UNPLUGGED LEARNING:

A report on the rise of mobile technology in learning.

November 2004

Foreword

This report was prepared to capture the information and knowledge gained by the writer at the MLearn conference in Rome, 5-6 July 2004.

A desk-top survey, and thus preliminary research was carried out so this document as such is not an empirical study. However research that was presented at the conference is incorporated as appropriate.

Research methods comprised internet searches, a literature review, and a range of interviews with academic and industry providers. The main contributors were the UK members of the MLearning Project, Ultralab UK, Learning and Skills Development Agency UK, Cambridge Training and Development and Complete Learning UK.

The document also draws on the writer's two research papers in eLearning. As an independent e-learning researcher Elizabeth Valentine has also published research on "The Convergence of Knowledge Management and E-learning" in 2002 (Henley MBA Dissertation) and "E-Learning: an Overview Study the market and New Zealand's capability" in 2004 for New Zealand Trade and Enterprise.

Dedicated to my dad, Maurice H Haley, who died just after I returned from the conference, and without who's inspiration as a teacher I would not have an enduring interest in learning and teaching.

Acknowledgements

This report was commissioned by the Ministry of Education in conjunction with the Ministry of Research, Science and Technology and written by Elizabeth Valentine, an independent eLearning researcher and analyst.

Many people gave generously of their time in interviews and in sharing their knowledge and experience. Those organisations underlined have been major contributors. Those not underlined mostly contributed in conference conversations and informal meetings, or personal correspondence:

- **Ultralab UK** - Richard Millwood, Jean Johnson, Tom Stacey, Stephen Powell, Stan Owers, Mark Constable, Jonny Dyer, Alice Mitchell, Carole Chapman, Leonie Ramondt, Kris Popat.
- **Learning & Skills Development Agency UK** – Jill Attewell
- **Cambridge Training and Development UK,** - Geoff Stead
- **Complete Learning UK** - Martin Deans
- **The Ministry of Education NZ**– Murray Brown, Murray Leach, Carolyn Holmes,
- **Games2Train USA** - Marc Prensky
- Athabasca University Canada – Dr Mohamed Ally
- Australian Army – Simon Geddes
- BBC UK – Paul Scott
- Centrul de Afaceri Transilvania – Dr Radu_Adrian Mlesnita
- CIBIT Holland – Prof. Michael Kelleher
- CityLink NZ – Neil de Wit
- Games2Train USA – Marc Prensky
- Giunti Interactive Labs Italy - Fabrizio Cardinali
- Intel Ireland – Gerard Smyth
- Nokia – Riitta Vanska
- Salburg Research Germany – Veronika Hornung-Prahauser
- TAFE Australia – Caryl Oliver
- University of Birmingham UK – Dr Russell Beale, Paul Kiddie, Dr Mike Sharples, Daniel Corlett
- University of Copenhagen Denmark - Trine Middelbo Sorensen
- University of Hagen Germany – Dr Georg Strohlein
- University of Helsinki, Finland – Janne Sariola
- University of Klagenfurt Germany – Stefan Plattner
- University of Wolverhampton UK – John Traxler
- Vodafone NZ - Reece Kingi; Vodafone UK - Gordon Bull, Jonathan Helps
- Various people at the MLearn 2004, Rome Conference 5-6 July conference whose brains I picked but whose contact details I did not get.

Unplugged Learning.

1: Executive summary

Mobile consumer, education and business applications are flourishing. Wireless and handheld technologies are already reshaping many industries including e-Learning. Convergent technologies, especially those involving hand-held, mobile devices are changing how, when and where people communicate, transact business and access information for a wide range of reasons including learning.

Mobile Learning or mLearning is relatively new. To leverage the advantages of mobile, especially digital mobile technology, will require that learning professionals extend their views and applications of learning models and theories (not just eLearning) to address the needs of an increasingly mobile and unplugged society. “The arrival of the pervasive digital media environment in the school, home and office seems imminent. The key factors contributing to this include:

- “Increasingly wider availability of broadband
- “Increased interest in home networks
- “Increased sophistication of personal digital devices
- “Ever-increasing libraries of digital content and knowledge bases.” (Smyth 2004.)

MLearning has the potential to weave itself into the fabric of a learner or worker’s study, business and personal activities, when and where they need it. While in 2004 these are very early days, mobile devices are already being used in education and corporate training to connect expertise with remote learners; to engage otherwise disenfranchised groups of learners; to contextualise research projects and support action learning. While demand may currently be slow,” the potential is significant.” (Bielawski & Metcalf 2003.)

Where mobile learning fits in a wide range of possible learning design and delivery methods as a part of a “blended” learning strategy is discussed. Trends in mobile technology such as convergence, digital mobile and geolocation are raised and lead to the conclusion that there are issues and benefits in four categories:

1. content for mobile devices
2. The range of devices and the wide range of functionality
3. Learners - how to engage and retain their interest when learning in this medium

4. Teachers – how they'll need to upskill, change and collaborate to make the most of the fast changing unplugged world their students are "native" to and in which they are expected to teach.

Key questions emerge: Will mLearning leverage the increasingly wide range of mobile and wireless enabled devices? What are the impacts for educators and learners? In what ways do our views of learning and learning delivery need to change? How might unplugged, hand-held learning impact instructional design and the technical and policy frameworks within which m-Learning will be designed and delivered?

This paper represents a "desk-top" analysis of the emergence of mLearning as a sub-set of eLearning. It draws on the writer's experience and research into the wider topic of eLearning and reports observations and interviews carried out at the July 2004 MLearn Conference in Rome (at which the writer presented a paper) and with a small sample of UK and New Zealand-based educators and policy makers.

Keywords: m-learning, convergence, interoperability, standards, content and curriculum, design, paradigm shifts.

2: Background

Information and Communication Technologies (ICT) have undergone dramatic changes in the last 25 years, each time providing opportunities for the education and training sectors. The 1980's saw the rise of the Personal Computer (PC), which brought computing into the home, and in education, put computing and computer based training into the classroom. This was the start of the notion of anywhere, anytime learning. The 1990's saw the emergence of the World-Wide-Web (the web), building on the infrastructure of the Internet, which revolutionised the availability and delivery of information and learning content.

The implications of web technologies on education, often described in terms of e-learning, are already far reaching; the potential is still being explored and debated. Much was promised and many were disappointed, often because content developers did not take the leap required to leverage the power of the e-medium available to them for learning and learning support. Much, often little more than electronic page-turning, was churned out with little consideration for what constituted effective instructional design and delivery in the e-medium. "Statistically significant gains in educational attainment are shown only in several areas and these are very small." (DfES Becta 2002.) "The general belief has been that technology has been imposed without due regard to technique, effectiveness and appropriateness and without consideration of learning theories and pedagogies." (Rentoul et al 2001.)

However, "In the midst of this information revolution, we are now confronted with a third wave of novel technologies, that of mobile and wearable computing, where computing devices are already becoming small enough so that we can carry them around on us at all times, and, in addition, they have the ability to interact with devices embedded in the environment. The emergence of this new wave of technologies offers many opportunities in the education sector." (de Freitas & Levene 2003.)

MLearning is where mobile telephony, internet and wireless enabled computing and eLearning converge. It means the increasing capability to learn or support a learning experience anytime, anywhere through bite sized instances or nuggets of learning from a note-book, tablet, wearable device, cell phone, personal digital assistant (PDA) or pocket PC (PPC).

An increasing number of learning professionals and observers in the UK, Europe and the United States are predicting that mLearning is both different from and potentially more impactful than learning delivered by plugged in, desk-top computers. The advantages being discussed highlight:

- Greater flexibility for the learner in terms of where they choose to study,
- How learners receive, collect data for and/or complete assignments,
- How action learning and research are supported and
- How learners record and share study data
- How making appropriate use of increasingly sophisticated multimedia features in digital mobile devices can assist with both learning and valid assessment.

Wearable and mobile devices allow the student to interact with data in a more casual and differentiated way. They are also considered to be cool thus reducing a possible barrier to learning through this medium.

Learners can chose a range of media within a pocket PC such as phone, audio or video, SMS, MMS, MP3 or the internet to connect to other learners or sources of learning, informing or transacting. Learners have an increasing range of multimedia tools available to assist with or utilise in their learning experience. For example the i-Mate PPC which is marketed in Europe as the XDA2, runs Microsoft Windows with Word, Excel and Windows Media Player standard and PowerPoint a pay to down-load. This PPC also is a phone, has a video, digital still camera and audio recorder, is blue-tooth, infrared, WiFi and Internet browser enabled, as well as a Palm – type organiser and miniature games console. The power of this early convergent device with optional add-ons (such as portable mini keyboard and data-show jack) can replace the need for a separate lap-top computer, digital camera, mobile phone, organiser and MP3 player. And while the digital camera, for example is currently only .3 mega pixels, this is predicted to change to 1.5 – 2 mega pixels within 18 months to two years.[1]

[1] It is understood that the next version of the XDA has been released in UK/Europe November 2004.

The added functionality of location sensing devices using GPS and GPRS can provide information about where the learners or learning interest sites are located and can tightly focus learning bites based on precise context. (Based on de Freitas & Levene 2003.)

2.1 Differences between eLearning and mLearning

There are differences between mLearning and eLearning. Emerging differences are varied.

- mLearning offers greater flexibility in where and when learning happens.
- mLearning is causing educators to rethink how learning happens and how specific learning needs and styles are expanded and enabled with multifunctional hand-held devices
- There is already strong evidence that students from a wide variety of age groups and different educational institution types (advantaged vs disadvantaged; private vs public: bricks and mortar vs distance;) are finding hand-helds a useful and engaging adjunct to traditional learning methods, with measurable results
- Handheld technology is already ubiquitous, covering a wide range of different device types
- Ownership of mobile devices is already penetrating community segments previously disadvantaged within the PC-related digital divide
- Phone technology advances are reaching critical mass faster than plugged in PC technology, because of the depth and breadth of market and multi-segment penetration.

(Attewell & Savill-Smith 2003; Caughlin 2003; Corlett & Sharples 2004; Tamahori 2004; Valentine 2002; 2004.)

From smart cell phones and PDAs to webpads and wearable devices, one-time curiosities are now indispensable business and learning tools. We now have a delivery system for learning, communicating, collaborating and supporting on-job performance

as well as transacting; and that represents a pretty powerful bag of tricks. (Based on Gayeski, 2002, pg 13.)

2.2 Scenarios for mLearning

To highlight the differences between eLearning and mLearning, here are some scenarios using:

a) Mobile phones

b) PPCs

c) Wearable and advanced digital mobile devices.

2.2.1: Scenarios using mobile phones

- A student sees a poster on a cafeteria wall challenging her to improve her maths. She tries the 15 questions, texts her answers to the number on the poster and gets an instant assessment (with details of who to contact if she needs help or wants information about options).
- A foreign language student is practising his vocabulary and pronunciation skills. He calls up a phone number that simulates various situations (e.g. buying a bus ticket) and speaks a phrase. The simulation gives him feedback on his grammar and his pronunciation. He keys a different phrase into his device (which contains translation software), and receives these back translated in written and auditory form (with correct pronunciation). He can learn new words and phrases and practice exact location, situation or topic-related sentences[2].
- A woman is waiting for a bus. She is taking her driving theory test in a week and is a bit nervous about it, so she loads an interactive game onto her phone that lets her practise and score 'quiz'-style questions while she waits.

2.2.2: Scenarios using Pocket PCs

- A group of students are studying the Monarch Butterfly. Using a range of PPC functions the children are able to plot the time, location and all phases of

[2] Geoff Stead of Cambridge Training and Development (CTAD) advises that while not all technical issues associated with this example can be dealt with on a single device, that it's "not very far off at all". (Stead 2004.)

development, recording information, images and notes using a range of different programmes. They beam data and files to each other via infrared, or send files via mobile internet, increasing collaborative learning and information sharing. They record digital images and sound bites about each development stage and use these to publish a multimedia page for a separate computer studies project.

- Students go to town in groups with a 'treasure map' downloaded onto their PPC and, as they solve the various puzzles in their PPCs-based assignment, they take photos of the solutions and MMS them back to the school. All the pictures and texts are automatically collected onto a web data-base, so that when they return they can show and discuss with other learners what they did and learned, and use the information to write up their group project.

- A 15 year old student is about to drop out of school. He has taken an assessment and knows he needs to improve his reading, but is very unmotivated. As part of a technology-based learning support trial he is lent a PDA-phone with a collection of learning materials matched to his needs. These are designed, some in game format, for the small screen: bright, brief, light-hearted, loud. He gets to keep the PDA-phone for a couple of weeks, and in the process learns to write and draw on it, as well as surfing the web and taking photos!

  He has never really been trusted with any valuable equipment before and after chatting with his project mentor, finds he feels really good about this and starts turning up at class again where the next step in his literacy improvement program is matched to his learning style and topics he is interested in. In the past he has consistently performed poorly in exams and written work. Because he also has some difficulty concentration and with written expression but has high verbal skills, as he progresses, non-standard, moderated assessment methods are used such as structured, recorded interviews in place of pen and paper exams. The multi-media nature of the PDA-phone assists with this, allowing him to photograph and record his achievements and send these to his

learning mentor as well as other young people on his learning network with whom he is encouraged to collaborate. He slowly starts to build credits within a qualifications framework, once previously though impossible by him, his parents and previous teachers.[3]

NB: All scenarios in 2.2.1 and 2.2.2 are based on examples supplied by Geoff Stead of CTAD – used with permission. [4]

2.2.3: Scenarios using devices & functionality in the not too distant future

- A qualified electrical engineer is fixing a high-voltage cable high up on the national grid, and encounters a technical problem she is unable to solve. Using voice recognition so that she can continue to work using both hands, she calls up learning support via her flexible-screen wrist-band communicator to log her into their knowledge- base. The knowledge base instantly sends her the schema required to complete the task. The learning instance is recorded automatically in her personal learning log (part of the company's LMS,) which she can access at any time to add to and comment on. This data auto-alerts the knowledge base supervisor who checks to see whether any improvement or learning added should become a permanent inclusion in the knowledge-base.
- A plumbing and drain-laying student is carrying out a practical component of his apprenticeship training. While in a drainage trench completing a set on-job task supervised by his employer, he is able to contact his remote learning mentor and ask questions as well as be tested on multi-choice, situation-specific questions by tapping the answers on the screen of his ruggedised mobile device during his tea break. Having completed a task his on-site supervisor watches as he explains what he did comparing what he is hearing and seeing with a downloaded assessment checklist, and making notes. The supervisor then completes his notes, merges his assessment via inferred beam with the apprentice's, and authorises the digital image and audio file created during the

[3] This example builds on concepts already in place through Notschool.net and the m-Learning.net project, and the research work carried via Ultralab UK.

[4] Geoff stead is software director of CTAD (www.ctad.co.uk). The base scenarios in 2.2.1 and 2.2.2 were created for the European Commission mLearning project (www.m-learning.net)

assessment with a digital signature, to show the job has been completed to standard. The student then creates and sends the joint multi-media file/s via mobile internet to his learning institution confirming the outcome of his assignment. This assessment is automatically logged into the Learning Management System (LMS), and the student's learning log is auto-updated.

The important and compelling fact about all of these examples is that most of the applications and software to engage in these scenarios already exists; much of it is already being used in eLearning by early adopters or in trial mLearning projects. What doesn't yet exist is the long-term strategy and policy that could leverage the uptake of mobile devices in education and training, and the rapid convergence that is occurring.

But such rapid technology and device evolution this will almost certainly present an ongoing problem for policy and decision makers.

2.3: The rapid uptake and ubiquitous nature of mobile devices

The following statistics demonstrate clearly the rapid uptake and ubiquitous nature of mobile technology. What available statistics don't yet tell us is how many people within key demographics own multimedia devices and how they are beginning to use them differently. Table one clearly shows mammoth global growth.

Table 1: Worldwide Penetration of Handheld Devices Through 2005

Country	1999	2005
Asia	125 million	310 million
Germany	22 million	62 million
UK	21 million	45 million
France	17 million	45 million
Netherlands	7 million	12 million
Belgium	3 million	7 million
Austria	3 million	6 million
US	1.7 million	24 million

Source: Datamonitor

Table two shows large predicted uptake of mobile internet usage.

Table 2: Global Internet and Wireless Users, 2001, 2004 and 2007

Subscribers	2001	2004	2007
Internet users (millions)	533	945	1,460
Wireless Internet users as % of all Internet users	16	41.5	56.8

Source: eMarketer, March 2002.

By 2003, there were 2.3 million mobile phones in use in New Zealand, with an estimated 60 per cent of households having at least one. (Mathews, 2003.) In table three, figures published in 2002, in the Wireless World Forum's Mobile Youth report, indicate that levels of mobile phone ownership by young adults (15-24) in these countries are very high.

Table 3: Global Youth mobile statistics 2002

Country	Age Group	Millions in population	Percentage owning a mobile phone
Italy	15-19	2.91	85%
	20-24	3.40	94%
Sweden	15-19	0.53	91%
	20-24	0.51	92%
United Kingdom	15-19	3.77	90%
	20-24	3.57	81%

The equivalent figures, from the same source, for some other European countries are:

Country	Age Group	Millions in population	Percentage owning a mobile phone
Finland	15-19	0.33	90%
	20-24	0.33	92%
France	15-19	3.86	81%
	20-24	3.81	83%
Germany	15-19	4.69	87%
	20-24	4.61	84%
Ireland	15-19	0.32	67%
	20-24	0.32	82%
Spain	15-19	2.36	72%
	20-24	2.94	81%

And for some other predominantly English speaking countries:

Country	Age Group	Millions in population	Percentage owning a mobile phone
Australia	15-19	1.33 65%	90%
	20-24	1.31 88%	92%
USA	15-19	19.92	40%

	20-24	19.12	61%
Canada	15-19	2.07	52%
	20-24	2.06	60%

Source: (Brown et al, 2002)

What is of note is the difference between European and North American statistics showing significantly higher uptake in Europe. Neither do these figure show Asian statistics where countries like Korea lead the world in the uptake of mobile technology. What these statistics do highlight is that a range of trends and issues will likely confront learning professionals going forward.

2.4: Trends in the use of mobile devices by young people

"A 2002 survey of young people's uses of mobile phones as part of the mLearning Project[5] showed that almost half of those questioned (746 young adults, aged 16-24) expressed an interest in using a learning game on their mobile to improve their reading, spelling or maths. The main findings were:

- The greatest interest in using mobile phones for improving skills was expressed by girls, 16-19 year olds and young adults educated to Levels 2 or 3 (GCSE or A-level, or the equivalent)
- Almost half of young people expressed an interest in using phone-based games to improve their spelling and reading (49%) and maths (44%). But they stressed that learning games must be appealing, relevant and fun, even addictive (in the case of maths) if they were to sustain interest, indicating that getting the design and content of learning games right is crucial. A few also expressed an interest in using phone-based games for learning a foreign language or for English as a foreign language
- More than half (57%) considered a mobile phone had changed their life, making it easier to communicate with others at any time and in any place
- The majority use phones to chat to friends (88%) and for text messaging (94%). Half use their mobile phones to play games, typically for 30 minutes a day
- When asked what new services they would like to see delivered through mobile phones, 63% expressed an interest in music (particularly radio). More than a

[5] See 3. 1. 3.

third (36%) would like to receive television through their mobile phones, and just under a third (31%) videophone facilities.

- Although only 5% of young adults currently use palmtop (handheld computers), 55% stated that they might use one under other conditions - if they were cheaper, could be used for music or as a mobile phone or if they had other facilities on them, for instance
- . 80% were not worried about the health and safety risks of using mobile phones." (m-Learning 1: 2004)

"Can cell phones really provide their owners with the knowledge, skills, behaviours and attitudes that will help them succeed in their schools, their jobs and their lives? I maintain the only correct answer to the, "What can they learn," question is "ANYTHING, if we design it right." There are many different kinds of learning and many processes that we use to learn, but among the most frequent, time-tested, and effective of these are listening, observing, imitating, questioning, reflecting, trying, estimating, predicting, "what-if"-ing and practicing. *All* of these learning processes can be done through our cell phones. In addition, the phones compliment the short-burst, casual, multi-tasking style of today's "Digital Native[6]" learners. Using cell phones as a learning device, whether in or out of school, requires a good deal of rethinking and flexibility on the part of educators." (Prensky 2004.)

[6] See 3.3 for definition.

2.4: Three key trends in mobile technology:

1. Convergence; digital game, picture and sound capable phones
2. Mobile internet
3. Geo-location

2.4.1: Convergence

Already the distinction between computer and communications devices is blurring significantly as voice activation and location-aware devices enable and potentially tightly personalise mobile device usage. As networks expand and converge and broadband access becomes cheaper and more readily available, the convergence of a wide range of technologies is increasingly impacting at both macro and micro levels.

Micro convergence is the blending of two or more devices or capabilities within a single device that were formerly separate. For instance, micro convergence occurred where the capabilities of a digital diary, mobile phone and computing came together to build a new pocket-sized computer, the PPC.

Macro convergence is described by Intel's Chief Technology Officer (CTO) Pat Gelsinger as when an invention or domain such as mobile technology triggers "enormous changes in people's perceptions … spawns huge changes in commerce, and ultimately creates tremendous changes in societies and economies around the world." (Intel 2003)

2.4.2: Mobile internet

Mobile internet is internet access over unplugged devices. With an increasing number of mobile phones powerful enough to browse the web, these unplugged devices are predicted to become a principal way in which people interact with internet-based services for information, e-commerce transactions and targeted e-Marketing.

If this shift from thinking of mobile devices as primarily being for communication, to communications, information and transactional devices occurs, a current barrier to wide use of mobile devices for learning will be removed. Evidence would suggest that this is already occurring. In 2003, the number of mobile internet users topped 115 million globally. In the UK, web

pages viewed by phone (28.5 million) tripled last year, while SMS messaging grew more slowly. “Mobile Internet is not just for kids. It is likely to follow a similar adoption curve to SMS, with an increasing median age for users:

- 90% of UK mobile users aged 18-44 are active SMS users
- 62% of UK mobile users aged 55-64 have used SMS.”

In addition, WAP, “a kind of mobile only version of the web is increasingly being surpassed on newer devices … capable of browsing the regular internet through built in browsers.” (Tamahori, 2004.) It is this web browser capability that is starting to get traction for learning content designers interviewed in the UK for example, trying to overcome multiple different device types when designing content. Web browsing has relatively stable and well tested features even for mobile devices, and represents a useful common platform for the delivery of a range of multimedia content.

2.4.3: Geolocation

Geolocation uses GPS or cell-site triangulation to pinpoint a device’s position.

- It is becoming mandated by some governments
- US law requires all new handsets be locatable to within 50 metres by end of 2005.

The ability to track the location of all mobile phones at any time is already a reality in the UK: Any Vodafone, Orange or O2 handset can be tracked from a website, though not as yet with pin-point accuracy unless GPS enabled. While geolocation may well be useful in field work and is already being trialled in settings such as museums, and historic sites, (Murelli & Bormida 2004; Tognoni 2004; Lonsdale et al 2004,) there are many issues to be solved such as privacy, accessibility, industry-wide platforms and marketing standards.

2.4.3.1: Case study #1 Singapore CitySIM.

When visitors hire phones in Singapore, they can get a SIM card with built-in software, featuring:

- Visitor information linked to their location
- Locations of nearest restaurants, banks, subway stations, nightlife attractions

- The same technology is being rolled out in UK, the Netherlands and Denmark.

"New silicon-based technologies such as sensor networks are converging with emerging wireless and communications technologies, creating new possibilities." (Intel 2003) For example in the healthcare industry and criminal justice systems, sensor devices are already able to wirelessly send bio-feedback data back to remote computers about vital body signs, or the location of a person at any given time.

3: Key issues for mLearning

A wide range of issues were discussed at the conference in the conference sessions as well as in the many networking discussions. Of note was the similarity of mLearning issues between the education and corporate learning sectors. Based on the conference and discussions with learning professionals in the UK and New Zealand, issues can be clustered as follows:

1. Strategy - where and how mLearning fits within wider education and training strategy
2. Usability – convergence and interoperability, connectivity and accessibility, software and design issues; standards
3. People – students and teacher impacts
4. Policy – the lack of it because the field is so new.

NB: Strategy and by association policy touch all categories.

3.1: Strategy

The main elements of strategic decision-making remain applicable. These elements include:

1. The vision and mission of the institution or organisation
2. Clearly defined customer segments / target audiences the institution or organisation primarily serves
3. A clear understanding of what differentiates the institution or organisation in terms of focus (topic specialisation or product) and learner segment
4. Most effective and efficient method or "blend" of instructional design, delivery and assessment.

MLearning can fit into "blended learning" strategy. However important, consistent themes for consideration in strategy emerged from the conference:

a) **mLearning is a sub-set of eLearning**. As such it needs to be considered within strategy in the same way that any education institution or corporate training department needs to view all other learning delivery methods based on 1 – 4 above.

b) Conference participants consistently believed that **mLearning is a means to enhance the broader learning experience**, not (as was predicted for eLearning) a primary method for delivering courses / distance learning.

c) **mLearning is a powerful method for engaging learners on their own terms** especially those who could be classed as non-traditional learners or for those groups of students who cannot participate in class-room learning for whatever reason.

3.1.1: Blended learning

Blended learning is a curriculum delivery strategy. As a strategy it is already widely used in both corporate training and education. The term applies to a blend of ways of delivering learning materials or enhancing the learning experience. Typically, blended learning refers to classroom-based learning in combination with other self-paced learning materials or methods such as field study, often delivered via or supported by e-delivery technology such as e-tutorials, chat rooms, moderated discussion, SMS and MMS feeds to data-bases etc. There is already success in using mobile enabled technology to target learners that are not well served through traditional teaching methods. (See RAFT Case study 3.1.4 as well as Scenarios 2.2.1 – 2.2.2.) Typical considerations in a blended strategy that includes mLearning are (depending on the technology deployed) are:

- Deciding on the range of technology tools and systems appropriate to learning objectives and learner needs including collaborative and learning delivery tools
- Incorporating into strategy and project scope the interoperability of systems hardware and software to support and enable blended learning such as learning object repositories, access and storage, LMS
- Designing the classroom to incorporate different ways of interacting as well as to house equipment
- Finding reliable wireless networking and accessible and affordable broadband connections
- Accessing facilities such as video conferencing

- Defining roles and skill requirements in these roles
- Managing the event - coordinating multiple people in multiple locations via multiple access points and types
- Achieving best synchronous collaboration between field and classroom
- Managing security, gateway and firewall issues
- Providing technology usage and access policies.

3.1.2 Case study #2 NotSchool.net

Notschool.net is an online research project looking at ways of re-engaging young people of school age back into learning. Notschool.net is specifically aimed at those for whom traditional alternatives such as home tutoring have not worked. The model of learning re-introduces the excluded to life-long learning. The project targets young people who had been out of the more traditional educational systems for a variety of personal and logistical reasons. They included the phobic, ill, disaffected, sick, pregnant and the excluded or expelled. Notschool.net, now being implemented internationally including in New Zealand, establishes virtual communities of young people. They learn as research assistants, able to research in any topic, supported by mentors, buddies and subject experts while using new technology. (NotSchool.net 2004)

3.1.3: Case study #3 European Commission funded mLearning Project

The ubiquitous and fashionable aspects of mobile technology present opportunities to reach learners that main-stream education may not currently be "touching". For example, the Learning & Skills Development Agency (LSDA) UK is coordinating the European Commission supported (Information Society Technologies initiative) mLearning Project. This 3 year pan-European, €4.5m R&D programme involves CTAD & Ultralab in the UK, Lecando in Sweden & CRMPA based at the University of Salerno, Italy. This collaboration between education and private sector companies aims to provide learner-centred, media-rich learning experiences targeted at young adults with poor literacy and numeracy. This dynamic, at risk market segment is estimated at 7,000,000 people between the ages of 16 and 24 in the UK. Many own mobile phones, PPCs and PDAs, game consoles and MP3 players. The segment includes the unemployed, the under-employed and those not participating in post-compulsory education/skills training, plus those who lack access to PCs. Text messaging has already proven successful in teaching basic literacy in this segment.

One very successful aspect has been in infrastructure involving mediaBoard. The pedagogy of the experience is nothing to do with the content at all; students run mobile-blog-type pages from their phones! http://mboard.m-learning.net is where it is hosted. (m-Learning.org. 1 2004; Stead, 2004)

3.1.4: Case study #4 RAFT

The RAFT (Remote Accessible Field Trips) is a well advanced European Commission assisted project that uses eLearning and mLearning systems to link field study and classrooms in real-time. The project specifically uses technology to improve and enhance the students' educational experience while reducing the cost of field study and increasing both safety and the efficient use of scarce teaching resources.

Using the RAFT approach only a few students go to the field with the remaining students interacting from the class-room in real-time with the field students. Using WIFI networking and the internet, the instructional design aims to enhance collaborative and cooperative learning.

Practicing teachers in a wide range of subjects are involved in increasing the amount of field work in the curricula. Learning objects created during field work are managed by an Adaptive Learning Environment for later reuse in assignments and in future study. A wide range of roles have been described and assigned to support the success. These cover roles such as "Scout, Analyst, Communicator, Reporter, Task Manager, Message Manager, Archivist etc. The reach of participating schools can be extended by having remote classrooms as well as remote experts contributing to and participating in the field study. The learning theories and pedagogies appropriate to RAFT, because of its m-learning context, include collaborative and cooperative, situated, peer assisted and vicarious learning.

Examples are noted in Table 4, and also demonstrate the concepts of learning as a social activity. (Example and table 4 on the next page are based on Rentoul et al 2001.)

Table 4: Learning Theory and RAFT examples

Learning Theory	RAFT Examples
Collaborative Learning (Lave and Wenger 1991),	Working with peers in the field and in the classroom; distributed working with other students in different parts of the country or world on topics of mutual interest. In corporate learning it is common for high-potential employees to be placed on important projects as a learning experience.
Cooperative Learning (Lave and Wenger 1991),	Group tasks e.g. problem solving or case-study analysis or action learning projects eg on pollution levels or traffic peaks and flows. Within the group there are roles e.g. researcher, communicator, measurer, collator and developer. Each contributes to achieve the joint result – a "jigsaw" process.
Situated Learning (Topping and Ehly 1998)	Field trips present many real-life practical problems to be solved and demands from several directions. Examples: visiting and interviewing a professional - an artist in their studio, a trades-person on assignment, a journalist at work, a scientist in the laboratory.
Peer Assisted Learning (PAL) (Topping and Ehly 1998)	In the field, a visually impaired or disabled student may be assigned a student to be his/her helper – the two work together gathering information for their group. Roles could be assigned here to best speak to ability
Vicarious learning (Lee *et al* 1999)	A student takes the role of process observer in a group. The student "learns" different techniques from observing other groups' approaches to their tasks. This is "meta-learning". Role plays to practice skills such as providing performance feedback in the work-place that include an observer role is frequently used in corporate learning.

3.2 Usability: Learning with small screens

The adaption of every technology has pushed the boundaries of our thinking and created new opportunities. The rapid advent of mLearning is driving the need for a number of paradigm shifts, as much because of the already ubiquitous nature of the technology, as the yet unrealised potential of an unplugged, connected, re-tooled, networked world.

The m-learning industry is in its infancy. However research predicts an integrated set of enablers that will bring about, "profound changes in the way that business-to-business and business-to-customer interactions occur." (Gayeski 2002 pg 149.)

3.2.1: Convergence and interoperability

Convergence and interoperability mean that the range of possible devices to consider for learning delivery is broadening almost daily. They may have evolved from obvious sources such as mobile phones and PDAs. Unexpected sources and potential entrants may also come from the digital photography, entertainment, game or even fashion industries. "Form factors, interfaces,

and primary uses of different mobile appliances depend on the evolution or background of the device." (Singh 2003.)

There are already a range of devices available that are more than a beefed-up super-phone, or telecommunication or GPS-enabled hand-held. Personal Mobile Gateways (PMGs) are being used in devices such as Pocket PCs, Smart Phones and telecommunications enabled Personal Digital Assistants (PDAs). PMGs and emerging mPortals link providers and learners using cellular and wireless technologies that "communicates with a … collection of smart, yet thin…fashionable, relatively low-cost devices." (Auslander 2002.)

3.2.2: Unplugged connectivity

The era of "plugged in" computing and telecommunications is rapidly being eclipsed by portable, telecommunication and wireless enabled devices. On a global scale:

- Laptops and PDAs now outnumber conventional PCs.
- More than 500 million web-enabled phones have been sold
- Mobile learning is already happening in education, corporate training, medicine, science, sales, hospitality, logistics, law enforcement and many other fields.
- GSM is available to over 1 billion customers globally

(Based on Gayeski 2002; Singh 2003; McCormack & O'Byrne 2004.)

Telecommunications and WiFi providers are a key. Vodafone's vision of maximum-access wireless technology is a future of frequent and effortless multi-media connectivity. (Vodafone 2004.) For example bendable, durable, multimedia delivery through a visual bracelet has potential application to learning support. Imagine providing technical learning (via a visual bracelet) to an electricity line-man who needs urgent remote learning while working up a power pylon on the national grid as mentioned in 2.2.3.

3G offers fast connectivity, and has been slow to get off the ground in New Zealand. However penetration in the USA and UK for example shows possibilities in the use of video calls between compatible handsets, and the use of downloadable video and audio content. In the future 3G capability

could enhance expert or teacher contact with field research, or support action learning or live simulation.

Multi-Media Messages (MMS) also have potential in learning support. This allows messages containing pictures, video, sound and text animation to be delivered to a handset. MMS enabled handset penetration is rapidly improving. Most MMS enabled phones have built in cameras and these have wide appeal across all demographics.

3.2.3: Unplugged accessibility

Wireless technologies make cable or wire-free computing such as PDAs, cell phones, cameras, speakers and headsets possible contenders for learning support as micro systems enable more functionality to be packed into these different devices. WiFi is predicted to replace higher speed wireless Ethernet access. Wireless technologies such as Bluetooth, WiFi, RFID (Radio Frequency Identification) and GPRS (General Packet Radio Service) offer everything from very short range (RFID) to global reach GSM (Global System for Mobile communications). With the advent of GPRS and 3G we can expect to see a lot more media-rich content being delivered via hand-held devices such as PPCs and PDAs, especially as broadband access becomes greater via hand-held mobile devices and costs come down.

3.2.4: Software and learning materials

Although current hand-helds have a wide array of applications built in, educators can greatly extend a hand-held's usability and usefulness by installing additional software. Much available software is Freeware, Shareware or Demo versions. However mainstream applications such as the new version of Macromedia Flash with wide application in mLearning are not free. Caughlin lists 78 applications applicable to a range of topics and educational levels. (Caughlin 2003, pgs 158-170.) Small screen size and ongoing differences between platforms (e.g. Palm OS and Windows for PPCs) are challenges for designers. Probably the old maxim "less is more" works best in this medium!

Designing learning materials for small screens requires a "fundamental shift in the learning model, style and application." (Bielawski & Matcalf, 2003

pg 334.) Early adopters to mLearning such as UK-based organisations Cambridge Training and Development (CTAD) and Complete Learning have had to overcome significant challenges to deliver learning to small-screen mobile devices.

3.2.4.1: Software and materials issues example #1 CTAD

"Our approach was to use a spread of technologies, so that they would work across a wider range of handheld gadgets. When it came to rolling out the materials across our 300 learners, though, we focussed on only 2 main gadgets. For the PDAs we used mostly flash (versions 4, 5 and 6!) and xhtml. "For the Eriksson P900s we used xhtml; java for phones (j2me[7].) For both we made use of the phone functions for doing audio-driven activities, a well as several picture-messaging challenges. We also offered a combination of on-line and off-line resources (the off-line ones always got the most use). There were loads of issues:

1. "Rapid evolution of mobile handsets - which technology to select? CTAD's solution was to use a buffer between our materials and the phone. (Buffer = flash player, web-browser, java player since it was someone else's problem [usually the device supplier] to make sure they worked on that phone!)
2. "Small screens, and a touch-screen at that (no rollovers. need large areas to click on etc)
3. "No control of context (e-learning assumes some dedicated time. m-learning does not. your bus could arrive mid-session)
4. "Materials had to have high media-values to compete with outside distractions
5. "Materials had to be short and sharp." (Stead 2004.)

3.2.4.2: Software and hardware issues example #2, Complete Learning UK

"We developed our first mLearning for PDAs using Flash versions 4, 5 & 6, and now use Flash MX and the Standalone Flash player to remove the need

---

[7] J2ME (Java 2 Platform, Micro Edition) is a technology that allows programmers to use the Java programming language and related tools to develop programs for mobile wireless information devices such as cellular phones and personal digital assistants (PDAs). www.zeroonesoftware.com/glossary.html

for local installation of the player. We chose this form of development as it sat well with our development group who were well versed in Flash. Subsequently we have delivered to PDA using simple HTML and have now developed a .NET Rapid Development tool to enable us to re-purpose to various platforms from a common asset base. This theoretically means that we can make once then deliver to PC, PPC, PDA, Smartphone, and (if the .NET framework works,) on Symbian[8] devices too. I call working at this screen size 'nano-media', and am finding that corporate clients consider the concept of mLearning to be a supplementary learning resource rather than primary.

"We have used the standard MMS/SMS tools to develop and distribute 2G and 2.5G content and have not seen any compelling evidence that J2ME is worth the investment for us to consider it a viable tool. Since we are most likely to create bespoke [customized] content rather than mass-market content, we have found the development costs prohibitive.

"The issues for handheld device learning, [also] include:

1. "Linking to an LMS
2. "File-size / bandwidth restrictions for wireless transmission of MMS/GPRS download (still only 100k max for MMS)
3. "Device memory
4. "Push v Pull
5. "Lack of meaningful interaction
6. "High infrastructure costs for deployment/management systems." (Dean, 2004.)

3.2.5: Standards

What both of these designer examples highlight is that as with eLearning, access, reusability and share-ability issues mean taking into account standards.

Standards such as SCORM around re-usable objects and metadata tagging make possible the necessary granularity in learning content for

[8] Symbian OS is the global industry standard operating system for smartphones and is licensed by the world's leading handset manufacturers, which account for over 80 percent of annual worldwide sales.

mLearning. Metadata standards underpin efficient search capabilities. Reusability helps keep content development & updating costs down.

MLearning standards are only just emerging and conference discussions flagged that current eLearning standards are not always applicable to the mobile medium and the various devices and may be a constraint if imposed.

3.2.6: Other barriers

As well as technical issues, people not wanting to use mobile devices to assist learning and a variety of requisite mind-shift changes, there are cost barriers. Graphically rich content, streaming media, real time remote wireless connection demands a high speed or broad band environment. "GPRS & CDMA are VERY expensive – up to $NZ1000 per GB. (On wire this ranges from $0 to $20, depending on the technology and data source). Watching a 128kbit/s video stream (low speed broadband is not capable on current 2.5G systems) will consume 1GB in approx 1,000 seconds (about 17 minutes). So it's likely that much mLearning will need to be hard-loaded to the devices when they sync or are attached to the "wire". (For example, hot-sync loading an e-book onto a Palm or PPC, not wirelessly)." (De Wit, 2004)

3.3: People – students and teacher impacts

Young people today live in a connected, graphical, game orientated, random access, parallel processing world that has little to do with the way teachers are taught to teach. More than 50% of the World's population is under 25 years of age. The fundamental problem that many teachers have is that their learners are "digital natives" i.e., they have grown up with technology and a rich multi-media environment. These people "download 2 billion ring tones per year and 2 billion songs per month and send 3 billion text messages per day." This is their territory! Many teachers however are over 25. Most are "digital immigrants" i.e., they arrived from a different time, they don't speak their language and they don't really know how things work. [9]

[9] Based on notes taken at e-Fest 11 October 2004, Wellington New Zealand from Marc Prensky's key-note speech. marc@games2train.com www.marcprensky.com Used with permission.

Learning using hand-held devices in particular presents unique challenges and requires a number of mind shifts for teachers and learners in order to realise the potential already highlighted by early projects.

3.3.1 Mind shift #1 – mLearning uses rich multi-media

The first shift is from “MLearning has limited learner interaction” to “mLearning uses rich multimedia in a small space format”.

Figure 1: mPortal from Ultralab.

Ultralab put in place a micro-portal (see Figure 1) during trhe m-learning trial (unfirtunately no longer in use) to enable access to learning materials, creative opportunities and collaborative areas for learners. Web access was formatted for small devices and integrates SMS and audio handling for… parts of the system. The source code will hopefully be released as an open source tool called “Snug-Fit”. (UltraLab & CTAD 2004.)

Another shift is away from the use of text to minimising text and using applications such as the latest versions of Macromedia Flash MX or QuickTime to enrich content with as much interaction (games and simulations are growing in importance) and as many graphics as possible (See 3.2.4.1 & 3.2.4.2). However the more sophisticated the delivery technology the more the question of ongoing teacher development comes to the fore.

3.3.2 Mind shift #2 – mLearning can enhance & enrich the learning experience.

The key to this shift is in redefining traditional views of learning for their application in this medium. If we mean personally attending a teacher-lead class or lecture then there’s a problem. However if learning also means using a blend of mediums appropriate to enhancing the learning experience, then hand-helds begin to be serious contenders. Context and topic are also important. As indicated in 3.3.1, there are already examples across multiple disciplines. However the portable nature of hand-helds has, for example,

enabled Special Education at University of Southern Mississippi to present learning modules (using video clips delivered by media player) to teach step-by-step, independent living skills to people with moderate disabilities. (Caughlin 2003)

This shift also requires a “fundamental shift in the learning model, style and application.” (Bielawski & Matcalf pg 334.) The key is a shift in orientation to time and location. The focus is on just-enough, just-in-time, on-location learning support. This means making information or topic related exercises available in learning bites that can be measured in minutes or seconds rather than hours, and delivered to the student on demand. Examples include guided tasks (eg in field study or location-based action learning assignments), instruction lists, job-aids, and reference-ware.

3.4 Teachers and technology

To fully leverage the potential of m-learning, education and training communities need to build on eLearning lessons around content design, storage, access and delivery. One reason that eLearning was not as successful as predicted was because many educators did little to leverage the power of the medium available to them, effectively building text-based instruction and putting it online – with disastrous consequences.

As technology becomes more sophisticated with regard to learning delivery, learning experience design, fit for medium becomes a serious issue. Even the shift in language from “instructional design,” to “learning experience,” represents a shift. Remember young people are native to a connected, graphical, game orientated, random access, parallel processing world. They engage with these mediums on a daily basis. So the old methods of step-by-step instructional design such as criterion referencing, step-by-step instruction, text and linear based learning is viewed by many students who have literally tuned out as boring and irrelevant. There are of course those who learn to play the old game well, i.e., those who learn early how to memorise and regurgitate facts in pen and paper tests. A single focus on these methodologies could be viewed as discriminatory to learners who do not naturally process and recall information in this way.

There are two keys:

1. Engaging learners on their own terms based on learning styles and interests
2. The use of non-standard assessment methods to track record and verify learning.

3.4.1 Case study #5 – engaging learners & non-standard assessment

Ozzie is a 19 year old New Zealand student with an average IQ of 148+ but he has attention deficit disorder. He struggled to stay at High School, leaving at the end of the 6th form with very few credits on the National Qualification Framework and believing that he is "thick and useless". The one thing he is passionate about and very talented at doing is writing computer generated music. He is able to concentrate easily on this topic unmedicated, has taught himself to use highly complex professional level editing and music generation software as well as construct complex music that was being played on alternative radio stations around his home city. He decided to take a 4 Month full time Sound Engineering Certificate offered by a Private Training Establishment. Things went well until he was expected to provide written assignments. After explaining to the tutors that he was virtually incapable of writing a cohesive paper, it was agreed that assessment would be carried out by observation and, for knowledge testing, by recorded interview. Because Ozzie had high verbal acuity and high skill and knowledge in his chosen topic, he came top of his class in 70% of his modules.

This case study highlights the importance of engaging learners on their own terms and also the need to evaluate a wider range of assessment methods.

3.4.2 Teachers using technology to design learning experiences

"A significant number of full-time [teachers][10] are being asked to take on e-Learning development or design functions. In some cases, this works out wonderfully. [They] may bring deep subject matter expertise and/or a crisp sense of the learning from the learner's perspective. However, sometimes the match between classroom competencies and instructional design competencies [especially in the electronic medium] is not there. There also

[10] Masie actually referred to trainers. However conference discussions precisely mirrored this issue as applicable to teachers.

seem to be a wide range of investment in re-training the trainers (from no investment to full instructional design classes)." (Masie 2004.)

Conference discussions highlighted the need for collaboration and multi-disciplinary teams within education and corporate learning. It is considered increasingly unrealistic to expect teachers to be good at all aspects of learning design and delivery as more and more distinctions and impacts are felt in an increasingly technology-enabled learning environment. For example:

- There are multiple software applications that could be deployed in creating a piece of instruction
- Different skills involved in face-to-face delivery and virtual classroom or online delivery
- Student are widely exposed to high quality multi-media content in other fields such as games, entertainment and advertising, thus raising their expectations around digital content and the quality of how the materials are designed and presented.

3.5 Policy impacts

Policy was nowhere to be found.[11] The overall conclusion from everyone interviewed in Europe and the UK was that the field is so new that there is no specific policy yet. That there will certainly need to be policy is without question, though the extent to which policy will be effective in such a fast developing field is an issue in itself.

Based on experience likely areas of policy impact are:

1. Education policy – covering issues such as:
    a. Strategy relating to eLearning and mLearning
    b. Non-standard learners, the excluded, those with learning difficulties; non-standard assessment and moderation;
    c. Trade and skills training
    d. Teacher development policy relating to the application of emerging technologies and how to make informed decisions about up-skilling teachers in e-Learning including m-Learning

[11] Jean Johnson (Ultralab UK) latterly advises that "DfES 5 year strategy (July 2002) and the Tomlinson report (just released in 2004) may point to policy impacts. There is also European Union policy on ICT, infrastructure and plenty on inclusion - what is missing is the mix of all 3 in one place." (Johnson 2004.)

   e. Instructional design and metadata standards and guidelines including policy around compliance with IEEE/SCORM/AICC e-Learning standards appropriate to mobile technology. This could have additional impacts into e-Government standards longer term.

2. IT/ eGovernment policy – relating to:
   a. Broadband, and digital mobile computing;
   b. Interoperability and compliance.
   c. Purchase decisions of software, hardware and infrastructure (such as Learning Management Systems in Mobile Learning.)
3. Human resource policy relating to how teachers, instructional designers and technology experts are remunerated
4. Social and education policy relating to access to technology, exclusion, disability and learning. Digital divide.

4: Conclusions

4.1 Educational conclusions:

A range of early evaluations including the skoool.uk portal conducted in May 2004, and the notschool.net project conducted in 2004 found in four categories: content, devices, learner and teacher issues and benefits.

4.1.1 Content:

Benefits for the learners are emerging, when a portion of learning includes mLearning:

- An appropriate blend of learning delivery based on topic, learner preferences and available technology places mLearning as part of a potential range of learning delivery solutions
- The content (irrespective of delivery medium) must be well structured, clear and pedagogically sound
- The content design must leverage the mobility aspect of this technology delivery.
- Early evidence suggests mLearning facilitates knowledge sharing and idea creation
- Content must be concise / fit for small screens; low on text high on graphics and interactivity.
- Content for younger audiences needs to be engaging, cool and fit for both audience and purpose.

4.1.2 Devices:

- “More and more powerful and ubiquitous networks are the key enabling factor to introducing new and more collaborative learning paradigms where participants do not need to be located in the same place.
- “In the context of the research and university world, this model allows for sharing of costly equipment as well as providing remote access to students”. (Giordano et al 2004.)
- Portable ICT does not dominate in the way that desk-top computers can and can be more readily integrated into classroom use and across the curriculum with a minimum of disruption to existing practices

- The use of wireless enabled notebook computers allows ICT work to be done in the classroom, saving time and space as well as expensive plugged in networks
- Portability enables students to take work home and to continue working anytime, any place
- GPS enabled mobile devices can provide valid support for instant information access and just-in-time lesson modification, even during in-field lessons. (Pintux, et al 2004.)
- Tablet PCs can enhance the informal and collaborative aspects of learning. (Corlett and Sharples 2004.)

4.1.3 Learner issues and benefits:

- Research demonstrates that a flexible model of assessment is manageable, scaleable and achievable, both remotely and on-line.
- Gains have been recorded in:
    - understanding and analytical skills, including improvements in reading and comprehension
    - writing skills (including spelling, grammar, punctuation, editing and re-drafting), also fluency, originality and elaboration
    - independent and active learning and self-responsibility for learnings
    - ITC literacy skills, confidence and enthusiasm
- Given the ability to make their own decisions about learning, young people evidence different learning styles and patterns from those expected or even possible in schools.
- Excluded young people in an on-line community evidence many examples of learning gains which cannot be rewarded by traditional assessment methods, or traditional accreditation models.
- Assessment and accreditation models can be developed within the national framework to fit what young people learn, as opposed to young people learning to fit the model.

(Harrison 2004, Johnson 2003 and 2004)

4.1.4 Teacher issues and benefits:

- Educators need to upskill in non-standard, valid assessment and moderation methods that use technology
- Teachers need to either collaborate with technically skilled colleagues or upskill to be able to design and deliver materials in mLearning
- Digital mobile devices offer a wide range of multi-media learning support options that can enhance and engage learners in compelling and pedagogically sound ways
- "Efficient administration of lessons and materials
- "Improved access to student and school data anytime, anywhere
- "Increased efficiency and accuracy of day-to-day registration of pupils
- "Enhancement of professional image" (Harrison 2004)
- Student retention has been positively impacted by the use of SMS services implemented into Kingston University
- Evaluation criteria for assessing mLearning materials have been established by University of Tampere, Finland

(Based on Harrison 2004, Johnson 2004, Syvanen & Nokelainen 2004.)

4.2 Recommendations

Because mLearning is a relatively new field ongoing research is strongly recommended. Future research might cover:

1. More research into non-standard assessment and non-standard learners is strongly recommended. This has particular applicability in Skills and Trade training and the enhancement and assessment of on-job learning. This research but should be wider than just in relation to m-Learning.
2. Inclusion in the Tertiary Education Commission's eLearning framework of the future, potential inclusion of mobile technology as a specified sub-set of eLearning.
3. Policy and strategy impacts – as the use of digital mobile in learning in the US and Europe becomes more advanced, elements of policy will be developed. More research into specific areas of policy impact is recommended.

4. Areas of innovation in software or hardware in New Zealand companies that could earn foreign exchange. For example creating a centre of instructional design excellence in mLearning content in New Zealand could create jobs locally as well as leverage unique skills and knowledge in New Zealand companies in digital imaging and game design. (Caution: “whizzy, funky” materials do not necessarily mean quality learning experience design!)
5. The impacts of wider collaboration and the increased use or expectation of shared resources with particular insights into changing roles, responsibilities as well as the HR and intellectual property effects on teachers and university staff.
6. Wider publication of examples of early adopters in this field within New Zealand.
7. Partnering between telecommunications companies, technology providers, software experts and learning experience designers to further research and development.

Elizabeth Valentine
Wellington New Zealand
November 20, 2004.

References:

Attewell J, and Savill-Smith C, (2003) *Mobile Learning and social Inclusion; focusing on learners and learning.* A book of research papers published by Learning and Skills Development Agency London, UK.

Auslander E, (2002) *A true paradigm shift for the wireless industry* Mobile Content Worldwww.mobilecontentworld.biz

Bielawski L & Matcalf D, (2003) *Blended eLearning: Integrating Knowledge, Performance Support and Online Learning* HRD Press

Caughlin J, with Vincent T, (2003) *Handhelds for Teachers & Administrators,* Tom Snyder Productions

Corlett D and Sharples M (2004) *Tablet Technology of Information Collaboration in Higher Education.* Conference paper MLearn 2004, Conference proceedings.

Deans M, email correspondence with the researcher, 6 September 2004

de Freitas S.& Levene M. *Evaluating the development of wearable devices, personal data assistants and the use of other mobile devices in further and higher education institutions.* Birkbeck College, University of London June 2003
http://www.jisc.ac.uk/index.cfm?name=techwatch_report_0305

De Wit. N, (June 2004), Personal correspondence with the author. *www.citylink.co.nz*

Department for Education and Skills (DfES) Becta (2002). ImpaCT 2 The Impact of Information and Communication Technologies on Pupil Learning and Attainment. DfES/0696/2002. Norwich, UK: Her Majesty's Stationery Office.

Gayeski DM, (2002) *Learning Unplugged; Using mobile Technologies for Organizational Training and Performance Improvement.* AMACOM

Harrison Bob, (2004) *A Community of Practice? The Toshiba Ambassador Programme.* Conference paper MLearn 2004, Conference proceedings

Intel (2003): Excerpt from promotional brochure published by Intel.

Johnson J, (2003) *Developing assessment online in an asynchronous learning community of excluded young people.* Presented at the Computer Assisted Learning Conference, Queens University Belfast.

Johnson J, (2004) Personal correspondence with the author. Ultralab UK. jean@ultrlab.net

Learn2Hand (2004) *Join the Mobile Learning revolution with Learn2hand Nuggets*
http://www.learn2hand.com/DesktopHome.aspx

Lave, J. and Wenger, E. (1991). Situated Learning Legitimate Peripheral Participation. Cambridge, UK: Cambridge University Press.

Lee, J., Dineen, F., McKendree, J. and Mayes, T. (1999). Learning vicariously in a distributed environment. *Active Learning 10* (July), 4-9.

Lonsdale P, Barber C, Sharples M Byrne W, Arvanitis T, Brundell P and Beale R, (2004) *Context Awareness for MOBIlearn: Creating an engaging lerning experience in an art museum.* Conference paper MLearn 2004, Conference proceedings.

Mathews, A. *Teen Cellphone Radiation Risk*, New Zealand Herald 04.04.2003 http://www.nzherald.co.nz/storydisplay.cfm?storyID=3350734&thesection=technology&thesubsection=general

McCormack D, & O'Byrne F, (2004) *10 Technologies Every Executive Needs to Know.* Aspatore Books

m-Learning: 1. (2004) *Pan-European Research & Development Programme* http://www.m-learning.org/index.html

m-Learning: 2. (2004) *See m-Learning in Action* http://www.m-learning.org/idemo/XDA2/index.htm

Murelli E, Bormida G, (2004) MOBIlearn *User Trials on Museum Scenario; the first results of preparatory work.* Conference paper MLearn 2004, Conference proceedings.

Notschool.net (2004) Extracts from website

Pincas, A 2004 *Using Mobile Phone Support for Use of Greek During the Olympic Games 2004 (The Inlet Project).* Conference paper MLearn 2004, Conference proceedings.

Pintux A, Carboni D, Paddeu G, Piras A, Sanna S, (2004) *Mobile Lessons: Concepts and applications for on-the-field georeferenced lessons.* Conference paper MLearn 2004, Conference proceedings

Popat K and Stead G (2004) *M-Learning via the Web: The challenge of size.* Conference paper MLearn 2004, Conference proceedings.

Prensky, M, (2004) http://www.marcprensky.com/writing/Prensky-What Can_You_Learn_From_a_Cell_Phone-FINAL.pdf Conference Paper –eFest Conference Wellington New Zealand.

Rentoul, R.M.S, Hine, N.A Specht. M., Kravcik, M., 2001 ***Beyond Virtual Field Trips: Collaboration and m-Learning*** University of Dundee, Division of Applied Computing, Fraunhofer-Gesellschaft, Institute for Applied Information Technology, St Augustine, BONN, Germany http://naweb.unb.ca/proceedings/2003/PaperRentouletal.html

Singh H, (2003) *Leveraging Mobile and Wireless Internet* Learning Circuits, American Society for Training and Development. www.astd.org

Smyth, G (2004) *Educational Content Anytime, Anywhere on Any Device* MLearn 2004 Conference Proceedings http://www.mobilearn.org/mlearn2004

Sotillo, S. "Pedagogical Advantages of Ubiquitous Computing in a Wireless Environment." *The Technology Source*, May/June 2003. http://ts.mivu.org/default.asp?show=article&id=950

Stead G, email correspondence with the researcher, 6 September 2004

Strohlein, G (2004) "*HistoBrick: utilizing J@ME to enable students to use mobile phones for game-based learning on descriptive statistics.* Conference paper MLearn 2004, Conference proceedings.

Tamahori C, (2004) Mobile Technology and Tourism Presentation www.shift.co.nz

Tognoni C, (2004) *A mobile interactive guide to the Museo Diocesano di Cantania: How to "Open" the museum using PDAs.* Conference paper MLearn 2004, Conference proceedings.

Topping, K. and Ehly, S. (1998). Peer-Assisted Learning. London & Mahwah, New Jersey: Lawrence Erlbaum Associates.

UltraLab & CTAD (2003) *M-Portal* http://www.m-learning.org/mPortal.html 20 June, 2004

Valentine ELH, (2004) *Overview Study – e-Learning: The Market and New Zealand's Capability* New Zealand Trade and Enterprise.

Valentine ELH, (2002) *The Convergence of Knowledge Management and e-Learning* Henley Management College MBA Dissertation.

Vodafone (2004) *Future Vision http://www.vodafone.co.nz/aboutus/future_vision.jsp*