Mobilising learning: A primer for utilising wireless palm devices to facilitate a collaborative learning environment

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Abstract

This paper outlines the potential for establishing the use of Palm PDAs as core ICTs (Information and Communication Technologies) within tertiary education courses. The potential of Palm devices integrated with a campus wireless network can facilitate the use of elearning tools to enhance tutor-student and student-student communication, collaboration, reflection and critique. Student productivity will be enhanced by the provision of a ubiquitous computing environment. The paper outlines how this will be achieved at Unitec.

Keywords

mobile devices, wireless

Introduction

Facilitating teaching and learning

Many Unitec courses tend to approach education from a constructivist, student-centred pedagogical perspective. An example of such a pedagogical approach is Diana Laurillard's (2001) conversational model of tertiary education that focuses on building communication between tutors and students and student to student. Technology can be successfully used to facilitate this approach to education. The explosion of elearning tools aimed at facilitating reflective communication is evidence of this, e.g. email, instant messaging, RSS (Really Simple Syndication, or Rich site Summary), Blogs, access to courseware and discussion boards, student web home pages, etc. (Farmer, 2004; Glogoff, 2005; Kaplan-Leiserson, 2004).

PDAs (Personal Digital Assistants — including Palm and PocketPC devices) have traditionally been seen as a way of carrying information in a more convenient format, with longer battery life than a laptop computer and less weight than a bag full of reference books. However, while some specific tertiary disciplines rely heavily on large databases of knowledge (medicine, law, etc.) that can be accessed conveniently on location using a PDA, most courses have more modest demands on student recall. What appears to be generic to all tertiary courses is the development of student communication, collaboration, reflection and critical thinking skills. These skills can be developed with the aid of elearning tools that can be accessed via PDAs. These tools include all of those mentioned above: Email, instant messaging, RSS, Blogs, access to courseware and discussion boards and student web homepages.

In conjunction with PDAs or laptops, wireless connectivity promotes the establishment of a virtual collaborative learning community producing a higher level of communication between tutors and students and between students themselves from anywhere on campus or any wireless hotspot. There are currently 59 Telecom WiFi hotspots listed in Auckland (Telecom NZ, 2005), including Starbucks cafes, hotels, and most shopping Malls. The term commonly used to describe this freeing of learning from specific classrooms or computer labs is m-learning.

> Advantages that PDA devices have in facilitating collaborative m-learning environments include:
>
> *Portability* - can take the computer to different sites and move around within a location
>
> *Social Interactivity* - can exchange data and collaborate with other people face to face
>
> *Context Sensitivity* - can gather data unique to the current location, environment, and time, including both real and simulated data
>
> *Connectivity* - can connect handhelds to data collection devices, other handhelds, and to a common network that creates a true shared environment
>
> *Individuality* - can provide unique scaffolding that is customized to the individual's path of investigation
>
> (Squire et al, 2002, p. 7)

Why Palm/PDAs?

While laptop computers can also meet the advantages listed above, for courses that do not require high level processing power and applications, today's PDAs provide all the processing power and communication applications that students need, at a lower cost, greater portability and longer battery life than a laptop computer. A PDA is not made redundant by a laptop or desktop computer, but is designed to complement them.

Students will not engage with elearning and collaborative communication tools if they do not have easy access to computers. Several departments on campus do not have dedicated computer facilities for student access, but could potentially provide ICT access for their students at a much lower cost and greater flexibility in the learning environment by integrating the use of wireless PDAs into their course delivery (GoKnow, 2004; Norris & Soloway, 2005).

The choice of PDA platform (PocketPC or Palm OS) is dependent on the key requirements of the end users. Medical courses and professionals in New Zealand tend to use PocketPC devices, but beyond this there is currently not much market penetration of PDAs in tertiary education in New Zealand. The Palm OS devices support a wider range of software, tend to be more reliable (crash less), and integrate better in a cross-platform environment (Macintosh and Windows) than PocketPC devices (Martin, 2005; palmOne, 2005). For disciplines where there is not a platform preference set, the author favours the Palm platform.

The wireless networking capability of today's PDAs is a key aspect of their mobility on campus but increases the cost of the PDA. The cost of wireless Palm devices sits affordably within the course-related costs funding that tertiary students receive ($1000NZ per year). A practical pricing point for students to purchase their own PDA is around $500–$600NZ. This leaves them with money for other course related costs as well. International students do not receive this funding, and will need to finance the cost of the PDA. Wireless PDA devices currently available in this price range include the Palm Zire72 (with additional WiFi SD card), Palm Tungsten E2 (with additional WiFi SD card), or Palm Tungsten T3 (no longer current). The new Palm Lifedrive (with integrated Bluetooth, WiFi, and 4GB HD) is outside this pricing, but bulk-buying deals may bring the price down to $600NZ.

Renaissance (the NZ importers for Palm) has supplied Unitec with a set of 18 LifeDrives for the purposes of initial feasibility trials.

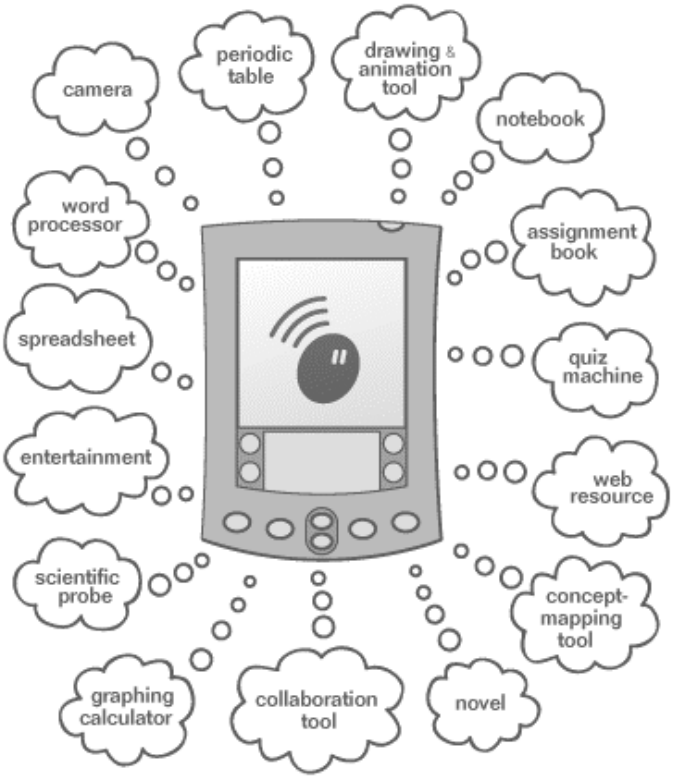

Figure 1: Uses of PDAs

(Source: GoKnow, 2005)

Some recent research has promoted the potential use of cell-phones as the technology of choice for mobilising student learning (Attewell, 2004; Prensky, 2005). However only the most expensive cell phones integrate the feature set available in dedicated PDA devices, and the cost to the student of text messaging, and data plans on 2G or 3G networks is currently prohibitive (at least in New Zealand). Eventually the cell phone and PDA will merge at an affordable price point and 3G or 4G networking will drop in price, but this is still in the future.

Collaborative learning tools for Palm

PDAs can be used for much more than mobile calendars or document editing. Virtually all the popular types of collaborative learning tools that are available for desktop computers are also available for PDAs (see table below for some example applications). It is these collaborative tools that can be utilised by virtually any course to facilitate development of reflection, critical thinking, communication, and collaboration skills. There is a range of applications available for Palm devices, from open-source freeware, to shareware and commercial products. Palm devices are usually supplied with a complementary suite of useful applications (*). These are also available for purchase from the Palm website for models not bundled with them. There is a huge range of software available for trial and purchasing from http://www.palmgear.com and similar websites. Below is a brief overview of example applications that the author recommends.

Table 1: Example collaborative learning applications for Palm

TOOL	Freeware	Shareware	Commercial
RSS			QuickNews ($21.38NZ) Web Pro* (via JavaScript)
Blog	Plogit U*Blog	Mo:Blog	Vagablog
HTML		PHTML ($14NZ)	Torpedo ($35NZ)
Email			Versamail* ($43NZ) Snappermail ($56NZ)
Instant Messaging	AIM v1 Agile Messenger	Chatopus ($21NZ)	VeriChat ($35NZ per year) AIM v 3.2 ($29NZ)
Web Browsing		Palmscape ($43NZ)	Web Pro* Xiino ($43NZ)
Wiki		AcroWiki ($21NZ)	
Remote Access	PalmVNC	AstroView Veta Universal ($14NZ)	Clicker ($29NZ)
File Transfer	LFTP TuSSH EzFTP TG ssh	VFSFTP ($21NZ) Drag'n'tooth ($14NZ)	WiFile Pro ($43NZ)
Mind Mapping			Inspiration ($43NZ)

Learning object development for Palm

Interactive multimedia learning objects can be created for delivery on PDAs. The latest generation of PDAs are capable of resolutions, colours and brightness to display video and animation effectively. The main multimedia authoring formats for PDA's are:

i. Flash
ii. QuickTime
iii. WAP (Wireless Application Protocol).

Flash has made its way from web-based applications to mobile devices including PocketPC and Symbian OS cell phones (Hess & Hancock, 2005). Flash now comes with templates for mobile devices, and the Flash Platform (latest version of Flash from Macromedia) is targeted at the burgeoning mobile market (Lynch, 2005). The beauty of Flash is its scalability and ubiquity. However, currently there is no Flash Player available for Palm OS devices (except for selected Sony Clie Palm devices).

QuickTime provides the scalability required to create multimedia learning objects for mobile devices, and supports a wider range of media formats than Flash. QuickTime movies can be viewed using the Kinoma Player for Palm, which also supports interactive QuickTime 'movies'. These miniaturised QuickTime movies can include video, hypertext, VR scenes and audio (amongst others). There are two main QuickTime authoring applications for Palm: Kinoma Producer, and iShell Mobile.

Simpler card-based authoring applications are also available for Palm. One example is 'Studycard'.

WAP provides another approach to authoring learning objects capable of being used on the Palm platform. WAP uses a subset of HTML, called WML (Wireless Markup Language). An example of a WAP based authoring application for Macintosh OSX is iWapper. Current PDAs are also capable of running the game engines that were used on desktop computers a few years ago. The advent of educational gaming provides another area to explore with PDAs.

Table 2: Example multimedia applications for Palm devices

APPLICATION	Freeware	Shareware	Commercial
Audio	AeroPlayer RealOne* Kinoma TCPMP	MMPlayer ($26NZ)	AeroPlayer ($36NZ) RealOne Kinoma ($34NZ)
Video	RealOne Kinoma TCPMP	MMPlayer	AeroPlayer RealOne Kinoma
Interactive Video	Kinoma		Kinoma
Document Reading	Adobe Reader* CSpotRun		Documents to Go* ($43NZ)
Document Editing			Documents to Go* Adobe Reader*
Input Utilities		FatFinger ($24NZ)	Thumboard ($21NZ)

Why wireless?

As already mentioned, the potential of mobile devices is enhanced with wireless technology. The wireless revolution is already here (Alexander, 2004) and is being driven by wireless consumer devices, burgeoning wireless hotspots and the falling costs of wireless access point hardware. Smaller tertiary institutions with relatively low investment in wired networks have embraced wireless technology for several years. However, the larger tertiary education institutions in New Zealand have been slow in implementing campus wide wireless networking. There are many advantages of wireless networks even for institutions with well-established wired networks. Boerner has written a good summary of relevant issues of wireless networks for tertiary institutions.

> Wireless LANs should be seriously considered when upgrading campus networks. The technology has matured and provides a positive set of advantages, including: cross-vendor interoperability, practical interference-free communication over reasonable distances, and minimal security that can be augmented by several emerging technologies. Access Point devices have advanced to allow scalable connection with the wired campus infrastructure, and students and faculty can roam the campus and maintain their network connection. Above all, retrofitting older buildings with networking using wireless technologies lowers the overall cost of ownership and facilitates faster installation, simplicity, and flexibility; and, except for connecting Access Points, physical wires no longer need to be run through walls or between floors.
>
> (Boerner, 2002)

Sotillo (2003, p. 5) describes the pedagogical impact of ubiquitous wireless computing:

> In summary, the advantages of wireless computing in education are ubiquity, portability, and flexibility for collaborative learning projects. Computer power everywhere and all the time means the ability—and the challenge—to integrate computers into every aspect of teaching, learning, and research. This represents a Copernican revolution in instruction, with the professor as guide and mentor rather than "fount of knowledge" or ultimate classroom authority.

Wireless productivity/connectivity

There are four main wireless technologies currently available for PDAs:

i. Infrared (IR)
ii. Bluetooth
iii. WiFi (802.11 …)
iv. 3G.

The main differences between these technologies, is an increasing order of magnitude of operational distance and data rates. Short-range connectivity is termed PAN (Personal Area Network), medium distance connectivity is W-LAN (Wireless Local Area Network, usually equated with WiFi), and longer-range connectivity is termed WAN (Wide Area Network). IR and Bluetooth are conceived as inter-device connectivity options, while WiFi provides access to a wireless W-LAN that can be bridged to the wired LAN. 3G-network capability provides WAN access, at a price premium.

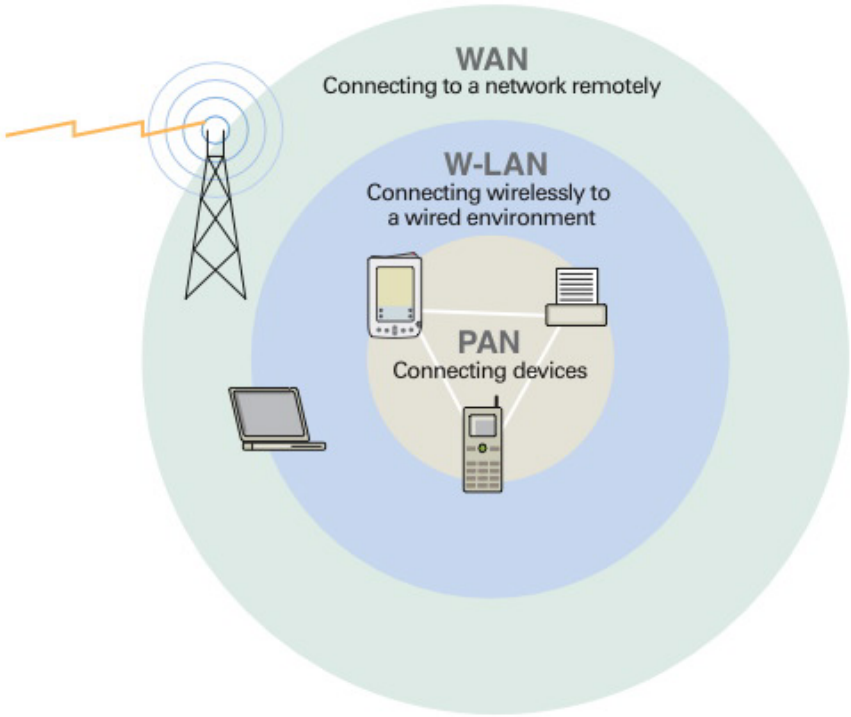

Figure 2: The wireless matrix

(Source: palmOne, 2002, p. 2)

Infrared connectivity is short range, and requires line of sight, is limited to 100kbps, but is good for quickly 'beaming' documents and applications between devices, providing one to one sharing of data (there are one to many 'beaming' applications around, but they are short distance). Infrared also allows a PDA to become a universal remote control for any IR capable device that supports the protocol.

Bluetooth operates in the 2.4Ghz frequency range, the same as WiFi, microwave ovens, and many mobile telephone handsets. It is limited to between 10 and 100m (depending on the strength of the transceiver, and any interfering materials), and a data rate of 1Mbps (the Bluetooth 2 specification now used in Apple Macintosh PowerBooks supports 2–3Mbps). Bluetooth connectivity also provides network and WAN access by pairing a Bluetooth cell-phone with a Bluetooth PDA. The Cell-phone can then act as a modem for the PDA. The cell phone can either provide dialup Internet access, by dialing into an ISP (limited to 9600 bps, but surprisingly useable for text and IM), or using a faster data protocol such as GPRS or CDMA that can provide data rates equivalent to a 56kps modem through to 1–2Mbps for 3G enabled cell phone networks. Of course the call duration has to be paid for, if using dialup access, and the data used if accessing via a faster data plan.

WiFi is the popular name for the 802.11 wireless Ethernet standard. WiFi is basically an extension and bridge to your wired network. Anything that can be done on a wired network can be done on the WiFi network (unless IT departments limit the functionality of the WiFi network). This allows the PDA device to piggyback onto the network. There are currently three types of WiFi, b = 11Mbps, g = 54Mbps (backwards

compatible with 802.11b), and a = 54 Mbps but uses a higher frequency spectrum and is not compatible with b or g. PDA's currently use 802.11b, as it requires lower power consumption than 802.11g or a. The range of WiFi connectivity is typically 50–100m, with data rates dropping with distance from access points to a minimum of 1Mbps before losing connection. The access point transceiver's signal can be boosted with the use of external aerials, or reduced by decreasing the transmitter power.

Because of the range of WiFi connectivity, security of wireless data becomes an issue. An unauthorised person can be sitting in the car park, or a café across the road from an access point and use any unprotected wireless network. WiFi security protocols range from WEP to WPA which both use encryption and password protection to secure the access to the wireless network and encoding of network data. 128 bit WEP is relatively easy for a hacker to crack, while WPA is much more secure. Unfortunately only the latest PocketPC 2003 WiFi devices and the Palm LifeDrive currently support WPA security, leaving older PocketPCs and Palm devices orphaned by WPA encrypted WiFi networks. An alternative (or even addition) to WPA for providing increased wireless access security is to use MAC (Machine Address Code — every network device has a unique MAC) filtering. A database of MAC addresses of allowed wireless devices only allows those devices to use the wireless network, blocking unauthorised use of the network. Another security option is using 802.1x, which employs a user logon authentication server. Unfortunately there is only one 802.1x client currently available for Palm devices, and this only runs on the defunct Tungsten C (there is a rumour that the LifeDrive will have 802.1x functionality via a future firmwear update).

3G cell phone networks can be accessed either by the expensive all-in-one PDA/phones (e.g. Palm Treo 650), or by pairing a 3G phone with a PDA via Bluetooth. The data rate of 3G networks is still slower than that of a fast ADSL broadband connection, but it is far more flexible. The main limitation of 3G networks is currently the cost of sending and receiving data (about the same level as when dialup Internet access began ten years ago) and the lack of competitive suppliers (in New Zealand). There is also development of 4G and WiMAX (802.16) networks, providing around 10Mbps data rates, but these are not currently on the horizon for New Zealand users.

Meeting the challenges of implementing wireless PDAs on campus

In planning to use wireless PDA devices to enhance learning, Wagner (Wagner, 2005, pp. 48–49) points out four key lessons that have been learnt from the elearning revolution so far:

i. Learning is a deeply personal act that is facilitated when learning experiences are relevant, reliable, and engaging.

ii. Different kinds of learning demand appropriate strategies, tools, and resources.

iii. Technology in and of itself may not guarantee better learning.

iv. The better the experience and the more intentional the results, the greater is the likelihood that learning will occur.

Advantages of wireless PDAs

- Small size and portability/mobility.
- Lower cost.
- Potential ubiquitous computing for all students.

Disadvantages/hurdles

- Small size screen.
- WiFi network security protocols.
- Stability of the Palm LifeDrive model.
- The cost to the student of purchasing his or her own PDA and applications.
- Tutor acceptance and use/modeling of the technology.
- Developing new pedagogies for integrating the PDAs into the course delivery.
- Convincing students to use the technology in a collaborative, educational way.
- Developing protocols and support structures for using the PDAs (this is part of developing the collaborative learning community).

Evangelising m-learning

The potential of wireless PDAs to provide the technology to enhance teaching and learning is established. Now tutors, administrators and students need to be convinced of this and be willing to embrace and utilise the technology. Merely providing technology does not guarantee it will be used in an educational way, as Duke University has recently learnt with its iPod programme (Bugeja, 2005). Moving beyond theory to implementation is the next step. To facilitate this the author proposes to facilitate and research the development of several trial courses during Semester 2 of 2005 and Semester 1 of 2006. By establishing 2–3 courses using PDAs and fostering teaching 'champions' the benefits of PDA use can be illustrated to other courses, and best practice principles will be developed. The first step is conveying the concept to potential trial tutors/courses.

To facilitate conveying the concept of the educational usefulness of PDAs, the author has developed several resources and approaches. One-on-one demonstrations with tutors will be utilised along with group presentations to groups of faculty and students. Demonstrating small screen devices to a group of people is problematic — sharing one or two PDAs within a group of people will not produce a favourable response. Either every participant needs access to a PDA, or a demonstration model's screen needs to be projected onto a large screen for everyone to see at once. Once shown the basics of operation and potential uses, users will be better prepared for a hands-on experience.

An interactive QuickTime Palm demonstration movie has been created. This movie has been skinned and scripted to behave similarly to a real Palm device with an assortment of screenshots of educationally useful applications 'installed'. The user can access the demonstration movie on a Macintosh or Windows based computer, either locally (off CD, HD or network) or from a web-based server (an 18MB download available from http://ltxserver.unitec.ac.nz/~thom/ LifeDriveDemov.html). This provides access for users to initially experience the Palm interface without requiring a real unit, or getting lost in device configurations.

Two solutions for presenting the Palm device and applications in real time to a group have been explored. The first is to use the Palm Simulator software (PalmSource, 2005) on a laptop computer attached to a video projector. The second is to use Palm remote control and screen sharing software on a laptop/desktop computer attached to a video projector. There is also the Margi Presenter to Go, SD card to VGA adaptor, however the screen update delays of 1–2 seconds renders this inadequate for the job, and the unit fills the Palms SD card slot leaving no access to SD memory cards or WiFi networking (on non WiFi built-in Palm models).

The Palm Simulator software is the actual Palm OS operating in real time on a Windows based PC. This can also be achieved on a Macintosh computer running Virtual PC, as there is currently no OSX version of the simulator software. This is a good solution, giving a very similar interface and playback experience as the real Palm devices. All network connections are shared from the host computers network connections, so certain firewalls may need to be disabled. The downside of the simulator is the inability to save complete Palm setups. A standard Palm ROM file needs to be loaded, then hot-synched from the host computer (using the network synch capability of the simulator software) to load any desired applications, preferences, and databases.

PDAReach (June Fabrics, 2005) is a windows application for remotely controlling and screen sharing of the latest Palm OS devices (Tungsten3 and newer). The software does not work within VirtualPC on a Macintosh computer. The software works well on a Windows PC, providing the full functionality of the Palm device attached via USB to the demonstration computer. However, the screen redraw rate is somewhat slow for any animation or video playback. Any network connections required by the Palm software must be made directly by the Palm device itself.

After demonstrating the devices and collaborative applications, the next step will be to get tutors to regularly use the technology themselves. Tutors must be comfortable and experienced with using the technology in order to effectively integrate the use of Palm devices into their courses, and to provide support for their students. The Tutor is the key initiator/modeler (to begin with) of the collaborative learning community that will be enabled by the use of the Palm applications. Without Tutor guidance, students will fail to recognise the educational usefulness of the PDAs and will instead use the devices for entertainment and in non-reflective or non-critical thinking ways.

The proposed research project

While there are several examples of integration of Palm devices in tertiary education in overseas institutions, there are few (if any) in New Zealand. The author is part of the Learning Technologies team at Unitec, and as such is ideally situated at Unitec to promote and research the potential of Palm devices to enhance the delivery of courses and student learning. It is proposed to run 2–3 trials with courses from different schools within Unitec during 2005–2006 with the aim of integrating the use of Palm devices into several courses for 2006 and beyond. The trial is needed to get buy-in for the concept from tutors and students at Unitec. Once a couple of courses are established integrating the technology, a domino effect will be created among the student population, much as that which spread the integration of BlackBoard (the elearning course management system used at Unitec) throughout courses at Unitec. The trials are also important to give tutors the skills and confidence in utilising the technology before full implementation within their courses.

A proposed trial of integrating wireless PDAs into the Elite Athlete course of the Unitec School of Sport has begun. The trial is a partnership between Learning Technologies and the School of Sport. The goal is to enhance teaching and learning using learning technologies that are currently unavailable to the School of Sport students.

Students will not engage with elearning and collaborative communication tools if they do not have easy access to computers. The School of Sport does not have dedicated computer facilities for student access, but could potentially provide ICT access for their students at a much lower cost and greater flexibility in the learning environment by integrating the use of wireless PDAs into their course delivery (GoKnow, 2004; Norris & Soloway, 2005).

From 2006 the primary funding for the PDAs will be from the students themselves. The cost of wireless Palm devices sits affordably within the course-related costs funding that tertiary students receive ($1000NZ per year). The Palm LifeDrive (with integrated Bluetooth, WiFi, and 4GB HD) retails for $899 NZ, but a group purchase deal should bring this cost significantly lower.

Keys to successful PDA implementation

- Tutor acceptance and use/modeling of the technology.
- Developing new pedagogies for integrating the PDAs into the course delivery.
- Convincing students to use the technology in a collaborative, educational way.
- Developing protocols and support structures for using the PDAs (this is part of developing the collaborative learning community).

Project steps/timeline

i. **Week 1**: Introduce teaching staff to technology, brainstorm new pedagogies for use with the LifeDrives.

ii. **Week 2**: Install Wireless network in main teaching area of School of Sport (provided by Learning Technologies for period of trial).

iii. **Week 3**: LifeDrive overview with School of Sport Teaching Staff.

iv. **Week 4**:LifeDrive overview with School of Sport students.

v. **Week 4**: Choose students to participate in trial (sign Acceptable Use Policy, and insurance).

vi. **Week 5**: Setup Mac workstation in School of Sport for students to hotsync LifeDrives (provided by Learning Technologies for period of trial).

vii. **Week 5**: LifeDrive training with staff and students.

viii. **Week 6**: Integrate LifeDrive into project/assessment.

ix. **Week 10**: Evaluate trial (student and staff feedback).

x. **Week 12**: Extend trial to all Elite Athlete students?

xi. **November**: Plan to integrate wireless PDAs into curriculum requirements for 2006?

Data collection procedures

i. Survey form for students and staff to complete at end of each term.
ii. Focus group.
iii. Reflective journal.

Costs

2005 — nothing for trial.

2006
i. Install wireless access point in School of Sport (Unitec IT department): $1500.
ii. Supply LifeDrives for School of Sport Teaching Staff @ $899 each retail.
iii. Mac or PC workstation setup for hot syncing LifeDrives ~ $1500.
iv. Students must budget ~ $700 to purchase their own LifeDrive as part of their course related costs.
v. Savings = reduced photocopying (electronic delivery of notes to students …).

Potential benefits for Palm and Unitec partnership

There has been limited adoption of student PDAs within tertiary institutions (and in particular Unitec) in New Zealand. A study by TechLearn (Smith, 2003) indicates that students are more likely to purchase a cell phone than a PDA, and most will not purchase their own PDA unless they can clearly see the potential/benefits for their studies. Demonstrating the potential of integrating PDAs into courses will lead to students purchasing their own PDAs. Tutors, and heads of departments need to be convinced of the benefits of integrating PDAs into their course delivery before they will do so. Once precedence is established, Palm could see a large number of potential sales of PDAs and associated accessories into the student population at Unitec.

Currently, the Nursing School at Unitec use Pocket PC devices as part of their clinical studies. This has been going very well for them, although they are only beginning to adopt wireless connectivity as part of the PDA implementation. However, there is currently no example/champion of Palm based devices at Unitec. A partnership with Palm/distributor has financial benefits for both parties — increased sales for Palm, lower costs and better support for Unitec and students.

Research questions

i. What are the key factors in integrating wireless PDAs within tertiary education courses?

ii. What are the technological challenges/barriers to implementation, and how will they be resolved?

iii. To what extent can these wireless PDAs be utilised to support learner interactivity, collaboration, communication, reflection and interest, and thus provide pedagogically rich learning environments that engage and motivate the learner?

Project methodology

The project is qualitative in nature, and uses a small ‘sample’ of participants evaluating the integration of wireless PDAs. The project will be conducted over a two-year period, and use action research as its methodology, involving one research cycle per semester. The action research cycles will provide time for reflection and feedback between researching and developing an appropriate interactive learning resource and trialing the resources on users. This reflection and feedback will provide data on the success of the implementation and integration of the PDAs and areas needing modification. The approach of action research provides a close fit with the researcher’s own view of education (transformative — seeking to produce change) and preference for qualitative rather than quantitative research. Action research also provides a close fit with the currently prevalent pedagogy: constructivism. Wadsworth (1998) identifies the key characteristics of ‘participatory action research’ as:

- The researcher is a participant.
- The researcher is the main research instrument.
- It is cyclical in nature, involves action followed by reflection followed by informed action.
- It is concerned with producing change. This change is ongoing throughout the process.
- The research is interested in input from participants/stakeholders.

Qualitative research provides rich data for educational situations (Hoepfl, 1997). Data collection methods will include focus groups of representative stakeholders and tutors keeping a reflective journal.

Conclusion

The m-learning revolution is underway, and it is time tertiary education harnessed its potential. There is great potential for using wireless PDA devices to facilitate/support learning and teaching at a tertiary level. The proposed research will form a sound basis for implementing m-learning.

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