



Evaluating mobile learning artefacts

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The design of mLearning applications based on mobile data technologies and the development of mLearning services implementing them is driven both by mobile technology innovation, and by the trend towards more student-centered and personalized learning. mLearning activities are normally delivered through an mLearning service, which may use a specialized hardware/software mobile learning artefact. The study aims to develop a framework for the evaluation of innovative mLearning artefacts with respect to their potential to succeed as mLearning services. The perceptions of the mLearning users are investigated in order to identify the dimensions of the framework. The outcomes of the completed study may highlight the role of artefact design in the adoption of the mLearning service and provide directions to artefact designers.

Keywords: Mobile learning, mLearning, evaluation, adoption, mobile value, artefact, value chain

Introduction and research background

In this study mLearning is defined as an ubiquitous learning activity based on a relevant pedagogical approach and supported by an appropriate mobile technology. The definition places an emphasis on pedagogy as a dimension of mLearning (Goh & Kinshuk, 2006; Sharma, Kitchens, Booker, & Xu, 2006; Sharples, Taylor, & Vavoula, 2007). Viewed from business and organizational perspectives mLearning also includes the service which delivers the educational content (Petrova, 2007); thus mLearning becomes part of an learning value chain, which meets potential mLearning ‘customers’ with industry stakeholders: service suppliers, software application developers and technology providers (Figure 1).

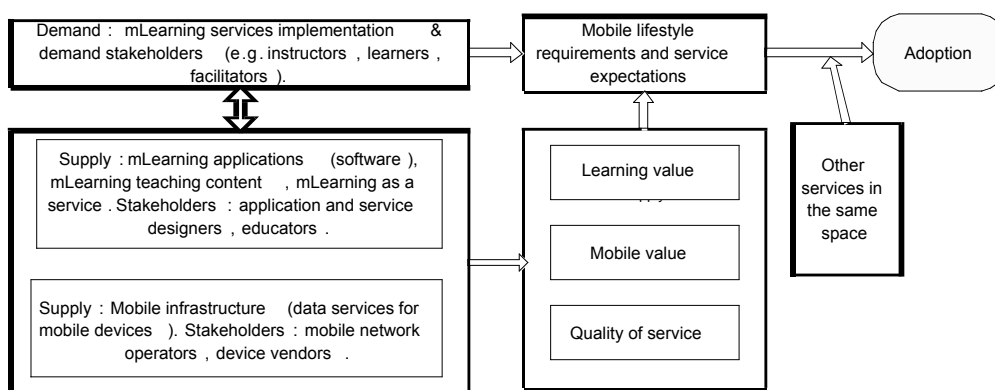


Figure 1: Modelling mLearning supply and demand

Stakeholders on the demand (use) side of the value chain include learners (end-users of mLearning), instructors (who engage students in mLearning using appropriate pedagogy), and institutional facilitators (who may support mLearning service provision as part of an institutional teaching and learning platform). The supply side of the value chain refers first to the provision of mLearning services designed to support the pedagogical model; stakeholders are mLearning designers (educators who provide teaching content; software developers who develop mobile applications). Secondly the value chain includes mobile network operators and mobile device vendors who provide mobile data technology services and development platforms.

The work presented here uses the technology known as the mobile Internet (MI) which refers to accessing the Internet via a mobile device such as a mobile phone. MI is a suitable platform for the development of innovative mLearning artefacts for flexible and blended mLearning models which may also take advantage of the predicted network convergence (e.g. Sharma & Kitchens, 2004). In the context of the study, a mobile artefact may include a physical mobile device and/or the specific application software, and uses MI as a mobile data service.

mLearning applications, services and artefacts

The design of mLearning applications based on mobile data technologies and the development of mLearning services implementing them is driven both by mobile technology innovation, and by the trend towards more student-centered and personalized learning (Petrova & Li, 2009). Innovative pedagogy relies on well established technology and focuses on first identifying and then meeting learner needs. In contrast applications driven by technology progress may be developed specifically to fit a new platform – for example the iPhone (Zittrain, 2009); the mLearning service needed to use such an application in an mLearning scenario may find itself targeting a relatively restricted student segment, and may not be viable. The trend to develop innovative and potentially useful mLearning artefacts which may not be aiming to solve a particularly well defined problem will continue as mobile technologies become more powerful and easily accessible. Therefore innovative software and hardware designers and developers may need to have a better understanding of the requirements and expectations of the mLearning demand side stakeholders in order to design and develop artefacts which can be converted from a prototype to an mLearning service with a high adoption potential.

Similar to other mobile services, mLearning services adoption is related to how well they fit in with the intended users' daily life style and preferences (Divitini, Haugalokken, & Morken, 2005; Song & Fox, 2005; Wuthrich, Kalbfleisch, Griffin, & Passos, 2003). However some technology aspects may become barriers to the adoption of mLearning – e.g. the limited text entry capability of the mobile phone, and the high cost of a multifunctional mobile device connected to the MI. Compared to the already widely adopted and institutionalized online learning, mLearning may be perceived as less efficient, less convenient and less affordable.

In summary it can be argued that in order to be successful, an mLearning service (and the underlying artefact) will need to be: i) highly compatible with a 'mobile' lifestyle (by offering specific 'mobile' value, ii) student-centred and providing a clear 'learning' value, and iii) of high technical quality (Figure 1). Based on this premise, the study presented here aims to develop a framework for evaluating innovative mLearning artefacts with respect to their possible success as mLearning services. The questions guiding the study can be formulated as: How do stakeholders perceive a new mLearning artefact, what are their expectations? What life style and quality of service factors are most influential in forming these perceptions?

Research approach

It is proposed to investigate the research questions formulated earlier through an exploratory study, evaluating a series of mLearning artefacts from a multiple stakeholder perspective. In order to develop a better understanding of the artefact and its potential, the study focuses on the interaction between people and artefact and on participants' ideas and perceptions about how the artefact may be used (Hevner, March, Park, & Ram, 2004). It follows the conceptual model in Figure 1 which links the mLearning value chain to the adoption process. A literature review extending the findings reported in (Petrova & Li, 2009) identified a number of lifestyle and quality of service requirements (related to instructors and learners) as summarized in Table 1.

In order to test the validity of the set of factors the authors applied it to the evaluation of two artefacts (a quiz and a game) from the CMER academic kit (CMER, n.d.). It was found that all factors were relevant and could be used as an evaluation framework measuring the potential value of an mLearning artefact.

This work in progress investigates further the importance of the factors listed in Table 1 and possibly other emerging factors by studying stakeholder perceptions and attitudes about an innovative mLearning artefact code-named 'Project iLiad'. Project iLiad connects an e-Book device to the MI via a 3G mobile phone which acts as a router between the e-Book and the mobile network. Any number of mobile users can join Project iLiad to form a small working group, and collaborate in real time by exchanging

Table 1: Instructor and learner mLearning requirements

Requirement/ Stakeholder	Description
Adoptable (Instructors)	Refers to the alignment of mobile learning content with the curriculum (Norris & Soloway, 2008).
Adaptable (Instructors)	Refers to customizing mLearning content with respect to the study context (Liu, Yu, & Ran, 2008; Torrente, Moreno-Ger, & Fernández-Manjón, 2008).
Assessable (Instructors & learners)	Refers both to formal and self- assessing of the appropriate learning outcomes (Rodin, 2004; Oliver, 2005).
Scaffold-able (Instructors & learners)	Refers to providing a clear value to students, with challenging but achievable tasks (McKenzie, 1999; Wilhelm, Baker, & Dube, 2001, p. 1).
Manageable (Instructors & learners)	Refers to managing the additional workload. Instructors may need to redevelop their courses. Students may use resources if they find the information useful but not if information overflow occurs (Petrova, in press).
Accessible (Learners)	Refers to mobile value: all resources related to a task or an activity being available anywhere/ anytime and when needed (Sharples, 2000; Thornton & Houser, 2005).
Enjoyable (Learners)	Refers to interactive and interesting content design which influences motivation positively (Jones, Issroff, Scanlon, Clough, & McAndrew, 2006; Liu et al., 2008).

annotated text and graphics including drawings; they can also discuss their work using voice communication simultaneously with the data transfer (B.-C. Seet, personal communication, July 2, 2008).

Primary data is being gathered using different techniques. Instructors and institutional facilitators (all recruited from the Auckland University of Technology) participate in group sessions of five to ten people where a working prototype is demonstrated by Project iLiad's designer, then trialed 'hands-on', and discussed. Up to six such sessions are planned to be conducted, in order to collect data from a larger sample. In order to identify the features of the artefact which may be useful (or not), and the possible value added use scenarios, participants are asked to record their perceptions and opinions using a questionnaire of eight open ended questions (Table 2).

Table 2: Questions for instructor and facilitators

Q1	Please describe how you would use 'Project iLiad':
Q2	Please describe the most valuable features of 'Project iLiad':
Q3	Please identify any features of 'Project iLiad' that you think are not important:
Q4	Please identify any possible issues with implementing 'Project iLiad' (e.g. financial, ethical, other):
Q5	Please identify any specific requirements that 'Project iLiad' needs to meet in order to fit into the New Zealand market and environment, and satisfy your expectations as a user/customer:
Q6	Please identify the advantages of using 'Project iLiad':
Q7	Please comment on the possible demand for services based on 'Project iLiad':
Q8	Other comments if any:

Learners (students enrolled in computer science and engineering programmes at the Auckland University of Technology) are given first a demonstration by Project iLiad's designer, and an opportunity to trial and discuss the artefact. They are asked to complete a questionnaire comprising 15 Likert scale questions focused on learner perceptions about how the artefact may add value to learning, what would be expected of the artefact's performance in terms of quality, and what would make a learner use a service based on Project iLiad in preference to other similar services. The Likert scale questions match the open ended questions in Table 2, but are more than eight in order to 'unfold' some more complex open-ended questions. Figure 2 shows an example. The sample is envisaged to include around 100 participants.

1. 'Project iLiad ' may open new opportunities for me to study and collaborate with my peers (tick one).

Strongly Agree	Agree	Not sure	Disagree	Strongly disagree
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Please describe the opportunities you see in using 'Project iLiad ':

Figure 2: A Likert scale question (example)

Finally the application and content designers of the artefact itself are going to be interviewed individually and in-depth in order to identify their motivation and expectations regarding future use, and the extent of their familiarity and understanding of other stakeholder needs and requirements.

So far data have been gathered from a number of instructors, facilitators and learners with two more sessions planned to be conducted by the end of 2009. The data analysis is yet to be completed however one interesting trend already emerged: All participants were very concerned with the proliferation of applications and the saturation of the learning space with competing services, and were very demanding in their expectations about the artefact's added value potential.

It is planned to extend the evaluation of the iLIAD prototype to academics and students at three overseas universities through posting an online survey using the Likert scale questionnaire mentioned above which will be illustrated by a Web based description of the Project iLiad prototype. Following the analysis of the data the revised framework will be applied to evaluate a second artefact (FLAGMAN, n.d.).

Discussion and concluding remarks

The study presented here is part of a larger project investigating mobile business services adoption across a spectrum of applications and services. The project studies the possible causal relationships between customer demand as related to lifestyle requirements and expectations about the quality of the service, and between demand and actual mobile service use. As the development of new mobile artefacts may remain technology driven (and not aiming to solve a particular problem), it is important to have a means to identify an artefact's potential for creating value and quality. In the case of mLearning, the investigation of the problem space of possible service scenarios where the new artefact may fit in may inform further development and fine tuning of the artefact. In particular the outcomes of the study presented here may highlight the role of the design of an mLearning application in the adoption of the related mLearning service, and provide directions to designers based on the findings about participants' perceptions of mobile and learning value, and possible use scenarios.

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References

- CMER. (n.d.). An academic kit for integrating mobile devices into the computer science curriculum. <http://cmer.cis.uoguelph.ca/kit/index.html>
- Divitini, D., Haugaløkken, O. K., & Morken, E. M. (2005). Blog to support learning in the field: Lessons learned from a fiasco. In *Proceedings of ICALT 2005* (pp. 219-221), Kaohsiung, Taiwan.
- FLAGMAN. (n.d.) Foreign language Mobile learning environment. <http://flagman.ecs.ru.acad.bg/>
- Goh, T., & Kinshuk, D. (2006). Getting ready for mobile learning - adaptation perspective. *Journal of Educational Multimedia and Hypermedia*, 15(2), 175-198.
- Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 28(1), 75-105. <https://doi.org/10.2307/25148625>
- Jones, A., Issroff, K., Scanlon, E., Clough, G., & McAndrew, P. (2006). Using mobile devices for learning in informal settings: Is it motivating? In *Proceedings of IADIS Mobile Learning 2006* (pp. 251-255), Dublin, Ireland.
- Liu, J., Yu, S., & Ran, M. (2008). Research on the communicative mobile English learning model. In *Proceedings of WMUTE 2008* (pp. 60-64), Beijing, China. <https://doi.org/10.1109/WMUTE.2008.26>
- McKenzie, J. (1999). Scaffolding for success. *From Now On* 9(4). <http://www.fno.org/dec99/scaffold.html>
- Norris, C., & Soloway, E. (2008). An instructional model that exploits pervasive computing. In *International handbook of IT in primary and secondary education* (pp. 849-860). New York: Springer. https://doi.org/10.1007/978-0-387-73315-9_50
- Oliver, B. (2006). Mobile blogging, "skyping" and podcasting: Targeting undergraduates' communication skills in transnational learning contexts. In *Proceedings of Microlearning 2005* (pp. 157-162), Innsbruck, Austria.
- Petrova, K. (2007). Mobile learning as a mobile business application. *International Journal of Innovation and Learning*, 4(1), 1-13. <https://doi.org/10.1504/IJIL.2007.011471>
- Petrova, K. (in press). An educational experiment with Short Text Messaging: Analysis and evaluation. *International Journal on Mobile Learning and Organization*.

- Petrova, K., & Li, C. (2009). Focus and setting in mobile learning research: A review of the literature. In Proceedings of the 11th IBIMA Conference (pp. 1456-1463), Cairo, Egypt.
- Rodin, L. (2004). *E-learning to m-learning: An investigation into the potential for content conversion*. In *Proceedings of MLEARN 2004* (pp. 171-176), Rome.
- Seng, J.-L., & Lin, S. (2004). A mobility and knowledge-centric e-learning application design method. *International Journal of Innovation and Learning*, 1(3), 293-311.
- Sharma, S. K., & Kitchens, F. L. (2004). Web services architecture for M-Learning. *Electronic Journal on e-Learning*, 2(1), 203-216.
- Sharma, S. K., Kitchens, F. L., Booker, Q. E., & Xu, H. (2006). Web services model for mobile, distance and distributed learning using service-oriented architecture. *International Journal of Mobile Communications*, 4(2), 178-192. <https://doi.org/10.1504/IJMC.2006.008608>
- Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers and Education*, 34(3-4), 177-193. [https://doi.org/10.1016/S0360-1315\(99\)00044-5](https://doi.org/10.1016/S0360-1315(99)00044-5)
- Sharples, M., Taylor, J., & Vavoula, G. (2007) A theory of learning for the mobile age. In R. Andrews & C. Haythornthwaite (Eds.) *The Sage handbook of elearning research* (pp. 221-247). London: Sage.
- Song, Y., & Fox, R. (2005). Integrating m-technology into Web-based ESL vocabulary learning for working adult learners. In *Proceedings of WMTE 2005* (pp. 154-163), Tokushima, Japan.
- Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. *Journal of Computer Assisted Learning*, 21(3), 217-228. <https://doi.org/10.1111/j.1365-2729.2005.00129.x>
- Torrente, J., Moreno-Ger, P., & Fernández-Manjón, B. (2008). Learning models for the integration of adaptive educational games in virtual learning environments. *Lecture Notes in Computer Science*, 5093, 463-474. https://doi.org/10.1007/978-3-540-69736-7_50
- Wilhelm, J., Baker, T., & Dube, J. (2001). *Strategic reading: Guiding students to lifelong literacy*, 6-12. Portsmouth, NH: Boynton/Cook Publishers, Inc.
- Wuthrich, C., Kalbfleisch, G., Griffin, T., & Passos, N. (2003). On-line instructional testing in a mobile environment. *Journal of Computing Sciences in Colleges*, 18(4), 23-29.
- Zittrain, J. (2009). Law and technology: The end of the generative internet. *Communications of the ACM*, 52(1), 18-20. <https://doi.org/10.1145/1435417.1435426>

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