radio open up the possibility of learning in remote locations and would include text as well as audio information.

Software – the software used on modern handheld computers is exactly the same as that used on desk/laptop computers. This will eliminate the need to have a desk/laptop as well as a handheld computer and with the addition of a larger screen and keyboard the handheld will equal the functionality of its larger counterparts.

Spray on screens – advances have been made with screen technology and ‘roll out’ or spray on screens have been tested and will be available shortly. The addition of light weight, flexible screens will overcome one of the barriers identified when using handheld computers.

Voice recognition – voice recognition software could be used to overcome some of the barriers associated with the small keyboard or point input devices. ‘Roll out’ keyboards are already available for many handheld devices but the addition of voice operation would significantly improve the effective input of data.

Global tracking systems – global tracking and mapping systems can be added to all handhelds and this will significantly increase their use by mobile learners.

Size – it is clear from other technologies that the size of handheld could be reduced significantly. However, there will be an optimum size accepted by the majority of users that fulfils the portability criteria whilst still retaining usability with regard to the input of data and screen size.

Scientific calculation – using handheld computers within education and training will enable on the spot analysis of scientific and other data as part of the learning process.

Evidence and assessment – the recording of evidence, photographic, video, audio interviews etc plus the ability to take ‘on demand’ on-line assessment will enable the learner to develop their individual e-learning portfolio as the experiences occur rather than try to get paper based evidence at a later date.

CONCLUSION

In just a few years the mobile telephone went from being a luxury item that up and coming executives used to impress their colleagues to an essential item carried by the majority of people in the Western world, including children. It is clear that the growth in mobile technology is set to continue and, in just a few years, an increasing number of people will be carrying sophisticated electronic communication devices on their person that equal the power of a desk/laptop computer at a fraction of the cost. The next generation of handheld devices already have the equivalent computing power of a desk/laptop computer, but in addition to this they have all the functionality associated with 3G technologies and instant access to the Internet. People have become increasingly dependant on the mobile telephone, in particular those of schools age, the majority of youngsters now carry a mobile telephone with them and it has now become embedded as part of accepted 'youth culture'. As the existing technology ages, fashions change, or more sophisticated technology becomes available, and affordable, it will be replaced with handheld computers. As with mobile telephones, handheld computers will be common place within all areas of life and the biggest take up of this technology will be 10 to 30 year olds. As this technology is going to become commonly available within education/training environments it would seem unrealistic not to take advantage of the benefits it offers. A number of Schools have already used the mobile telephone and text messaging to improve truancy and pilots have been undertaken to deliver short modules of learning. A limited number of pilots have also been conducted in Schools, Further/Adult and Higher Education to investigate how PDAs and handhelds could be used and evaluate the benefits they could bring to education and training in the future.

The publication of the '14-19 Curriculum and Qualification Reform' by the 14-19 reform working group in October 2004 clearly highlights the Governments intention to introduce more flexibility and choice, including greater access to vocational qualifications, to ensure all young people are given the opportunity to succeed and leave formal education with a relevant qualification. The reforms will have a knock-on effect throughout Further/Adult and Higher education and the way the curriculum is devised, delivered and assessed. The use of handheld computers could be one way of bringing together all of the elements that are necessary if the reforms are to be implemented successfully. Obviously handhelds are only one element of what would be needed to bring about the reforms suggested but if information cannot flow easily, effectively and electronically the reforms will become a bureaucratic nightmare.

The latest news (5 January 2005) is that at least 20 mobile providers have formed a consortium to develop a new standard ("Super 3G,") for the transmission of data over mobile networks. The new standard will be up to 10 times faster than 3G, which at this point in time is still in its infancy. It is further reported that the development of the technology could conclude by 2007, with commercial launches after 2009. It is thought that Super 3G could allow for services not available over 3G, including continuous video broadcasting and full movie downloads.

It is inevitable that the speed of change with regard to mobile communication devices in particular and technology in general is set to continue and a great deal of 'new' technology will be out of date by the time it reaches the mass market. It is also clear that advances in the delivery and assessment of education and training will continue to play 'catch up' with advances in technology unless educationalists and technologists can find ways of collaborating more closely. New models of collaboration between public and private organisations within the technology industry, education and training will be need in the future if the rapid technical advancement for profit is to be harnessed for the benefit of education and training.

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'Multimedia Portables for Teachers Project'

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'Mobile and PDA technologies and their future use in education'

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'The use of palmtop computers for learning - A review of the literature'

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Web Links

Please note that all web links were active on the 5 January 2005.

Quick Guides

Your handheld is much more than just an information manager, it's a full-fledged computer capable of running thousands of programs. Currently, there are more than 20,000 titles available for the Palm OS. Each of the Quick Guides below will give you a sampling of software and accessories available for your handheld in selected curriculum areas.

<http://www.palmone.com/us/education/resourcelibrary/quickguides.html>

Learning with handhelds – Video case study

Handheld computers will make a real difference in K-12 classrooms. With 1:1 computing - each child having his/her own personal, handheld, mobile computer - children will use their handhelds for essentially 100% of the classroom's teaching and learning activities. Educationally appropriate software, curriculum and professional development is key in bringing that vision to reality.

<http://goknow.com/Video/LearningWithHandhelds/>

Teaching with handhelds

With a computer that fits in the hand and free of connections to school walls, today's student holds technology that has every potential to integrate as a learning tool almost as effortlessly as pencil and paper. Not only do handhelds provide a portable organizer and time manager, but they allow students to enter, manipulate, and analyze data at its source. Additionally, instructional enhancements like video, audio and other files can be easily transferred to handhelds for access anytime. *Teaching With Handhelds* has three sections that present a collection of instructional examples showing how handhelds are used as learning tools. The selection of instructional examples were developed by teachers and shared here for others to adapt and implement in their classrooms.

http://www.intel.com/education/handhelds/teaching_with_hh.htm

BECTA, Portable ICT devices (Handheld computers in schools)

Handheld computers could bring important benefits to schools, assisting in administration, supporting classroom management and enabling personal and group learning. Becta is carrying out a pilot project to evaluate the use of handheld computers in schools, both for managing teachers' work and for teaching and learning.

<http://www.becta.org.uk/research/research.cfm?section=1&id=541>

LSDA

Learning with mobile devices: research and development - a book of papers.

The authors who have contributed to this book are researchers, developers and practitioners in both educational and commercial organisations from a number of different countries. They all have in common an interest in the new and quickly evolving field of mobile learning. The papers are based on presentations given at a very successful and enjoyable international conference, MLEARN 2003, which was hosted in London in May 2003 by the Learning and Skills Development Agency (LSDA). The conference was organised by LSDA, as the coordinating partner of the m-learning project, in collaboration with our sister project MOBlearn.

<http://www.lsda.org.uk/pubs/dbaseout/download.asp?code=1440>

LSDA

The use of palmtop computers for learning - A review of the literature.

This research report is the result of a literature review conducted by the Learning and Skills Development Agency during the m-learning project. The focus is on research involving the use of palmtop computers for learning. The motivation for this review is to inform the design and development of mobile learning materials and systems and to inform the project's research activities. This report highlights many interesting pedagogic and technical issues, which makes it a useful reference for teachers, trainers, developers, researchers and others with an interest in mobile learning.

<http://www.lsda.org.uk/pubs/dbaseout/download.asp?code=1477>

LSDA

m-learning is a pan-European research and development programme. It is aimed at young adults, aged 16 to 24, who are most at risk of social exclusion in Europe. They have not succeeded in the education system, cannot read and write adequately and have problems with simple calculations except in familiar contexts. They are not currently involved in any education or training and may be unemployed, under employed, or even homeless.

*What do many of these young people have in common? **A mobile phone***

<http://www.m-learning.org/index.shtml>

Other useful Web links

The BBC's GCSE Bitesize – games as examination preparation that can be downloaded to mobile phones.

www.bbc.co.uk/schools/gcsebitesize

Cooties and Geney™ simulation games – The Cooties game is a virus simulation game for learning science

www.goknow.com/Products/Cooties.html

The Handheld Educator (American) – Download these supplements on handheld computing. You'll find innovative activities for you to use in your classrooms and information on how to manage, evaluate, and more.

<http://techlearning.com/palm/>

What types of mobile internet connectivity are there?

(Information from the BECTA Technical papers 'Mobile internet connectivity' 2003)

- **Global systems for mobile communication (GSM):** designed for voice communications, but adapted for small amounts of data transfer.
- **High speed circuit switched data (HSCSD):** designed to allow GSM to transfer data at rates of up to four times the original network data rates.
- **General packet radio services (GPRS):** designed to give increased data rates as well as charging based on the amount of data transferred rather than the time spent transferring the data.
- **Third generation (3G) mobile:** designed to offer a consistent set of services to mobile computer and phone users. Increased data rates (up to a theoretical maximum of 2Mbps) should allow a far wider range of services, including video conferencing.
- **Enhanced data GSM environment (EDGE):** designed to co-exist with GSM. It should allow GSM operators who don't have licences for the 3G spectrum to provide users with data rates that would, in some cases, challenge 3G data rates (up to a theoretical maximum of 554Kbps).
- **Public access WLAN:** designed to enable users to access the Internet in localised 'hotspots' via a wireless local area network (WLAN) access card and a personal digital assistant (PDA) or laptop. While data speeds are relatively fast compared with mobile telecommunication technology data rates, their range is short.
- **Linked public access WLANs:** designed to link a number of public access WLANs to give high speed access in, for example, the centre of a town.
- **Public access WLAN and mobile telecommunication convergence:** access technology that allows users/devices to swap between a telecommunications technology (eg GPRS, 3G) and public access WLAN to gain the highest available data rate, depending on their geographical location. This is now being discussed and it is likely that devices will become available that allow seamless roaming between technologies.

APPENDIX B

Data rates, coverage and range for mobile internet connectivity

(Information from the BECTA Technical papers 'Mobile internet connectivity' 2003)

Network/ Technology	Absolute maximum data rates	Present realistic maximum data rates	Future realistic maximum data rates	Range	Coverage
<i>Mobile Telecommunications</i>					
<i>Fixed LANs</i>	100/1000 Mbps	70/700Mbps	7Gbps	~100m	n/a
<i>GSM900/ 1800</i>	9.6Kbps	9.6Kbps	9.6Kbps	Only limited by adoption of technology by the operator	Some operators offer 99% coverage of UK Population
<i>HSCSD</i>	57.6 Kbps using GSM 1800, 38.4 Kbps with GSM900	~9.6Kbps– 38.4Kbps for GSM900	~9.6Kbps– 38.4Kbps for GSM900	Only limited by adoption of technology by the operator	99% coverage of UK population via one UK operator
<i>GPRS</i>	171.2Kbps	52Kbps*	85.6Kbps* (estimated)	Only limited by adoption of technology by the operator	Some operators offer 99% coverage of UK Population
<i>EDGE</i>	554Kbps	n/a	~128Kbps– 344Kbps*	Only limited by adoption of technology by the operator	Too early to comment as not apparent which operators will fully adopt EDGE
<i>3G</i>	384kbps -2Mbps (depending on network implementation)	128kbps* (estimated)	144kbits- ~512Kbps* (estimated)	Only limited by adoption of technology by the operator	Currently, selected densely populated areas of UK. Condition of 3G licence is 80% population coverage in UK by end 2007
<i>Public Access WLANs</i>					
<i>Public Access WLANs (802.11b)</i>	11Mbps	7Mbps	7Mbps	~100m	Presently >1000 (estimated) in UK
<i>Linked public access WLANs</i>	11Mbps	n/a	7Mbps or 27Mbps- 30Mbps (dependant on standard implemented)	City centre, for example	Potentially several thousand in UK by 2007

Key barriers to using ICT*(information from BECTA 2003)*

- lack of access to appropriate ICT equipment
- lack of time for training, exploration and preparation
- lack of models of good practice in ICT
- negative attitudes towards computers in education
- computer anxiety and a lack of confidence
- fear of change and a lack of personal change management skills
- unreliable equipment
- lack of technical, administrative and institutional support.

Teacher-level barriers (BECTA 2003)	School-level barriers
<ul style="list-style-type: none"> ➤ lack of time — for both formal training and self-directed exploration (Fabry & Higgs 1997), and for preparing ICT resources for lessons (Preston <i>et al.</i> 2000) ➤ lack of self-confidence in using ICT (Pelgrum 2001) ➤ negative experiences with ICT in the past (Snoeyink & Ertmer 2001) ➤ fear of embarrassment in front of pupils and colleagues, loss of status and an effective degrading of professional skills (Russell & Bradley 1997) ➤ classroom management difficulties when using ICT, especially where pupil-to-computer ratios are poor (Drenoyianni & Selwood 1998; Cox <i>et al.</i> 1999) ➤ lack of the knowledge necessary to enable teachers to resolve technical problems when they occur (Van Fossen 1999) ➤ lack of personal change management skills (Cox <i>et al.</i> 1999) ➤ perception that technology does not enhance learning (Yuen & Ma 2002; Preston <i>et al.</i> 2000) ➤ lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer 2001) ➤ perception of computers as complicated and difficult to use (Cox <i>et al.</i> 1999). 	<ul style="list-style-type: none"> ➤ lack of ICT equipment (Pelgrum 2001; Guha 2000), and the cost of acquiring, using and maintaining ICT resources (Cox <i>et al.</i> 1999) ➤ lack of access to ICT equipment due to organisational factors such as the deployment of computers in ICT suites rather than classrooms (Fabry & Higgs 1997; Cuban <i>et al.</i> 2001) ➤ obsolescence of software and hardware (Preston <i>et al.</i> 2000) ➤ unreliability of equipment (Butler & Sellbom 2002; Cuban <i>et al.</i> 2001) ➤ lack of technical support (Preston <i>et al.</i> 2000; Cox <i>et al.</i> 1999) ➤ lack of administrative support (Albaugh 1997; Butler & Sellbom 2002) ➤ lack of institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change (Larner & Timberlake 1995; Cox <i>et al.</i> 1999) ➤ lack of training differentiated according to teachers' existing ICT skill levels (Veen 1993) ➤ lack of training focusing on integrating technology in the classroom rather than simply teaching basic skills (VanFossen 1999).

Key questions for schools

- What barriers do teachers in your school think affect their use of ICT?
- Is the whole school involved in, and supportive of, the process of integrating ICT?
- Are ICT resources deployed so as to enable teachers to access them easily and integrate them effectively?
- Is your ICT training provision focused on pedagogy, differentiated by skill level, and arranged with sensitivity to teachers' workloads?

101 GREAT EDUCATIONAL USES FOR YOUR HANDHELD COMPUTER

<http://www.k12handhelds.com/101list>

You may find a few 'Americanisms' in the list below but there are a number of thought provoking ideas you may find useful.

Administrative Applications

1. Keep your schedule
2. Track student progress on specific skills
3. Conduct authentic assessment
4. Use a calculator
5. Make a database of key content and concepts for student use
6. Take attendance
7. Instantly access student information, such as schedules, demographics, or parent contacts
8. Organize your reading lists
9. Take notes at a meeting or in a class
10. Record and tabulate grades
11. Track computer hardware and software inventory
12. Enhance school safety with bar code IDs and an emergency management system
13. Store and access lesson plans
14. Use a rubric to assess and score student work
15. Access a database of curriculum standards and related curriculum resources
16. Keep an inventory of books and other instructional materials
17. Store and track student IEPs
18. Track technical support requests
19. Keep a list of all your important contacts
20. Evaluate teacher performance and record observation notes
21. Access, track, and manage library book or textbook inventories
22. Track, organize, and control inventories and safety information for chemicals in the lab
23. Let students have constant access to their current grades (very motivating!)
24. Track teacher recruiting activities
25. Access human resources benefits information
26. Look up technical troubleshooting information
27. Keep emergency procedures and checklists readily accessible

Communication and Collaboration Applications

28. Send an email
29. Group schedule school meetings
30. Collaborate on a graphic organizer
31. Send or receive a fax
32. Make a presentation
33. Make a phone call
34. Distribute school activity information to students and parents
35. Exchange information with a colleague
36. Share a downloaded web page with someone
37. Send assignment information home to parents
38. Have students turn in an assignment electronically
39. Get parents' sign-offs

40. Transfer a file from your PC for instant access
41. Write an e-book and share it with others
42. Take an online course
43. Send and receive instant messages
44. Conduct group writing activities
45. Record voice notes
46. Transmit closed captioning of lectures for the hearing impaired
47. Access online educational events and news

Teaching and Learning Applications

48. Take and store digital photos for a project
49. Make a spreadsheet
50. Draw a picture
51. Make a concept map summarizing a chapter
52. Form, visualize, and solve equations
53. Keep track of your class schedules, assignments, and grades
54. Record observations on a field trip
55. Read an e-book
56. Find locations with a GPS
57. Study and compose music
58. Graph data
59. View and use maps
60. Increase content accessibility for those with disabilities
61. Gather data on temperature, light, voltage, pH, and more with data probes
62. Program your own handheld application
63. Conduct a surveying expedition
64. Look up a word in a dictionary
65. Use flashcards
66. Use a tutorial for self-study
67. Conduct a stock market simulation
68. Take notes and write a research paper
69. Take notes in class
70. Practice handwriting
71. Study a foreign language
72. Listen to historic speeches
73. Take part in a collaborative simulation
74. Do research on the web
75. Conduct an academic competition
76. Gather and analyze data on environmental issues
77. Make a timeline
78. Look up a word in a thesaurus
79. Create an outline
80. Study for a test
81. Give students step-by-step instructions or visual plans for projects
82. Keep a journal
83. Create fitness records for students
84. Access writing prompts and editing checklists
85. Learn to read and write Japanese characters
86. Learn about concepts in measurement
87. Practice multiplication tables

88. Access the periodic table
89. Manage a collaborative project
90. Look at reference diagrams on parts of the human body
91. Make a photo album
92. Listen to and study classical music
93. Build a robot controlled by a handheld device
94. Track a community service learning project
95. Read about the latest current events
96. Study astronomy
97. Build vocabulary through word games
98. Find or create a geocache (Geocaching Geocaching Geocaching is a game for users of Global Positioning Systems (GPS)).
99. Have classes create their own mobile information channels to share information with other classes or the community
100. Create a database of endangered species
101. Read historical primary source documents

About the author

Dr Bill Lockitt – Account Director (Post 14 education and training)



Bill has responsibility for the development of post 14 education and training at 3T. Prior to joining 3T in December 2003 Bill spent three years developing e-learning as part of the government's '*learnirect*' and UK on-line initiatives run by Ufi. Prior to this he managed part of the Quality in Information and Learning Technology (QUILT) initiative and produced a number of publications for the Learning and Skills Development Agency (LSDA). Bill has also developed innovative multimedia, flexible and open learning delivery methodologies as part of an Esmee Fairbairn Fellowship and completed a PhD entitled 'The effective integration and management of information communication technology within further and adult education delivery methodologies' in May 2001. Bill is a qualified ALI and Ofsted Inspector.

Previous 3T Papers

The first paper – 'Unlocking the Potential of Information Learning Technology (ILT)' discusses learning styles and how ICT/ILT can be used to enhance the learning experience.

The second paper – 'Adult, Community and Work-Based Learning: e-learning' looks at the issues affecting adult learners and highlights how the effective integration of e-learning can enhance the learning experience.

The third paper – 'Using ICT to Develop the 14 to 19 Curriculum' highlights some of the issues associated with the reform of the 14-19 curriculum and the role of ICT.

The fourth paper – develops one of the conclusions from the previous paper in relation to '**Change Management**'. It highlights some of the common theories used when implementing change and uses practical activities to embed the theories discussed.

Please e-mail blockitt@3T.co.uk for back issues.

Feedback

3T is proud to be at the leading edge in the development of e-learning materials, learner and CPD (Continuing Professional Development) support processes and innovative online assessment solutions. If you would like to discuss the issues raised in this paper further, or would like to arrange a visit to discuss individual requirements, we would be pleased to hear from you. To view a small selection of 3T projects follow the links on the following page.

SELECTION OF 3T PROJECTS

E-Consultations

<http://www.dfes.gov.uk/consultations>

3T is currently working closely with the Consultation Unit at the DfES to design, develop and launch Phase Two of a highly sophisticated but simple-to-use website application that publishes and processes Government consultations. Lead developers, designers and project managers have been working closely with the Unit and the DfES project management team. We have utilised a Rapid Application Development approach to help the unit to transfer an offline paper-based process into an electronic online system.

Key Stage 3 ICT Onscreen Tests

<http://www.rm.com/qca/default.asp>

<http://www.rm.com/investors/NewsDetail.asp?cref=IN280398>

The Qualifications and Curriculum Authority (QCA) is developing an onscreen test to provide an independent measure of pupils' attainment in information and communication technology (ICT) at key stage 3 (years 7-9) for schools in England. It will assess ICT capability across levels 3-8 of the national curriculum. The test will be marked automatically and then verified by human markers. It will provide:

1. Summative information in the form of a national curriculum level for each pupil
2. Detailed feedback about pupil performance that schools will be able to use to inform future teaching and learning.

Widening Horizons

<http://www.dfes.gov.uk/progressfile/wideninghorizons>

The Department for Education and Skills (DfES) invited 3T to develop an online version of the CD-ROM "Widening Horizons", produced by 3T for 16 to 19 year olds. The online application integrated the core content with a suite of supportive online tools to help the user plan, organise and manage a range of targets to help them towards a university place, a career, or further training. The DfES plan to position Widening Horizons as its flagship product for the sector.

Moneytalk

<http://www.money-bsa.org.uk/site/page.php?cms=8>

Moneytalk is a fun, realistic and truly useful CD ROM, delivered to adults through colleges, libraries, and other adult learning venues as part of a supported learning programme. The Financial Literacy project, part of the Government's Skills for Life strategy, is a programme designed to improve the financial understanding of adults.

For a full list of 3T projects and case studies visit the 3T Web site: <http://www.3t.co.uk>

