

LITERATURE REVIEW ON WORK-BASED MOBILE LEARNING

1.0 Learning with technology

Over the past two decades there appear to be a paradigmatic shift away from education and training to learning; from teacher-centred to student-centred education; from rote learning to learning as reflection; and from face-to face to distance and e-learning (Jarvia, Holfors, Griffin. 2003). One dominant feature of this shift is the innovative application of technology to enhance the delivery of education. The emergence of a new approach to learning characterised e-learning has led to new perspectives on learning presented through different theoretical lenses (Conole and Oliver, 2007). The pedagogical potential offered by handheld devices, is one such perspective called m-Learning. Mobile learning, as this is now commonly known has grown as an extension of the elearning frontier from a minor research interest to a set of significant projects in schools, workplaces, museums, cities and rural areas around the world (Sharples, 2007). This wave of interest in the educational potential of handheld technology is seen as a deliberate effort aimed at ‘domesticating’ mobile devices for educational purposes (Bachmair 2007. p. 106). Combined with web 2.0 technologies, mobile devices are today seen as offering new learning possibilities which represent a dynamic change in the strategies employed by learners and their production and consumption of learning products (Conole et al 2008). There is considerable interest from educators and technical developers in exploiting the unique capabilities and characteristics of mobile technologies to enable new and engaging forms of learning (Naismith, et al 2004)

2.0 Definitions of Mobile Learning

Various definitions can be found in the literature on mobile learning from technical, spatial and context driven perspectives. Quinn (2000) has defined mobile learning as “elearning through mobile computational devices” a definition similar to the view that “There is common agreement that m-learning is elearning through mobile computational devices” (Trifonova and Ronchetti (2003). Taking a more spatial perspective, (O’Malley et al, 2003) have define mobile learning as “any sort of learning that happens when the learner is not at a fixed predetermined location or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies”. In this regard “the field is concerned with learner mobility in the sense that learners should be able to engage in educational activities without the constraints of having to do so in a tightly delimiting physical

environment” (Kukulka-Hulme, 2005). Thus “mobile learning is not just about learning using portable devices, but learning across contexts” (Walker, 2007).

Other features which distinguish mobile learning from other forms of e-learning can be found. Distinguishing features put forward include site-specific learning and degree of ownership and control over the learning process (Laurillard, 2007); personalisation, adaptation, engagement, self evaluation and reflection by the learner (Stead, 2006); change in the physical relations between teacher and learner, learner generated context, and learner generated understanding (Winters 2007, p. 7 - 8); and the affective dimension offered by the mobile learning experience (Jones, Issroff & Scanlon 2007). Learning activities reportedly supported by m-learning also point to some distinction. They include:

- exploring a physical environment
- discussing with peers synchronously and asynchronously
- capturing data through sound, images and text
- adapting learning in the light of feedback or comment
- reflection using shared knowledge products (Laurillard, 2007).

Furthermore the issues mobile learning engender such as profiling of learners (Becking et al 2004), learning conditions (Walker 2007), accessibility and user control (Syvanen and Nokelainen 2004), usability factors (Kukulka-Hulme 2007), evaluation of mobile learning (Taylor 2007), learning design (Milrad 2007), and integrating mobile devices with broader educational scenario (Hoppe 2007) offer insights which helps to differentiate mobile learning from other forms of learning. Specific examples of case studies which reflect some of these issues can be found in the work of Wisharta (2007) and Matasuura (2005), McFarlane, Roche and Triggs (2007), Rekkedal and Dye (2007), Kukulka-hulme and Traxler (2005), and Smith (2003).

3.0 Mobile technologies and systems

The challenges posed by the technical functionalities of mobile devices when used for learning has been addressed by Trinder (2005). In a well elaborated discussion, he provides the context and framework for understanding the technical environment and systems within which mobile learning operates addressing both emerging and established systems. The main challenges identified are as follows:

- i. Physical size of the screen and screen resolution in terms of pixels.

- ii. Number of buttons - push buttons, jogs dials, roller wheels, joy sticks, touch-screens - for navigating through menus and data entry options.
- iii. Text and data entry using handwriting recognition and external add-on keyboards for large amounts of text.
- iv. The CPU and memory. Most current PDAs have a processing speed ranging from 105 – 400MHz and between 21 – 64 MB RAM and do not incorporate disk drives but instead use the RAM.
- v. Direct communication using wireless connections such as infrared port for beaming items using line-in-sight, bluetooth and radio systems.
- vi. Although batteries are rechargeable, programs on PDAs can be lost when power runs out
- vii. Requirement for synchronization for back up and updates e.g. appointments and copying information unto another device for safe keeping and archiving.
- viii. Many companies produce different versions of applications, hence a program written for XP on a desktop will not run on a pocket PC and vice versa
- ix. Questions around convergence. As technology continues to improve different function are being combined for convenience or to complement existing features e.g. camera, MP3 players.
- x. Personal data security. Although passwords can restrict access to the device, the frequency of entering passwords can be problematic. Alternatives available are biometric mechanisms such dynamic signature recognition, finger print recognition and picture password.

4.0 Theoretical perspectives on mobile learning

In an attempt to consolidate the mobile learning domain, a number of writers have demonstrated how existing theories of learning could be used to evaluate the applicability of mobile technology in the educational context. In an elaborate activity-centred literature review on mobile technologies and learning, Naismith et al (2004), have identified a number of examples of how mobile technology can be appropriated in a learning context from a behaviourist, constructivist, situated, collaboration, informal and lifelong learning, and teaching support perspectives. Taking a more dialectical approach, Taylor, J et al (2006) have also presented a task model for mobile learning deriving from socio-cognitive engineering design methods. The approach is in many ways similar to that put forward by Sharples,

Taylor, and Vivoula (2006). A communication and everyday media use and learning perspectives have also been proposed by Nyíri (2002) and Bachmair (2007) respectively.

5.0 Mobile learning design

Shifting our attention to designing for mobile learning, the work on the London Pedagogy Planner (2007, that of Conole et al (2008) from the JISC funded LXP project, and that of Falconer et al (2007) from Mod4L provide important approaches which are relevant to mobile learning design. For example the LPP offers blended learning design approaches, the Mod4L project provide examples of generic learning designs applicable to mobile learning such as social-constructivist learning design, case based learning design, practice based learning design, reflective learning design, and cognitive scaffolding design. The value of the Mod4L designs is that it emphasizes the roles of both teachers and student in the design process. Arguing for a rethink of pedagogies for the digital age Beetham and Sharpe (2007) have put forward a case modeling solutions that best meet the needs of learners. O'Malley et al (2003) have also outlined guidelines which directly address pedagogically useful activities that can support learning with mobiles technologies. Taking up one of the *big issues* in mobile learning, Milrad (2007) has proposed scenario based learning design for mobile learners focused on settings, actors, goals/objectives and actions and events. Mohamed (2004), has offered principles for designing mobile learning materials which address:

- how learning system interacts with learners,
- organizing information in chunks to facilitate processing,
- using concept maps or networks to represent information,
- using intelligent agents to determine what learners did in the past in order to adapt interfaces for future interactions with learning materials
- using learning objects to accommodate different learning styles and characteristics.

One question which has also captured the attention of mobile learning designers is the question of learning evaluation. Vavoula and Sharples (2008) have put forward a framework for evaluating and measuring the outcomes of mobile learning at three levels:

- micro level evaluation concerned with usability and utility factors
- meso level evaluation focused on the learning and educational experience

- macro level evaluation concerned with integration within existing educational and organizational contexts.

6.0 Work-based mobile learning

When we assess the use of technological devices within different modes of learning, one area where mobile and handheld devices have made an impact is work-based learning. Driven by economic and social imperatives and increasing concern for maintaining and developing individual competences, work-based learning has assumed centre stage in the lifelong learning agendas of most governments. From reasons ranging from adapting existing workforce to a changing global business environment; maintaining capacities and effective performance; and extending career mobility; learning from work or through work has today become an important part of how individuals acquire knowledge and skills. Doctors, nurses, lawyers, accountants, teachers etc today utilised this mode of learning thus making work-based learning a learning environment in its own right rather than an environment that augments learning in and from educational institutions (Harteis, 2008). It needs to be pointed out though that there is a wide variation of approaches characterised as work-based learning, including but not limited to work placement and sandwich courses, independent studies, access and accreditation of experience, and development of competences and capabilities (Boud, and Solomon, 2001).

Within the context of technology mediated learning, what could be termed “*work-based mobile learning*” is evident from the work of Kneebone, and Harry (2005) on perioperative specialist practitioners; that of Koschembahr and Sagrott (2005) on IBM employees, that of Wishart and McFarlane (2005) on Teacher Training, that of Nikoi (2008) on Teaching Assistants in primary schools and that of Pimmer and Grohbiel (2008) focused on the corporate setting.

Despite their promising results, learning with mobile technologies has not been without challenges. A study on work-based learning carried out by the Higher Education Academy in UK (Nixon, et al 2006) has highlighted various issues which include amongst other expanding provision, quality assurance, engaging employers, and pedagogic practice. Other issues identified elsewhere as mediating factors for effective work based learning structure around relational interdependencies (Billett, 2008), motivation (Lehtinen, 2008) and the organisational environment (Murtonen et al , 2008). The complex relationship of individual

and socio-economic processes which define and shape learning processes within the work-based mobile learning environment can be summed up as follows:

- A substantial part of the learning occurs off campus
- The workplace provides the context for experiencing learning
- Learning is spatial occurring across a range of settings – workplace, university, college, home etc
- Learning is self-regulated based on constructive inquiry
- Mobile devices mediate the learning process
- Individual competence in using a range of technological tools is crucial
- Learning involves evidence gathering and hence information management skills
- Where available, learning requires access to resources held remotely on a VLE
- Interaction with peers and collaborative learning on shared tasks is deemed important
- Communicating and interacting with tutors both face-to-face and remotely is essential
- Work plans, personal development plans and project plans are considered critical

7.0 Learning support for mobile learners

The recognition that teaching and learning has a supportive dimension is a fact which has long been recognised by educators. When the issue is addressed within Higher Education, we find that there are differences in service levels; the nature of support offered and the form support takes. In most cases existing support services are generic and tokenistic as opposed to being diverse and personalised, they are separated from teaching and learning instead of being embedded in them, they are reactive as opposed to proactive, they emphasise direct intervention by an *expert* as opposed to a peer, they are systemic as opposed to blended (people and tools) and managerial driven as opposed to learner driven. Examples of such dispersed models of learning support abound. For example, emphasis has been placed on physical learning locations within institutions (Taylor C, Shanklin A, Craig H, 2006), support focused solely on teachers (Carrillo et al. 2007), library embedded support services (Spacey, R. and Goulding A. 2004), technology driven solutions (Rudman, Sharples and Baber) support directed at the needs of distance learners (McLoughghlin, C. 2008), support for disabled students (Avramidis and Skidmore 2004); support using web 2.0 technologies such as podcast (Nie and Edirisingha 2007) support provided by online communities (Anderson, 2004), student led support (Biggerstaff 2007), and use of social networking technologies (Westera and Wagenans 2007).

Whilst acknowledging the value of these various approaches, what is evident from them is that they are prescriptive, disparate and reflect what Cottrell (2001) has called remedial or deficit models. When these remedial and deficit models of learning support are applied to work-based mobile learning they ignore the specific demands of this mode of learning which is underpinned by learning across context and movement through various learning locations.

There have been various suggestions for reconceptualise learning support in the educational literature which is relevant to the needs of mobile learners. For example Cottrel (2001) has suggested a holistic developmental model of learning support underpinned by the following:

- begins with the overarching ethos and culture of the institution
- is embedded in the curriculum
- is integrated into teaching
- draws on the skills of peers
- utilises various technologies
- embedded into wider systems and procedures such as admissions, induction programmes and assessment practices.

Tait (2000) has also argued strongly in favour of incorporating customer centred practices into approaches to learning support which take into consideration the demands of course programmes such as assessment. Robinson, Riche and Jacklin (2007) have also called for the integration of university led and non-university led support services which provide opportunities to develop supportive relationships in the formal and informal learning environments. Their recommendation is base on a study which found that non university led sources of support account for 78% of student responses. Williamson (2006) has advocated what she calls *deep support* linked to well-being but crucially focused on learning. Kukulska-Hulme and Traxler (2005) have also shown how the functionalities of PDAs and a mix of media, methods and mobile applications can be used to provide both generic academic and subject-specific support for mobile learners. They argue strongly in favour of learning support which is provided spontaneously irrespective of whether learners are on campus students, part-time students, distance learners or employees learning in the workplace.

8.0 Conclusion

Trends in mobile technologies suggest that they have the potential to impact positively on learning in general and higher education in particular. In the near future, it is expected that

learning will move more and more outside the classroom and lectures halls into the learners environment both real and virtual (Naismiths et al 2004) mediated by mobile devices. For this to happen:

- the usability of mobile devices for educational purposes will need to improve
- relevant and usable theories of mobile learning will need to be developed
- innovative learning design and delivery methods suited for “learning anywhere and at anytime” will need to be promoted
- educational institutions would have to adopt policies which support integration of mobile and handheld devices into the formal learning environment

References and bibliography

1. Anderson, B. (2004). Dimensions of learning and support in an online community. *Open Learning: The Journal of Open and Distance Learning* 19:2, 183-190.
2. Avramidis , E. & Skidmore D. (2004), Reappraising Learning support in Higher Education. *Research in Post-compulsory Education*. Vol. 9 No. 1. pp. 63 – 81.
3. Bachmair, B., (2007). Mobile Learning and media use in everyday life: towards a theoretical framework In Pachler, N. ed., *Mobile Learning: towards a research agenda*. London: Institute of Education (2007).
4. Becking, D et al., (2004). Didactic Profiling: Supporting the Mobile Learner. *ELEARN* pp. 1760-1767.
5. Beetham, h. and Sharpe, R. (2007). *Rethinking Pedagogy for the Digital age*. London: Routledge.
6. Billet, S. (2008). Learning through work: exploring instances of relational interdependencies. *International Journal of Educational Research*. Vol. 47. Pp. 232-240.
7. Biggerstaff, D., (2007). Online Educa Berlin 2007. 13 International Conference on Technology supported Learning and Training. November 28 – 30. 2007. pp. 142 – 143.
8. Boud, D. & Solomon, N., (2001) *Work-based learning: A new higher education?* The society for Research into Higher Education and Open University Press. pp. 1-9.
9. Carrillo et al (2007). Let me Learn: A system for teaching ICT skills to University Teachers. *Online Educa Berlin 2007. 13 International Conference on Technology supported Learning and Training*. November 28 – 30. 2007. Pp. 104.
10. Cottrell, S. (2001). *Teaching study skills and supporting learning*. Basingstoke:Palgrave. pp. 40-65
11. Conole and Oliver (2007). *Contemporary perspectives in E-Learning research*. London: Routledge. 2007.
12. Conole et al., (2008). “Disruptive Technologies”, ‘pedagogical innovations’: What’s new? Findings from an in-depth study of students use and perception of technology. *Computers & Education* 50 pp. 511-524.
13. Falconer et al., (2007). *Mod4L Final Report: Representing Learning designs*. www.jisc.ac.uk/media/documents/programmes/elearningpedagogy/session2mod4l.pdf -March 2007. [accessed 28-4-2008.]
14. Harteis, C., (2008).The workplace as a learning environment. *International Journal of Educational Research*. Vol. 47. pp. 209 -212.
15. Hoppe, U., (2007). How can we integrate mobile devices with broader educational scenarios? In *Big Issues in Mobile Learning*. Sharples, M., A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
16. Jarvia, P., Holford, J., Griffin, C., (2003). *The theory and practice of Learning*. London: Kogan Page.
17. Jones, A., Issroff, K., Scanlon, E., (2007). Affective factors in learning with mobile devices In *Big Issues in Mobile Learning*. Sharples, M., A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
18. Kneebone, and Harry (2005) Training perioperative specialist practitioners. In. Kukulsa-Hulme, A. & Traxler, J., (Eds) 2005. *Mobile learning: A handbook for educators and trainers*. London: Routledge. pp. 106 – 115.

19. Koschimbahr, C., and Sagrott, S., (2005). The future of learning at IBM: empowering employees,
20. Kukulska-Hulme, A., (2007). Mobile usability in Educational Contexts: What have we learnt? *International Review of Research in Open and Distance Learning*. Vol. 8, No. 2. Pp. 1-16.
21. Kukulsa-Hulme, A. & Traxler, J., (2005). *Mobile learning: A handbook for educators and trainers*. London: Routledge
22. Laurillard, D. (2007). Pedagogical forms for mobile learning. In Pachler, N. ed., *Mobile Learning: towards a research agenda*. London: Institute of Education University of London.
23. Lehtinen, E., (2008). Discussion: Bridging the individual and social in workplace learning and motivation. *International Journal of Educational research*. Vol. 47. Pp. 261-263.
24. London Pedagogy Planner. Found at: http://www.wle.org.uk/d4l/index.php?option=com_docman&Itemid=27
25. Matasuura, K., et al. (2005) Ubiquitous Learning Management with e-Portfolio on PDA/PC. *Proceedings of E-Learn*, October 24-28, Vancouver BC, Canada.
26. McLoughlin, C. Learner Support in Distance and networked learning environments: ten dimensions for successful design. *Distance Education*, 23:2, 149 – 162.
27. McFarlane, A., Roche, N, Triggs, P., (2007) *Mobile learning: Research findings Report to Becta*. University of Bristol
28. Milrad, M., (2007). How should learning activities using mobile technologies be designed to support innovative educational practices? In *Big Issues in Mobile Learning*. Sharples, M., A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
29. Mohamed, A., (2004). Using learning theories to design instructions for mobile learning devices. In. *Mobile anytime everywhere: A book of papers from MLEARN 2004*. Attewell, J., and Savill-Smith, C., (Eds). pp. 5-8.
30. Murtonen, M., et al. (2008). Motivational orientations in work. *International Journal of Educational research*. Vol. 47. pp. 213-222
31. Naismith, L., Lonsdale, P., Vavoula, G., Sharples, M., (2004). In *Literature Review in mobile Technologies and Learning*. Futurelab Series.
32. Nie, M., and Edirisingha (2007). Using podcast to support students learning in GEES subjects. . *Online Educa Berlin 2007*. 13 International Conference on Technology supported Learning and Training. November 28 – 30. 2007. Pp. 289 – 291.
33. Nikoi, S., (2008). Accounted Learning: A Wolf oriented approach to mobile learning. In *Proceedings of the mLearn2008 conference*. 7th-10th October 2008. Ironbridge Gorge, Shropshire, UK. 2008. pp. 208 – 215.
34. Nixon, et al., (2006). *Work-based learning: Illuminating the higher education landscape*. The Higher Education Academy July 2006. Found at: http://www.heacademy.ac.uk/assets/York/documents/ourwork/research/wbl_illuminating.pdf
35. Nyíri, K., (2002) *Towards a Philosophy of M-Learning*. Presented at the IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE 2002), August 29-30, 2002, Teleborg Campus, Växjö University, Växjö, Sweden
36. O'Malley et al., (2003). *MOBILearn. Guidelines for Learning, Teaching and Tutoring in a mobile Environment*. June 2003. www.mobilelearn.org [accessed 28-4-2008]
37. Pimmer, C., and Grohbiel, U., (2008). Mobile learning in corporate settings: results from an Expert Survey. In *Proceedings of the mLearn2008 conference*. 7th-10th October 2008. Ironbridge Gorge, Shropshire, UK. 2008. pp. 248-255.
38. Quinn C. 2000. *M-Learning: mobile, wireless, in-your-pocket learning* LineZine. Fall 2000. Found at: <http://www.linezine.com/2.1/features/cqmmwiyp.htm>
39. Rekkedal, t, Dye, (2007). A. Mobile Distance Learning with PDAs: Development and testing of pedagogical and system solution supporting mobile distance. *International Review of Research in Open and Distance Learning* vol. 8, No. 2.
40. Robinson, C. Riche, L P. Jacklin A. (2007). Student' views of support in higher education: a study of current practice and future directions. *Higher Education Review*. Vol 40. No. 1. 2007.
41. Rudman, P. D., Sharples, M., and Baber, C., Supporting learning in conversation using Personal Technologies. Found at: http://www.eee.bham.ac.uk/handler/ePapers/mlearn_rudman.pdf
42. Sharples M., Taylor J., Vavoula G., (2006). *Towards a Theory of Mobile Learning*. Centre for Educational Technology and Distance Learning, University of Birmingham.
43. Sharples, M., (2007) *Big Issues in Mobile Learning: A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative*.
44. Sharples et al., (2005). Final report: Scoping study for the pedagogy strand of the JISC learning programme. http://www.jisc.ac.uk/upload_documents/scoping_study_final_report.

45. Smith , T.. Personal Digital Assistants (PDA) in Further and Higher Education. At www.ts.consulting.co.uk [accessed 11 April 2008.]
46. Spacey, R. and Goulding, A. (2004). Learner support in UK public libraries. *Aslib Proceedings: New Information Perspectives*. Vol. 56. No. 6. pp. 344-355.
47. Stead, G., Mobile technologies: transforming the future of Learning: A look into the future of learning technologies by, Tribal CTAD. (<http://www.m-learning.org/knowledge-centre/m-learning-research.htm>) [accessed on 7 march 2008].
48. Syvänen, A., and Nokelainen, P., (2004). Evaluation of the technical and pedagogical mobile usability. In *Proceedings of mLearn*. P. 191 – 195
49. Tait, A., (2000). Planning students support for open and distance learning. *Open Learning*. Vol. 15. No. 3. 2000. pp. 287- 299.
50. Taylor C, Shanklin A, Craig H, (2006). Supporting Students in Difficulty: A guide for staff at University of Leicester. pp. 1-11.
51. Taylor, J et al. (2006). Towards a Task Model for Mobile Learning: a Dialectical Approach. *International Journal of Learning Technology*. 2, 2/3. pp. 138 – 158.
52. Taylor, J., (2007). Evaluating Mobile Learning: What are appropriate methods for evaluating learning in mobile environments? In *Big Issues in Mobile Learning*. Sharples, M., A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
53. Trinder, J., (2005) Mobile technologies and systems. In. Kukulsa-Hulme, A. & Traxler, J., (2005). *Mobile learning: A handbook for educators and trainers*. London: Routledge
54. Trifonova and Ronchetti (2003) Where is mobile learning Going 2003 p. 1794 : In *ELEARN 2003 proceedings*. Found at www.trifonova.net/docs.
55. Vavoula., G. and Sharples, M., (2008). Challenges in Evaluating Mobile Informal Learning. In *Proceedings of the mLearn 2008 conference*. (Traxler, J., Riordan, B., and Dennett C., Eds. 7 -10 October 2008. Wolverhampton UK. pp. 296 – 303.
56. Walker, K., (2007). Mapping the landscape of mobile learning. In *Big Issues in Mobile Learning*. Sharples, M., (Ed). A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
57. Westera, W., and Wagemans, L., Help me! Online learner support through the self-organised allocation of peer tutors. *Online Educa Berlin 2007*. 13 International Conference on Technology supported Learning and Training. November 28 – 30. 2007. pp. 105-107.
58. Williamson, S., (2006). Deep support-1: A new shape for schooling? Found at: <http://www.ssat-net.net/pdf/Deep%20Support%201%20-%20Chapter%201.pdf>
59. Winters, N., (2007). “What is mobile learning”? In *Big Issues in Mobile Learning*. Sharples, M., (Ed). A Report of a workshop by the Kaleidoscope Network of Excellence Mobile Learning Initiative.
60. Wisharta J., (2007). PDAs and handhelds: ICT at your side and not in your face. In *Technology and Education*. 16 (1) p. 95 -110.
61. Wishart and McFarlane (2005) on PDAs and Teacher Training (Information Technology in Teacher Education Spring 2005. No. 49. http://www.itte.org.uk/newsletters/itte_nl_49.pdf

© Samuel Nikoi. *Work-based Learners in Further education (WalF) project. 2008.*

