Mobile Learning Model for Zimbabwe Higher Education

Lydia Maketo
School of information Systems
Curtin University
Perth, Australia
email:lydia.maketo@student.curtin.edu.au

Abstract—The benefits of mobile-learning (m-learning) have been widely publicised. Research on m-learning is predominantly from developed nations, with a paucity of empirical studies on the adoption and implementation of m-learning in the tertiary institutions of developing nations. Although there are numerous m-learning projects in developing countries, few research projects have investigated the feasibility of implementing m-learning in tertiary institutions in these developing countries including Zimbabwe. This study attempts to determine the feasibility of implementing m-learning in Zimbabwe by investigating factors that influence m-learning implementation and adoption, discovering students' and lecturers' attitudes towards m-learning, and discussing the potentials and challenges of m-learning. This study will develop a new model for m-learning, especially for Zimbabwean universities and other tertiary institutions in similar developing countries, thereby providing a conceptual foundation for future related research.

Keywords-Mobile-learning; m-learning; developing countries; universities.

I.   INTRODUCTION

The proliferation of mobile devices, particularly mobile phones, in developing nations, such as Namibia, Kuwait, India and Zimbabwe [1]-[4] has given hope to the integration of mobile technology into education practices. Studies from developing countries [5]-[9] have shown positive results for m-learning projects in supporting education in remote locations. In order for m-learning to succeed in higher education in the developing countries, it is necessary to understand the factors that influence m-learning implementation and adoption in such countries. To this end, this study addresses three research questions:

(1) What are the factors that influence the implementation of mobile learning in Zimbabwe?
(2) What are students' perceptions toward the mobile learning model?
(3) What are the academic staff perceptions toward the mobile learning model?

This paper is organized as follows: Section 2 introduces related studies followed by discussions on the importance of m-learning in Zimbabwe, m-learning potentials and challenges and the research gap. Section 3 discusses the research methodology. Section 4 presents the research outcomes. In Section 5, the proposed m-learning model is presented. Section 6 concludes the study.

II.   BACKGROUND

A.   M-learning definition

There is not yet a consensus on the definition of m-learning from an academic or professional standpoint which could be attributed to the rapidly evolving nature of the field. Literature shows varied definitions of m-learning revolving around the ambiguity of "mobile" in mobile learning [10]-[13]. Most studies focus on the mobility of the technology or the mobility of the learner, with one study highlighting the mobility of the content [14]. Earlier definitions of m-learning took a techno-centric perspective, defining m-learning as learning using mobile devices with an emphasis on the mobility of technologies [15]-[18]. The focus has shifted from the mobility of the devices to the mobility of the users [19]-[21]. There is a general consensus that m-learning involves the use of ubiquitous mobile devices for learning and teaching. This study focuses on learner-centred mobility, since learners use various technologies such as mobile devices, their own or other people's computers, as they move between settings.

B.   Why M-learning in Zimbabwe

Education is widely accepted as a major factor in economic development [22]-[24]. Although educational indicators suggest that there have been improvements in Zimbabwe, such as increased enrolment across the different levels of education, the quality of education still faces noteworthy challenges.

Lack of access to quality education continues to be a major impediment to economic growth in developing countries. In Zimbabwe, universities are responsible for producing highly skilled manpower and are therefore central to the development of the country. There is a need to improve access to quality, cost-effective education in Zimbabwe. M-learning presents an opportunity to improve the quality of education in Zimbabwe given the availability of cheaper mobile devices, and that Zimbabwe can by-pass the fixed telephony network and increase mobile phone networks. Hence, m-learning has the potential to reach a wider segment of the population, facilitating the expansion of educational projects.

Zimbabwe has sixteen universities and eight polytechnic colleges, these institutions are yet to fully embrace m-learning. The information and communication technologies (ICT) infrastructure in some of these institutions is underutilised. In teaching and learning, ICT is largely used for placement of course outlines, notes, assignments and website links [25][26]. The integration of ICT with education is not uniform in Zimbabwe tertiary institutions.

C. M-learning potentials

M-learning provides a relatively cheaper means of integrating education with technology. Mobile devices are less expensive than personal computers (PCs) or laptops. The mobile phone density in Zimbabwe is above 100% [2]. Hence, m-learning has the potential to provide more access to information. Three important benefits of integrating education with technology are access, support and communication [27][28].

The mobile learning research community has proved that m-learning can enhance, extend and enrich the concept and activity of learning itself, beyond earlier conceptions of learning [29]. Some of the possibilities of m-learning include situated learning, context-aware learning, and personalised learning. M-learning enables learners to have access to a variety of resources and communities that share the same interests even in different locations, which produces a dynamic educational experience [30].

M-learning enables interaction between learners and lecturers and amongst learners themselves. M-learning fosters collaboration opportunities for learners [7] [30] [31]. There is evidence that collaboration produces better understanding [32]. Learners can now benefit from a range of user-generated content that can be accessed through various mobiles such as podcasts, which is native to mobiles; Wikipedia, that can be accessed on low-end mobiles and YouTube, which is accessed on high-end mobiles.

Most learners own and love mobile technologies and use them regularly in their personal lives [33][34]. It seems likely that these same learners would want to use their mobile devices to personalize their education and make it more engaging.

There are a number of m-learning pilot projects that have been carried out in developing countries, such as m-learning curriculum framework in South Africa [19], smartphone-based m-learning with physician trainees in Botswana [35], using mobile phone cameras for science learning and teaching in Sri-Lanka [36]. The pilot projects in developing countries have yielded positive results, which is encouraging so far. All countries need to educate the next generation's workforce. For developing countries, there is a need to provide education of an acceptable standard in order to produce a workforce that is effective and can support economic growth.

D. M-learning challenges

M-learning initiatives are infeasible in some developing nations because of a myriad of obstacles. A major impediment to m-learning adoption is inadequate infrastructure in the form of unreliable electricity supplies [37][38] and poor Internet connectivity [29][39][40].

Another major barrier to m-learning adoption is the high initial investment costs. There are high costs associated with equipment, connectivity, technical support, training and maintenance [31][41].

Some developing countries have educational policies restricting the use of mobile devices for learning, and some have government officials who are unaware of the potential of mobile phones to enhance education [27][38].

Academics have raised curriculum issues associated with m-learning from both pedagogical and practical perspectives [30]. Lecturers also expressed concerns regarding privacy and security [42]. There are fears that confidential information could be potentially exposed to students and that quality of content could be compromised when transferred to mobile learning activities [42]. Educators' concerns about security and privacy can prevent the effective penetration of mobile technology in the educational realm [43]. It is important to acknowledge the concerns raised by the lecturers as downplaying these concerns may prevent these key stakeholders from capitalizing on the benefits of mobile technologies in education.

Technological constraints such as size of device, multiple standards, numerous operating systems, and low battery life should also be considered when implementing m-learning [20][39][44][45]. It is difficult to address all barriers to m-learning as the obstacles are wide-ranging because of the diversity of developing nations.

E. Research Gap

There is a lack of m-learning models and frameworks grounded in empirical research in the context of developing countries. Literature [16][41] attributes this gap in research to lack of resources, in sharp contrast to developed countries where m-learning was facilitated by adequate resources and infrastructure. Previous researchers have examined the various combinations of aspects which influence m-learning implementation [45]-[50]. There are suggestions that models from developed countries can be applied to developing nations [41]. However, [38] argues that in developing countries various factors need to be considered. These include different levels of infrastructure, the needs and challenges due to unique cultures, as well as the various views of what constitutes learning if learners are to benefit from m-learning.

A review of the available m-learning frameworks from both developing and developed countries shows that the existing m-learning frameworks cannot be adopted as there are gaps in these conceptual models, making them inadequate for implementation in the Zimbabwean context

with respect to (1) factors influencing m-learning adoption (2) challenges to m-learning (3) m-learning characteristics and (4) pedagogy. There is a need to conduct research which includes the various aspects as in the proposed conceptual model to examine how they *collectively* influence m-learning implementation.

III. RESEARCH METHODS

The mixed-methods approach will be employed for this study. Participants for this study will be drawn from m-learning stakeholders in tertiary institutions comprising students, lecturers, administrators, librarians and information technology (IT) personnel and the relevant government ministries in Zimbabwe.

The study will adopt an exploratory design because of the scant previous research on m-learning in tertiary education in Zimbabwe, starting with the in-depth interviews followed by focus groups.

In-depth interviews will be used to collect data from the lecturers, library staff, administrative staff, university IT staff, mobile service providers, the Ministry of Higher Education, and the Ministry of ICT. Based on the proposed conceptual model, the themes to be discussed will include connectivity, educational policies, themes based on characteristics of m-learning and expectations of lecturers. It is anticipated that other themes will surface during the interviews.

Focus groups will be used to elicit learners' attitudes, experiences, beliefs and reactions which cannot easily be obtained by other methods. Purposeful sampling will be used to select focus groups. The pre-defined themes based on the proposed model will include usability, Human-Computer Interaction (HCI), cheaper mobile phones, culture and learners' expectations. It is anticipated that other themes will emerge from the focus group discussions.

IV. RESEARCH OUTCOMES

It is anticipated that this study will contribute to theoretical knowledge about various aspects underlying the successful implementation of m-learning in universities, both generally, and more specifically in relation to the mainstream higher education context of Zimbabwe. The latter poses a set of challenges that require careful investigation prior to the introduction of widespread m-learning in university pedagogy. This study will make a theoretical contribution in that it will show how each aspect of the proposed conceptual model is interacting (moderation/mediating) with others, and how all aspects will synergistically influence m-learning implementation. Furthermore, the study seeks to contribute to theoretical knowledge by offering recommendations regarding m-learning in developing countries. Students, researchers and academics will be able to use this model as a reference in future related studies.

From a practical perspective, the research aims to introduce an m-learning model for tertiary institutions in Zimbabwe, to facilitate the integration of technology in their teaching and learning approaches. It is anticipated that the m-learning model will encourage m-learning adoption and implementation in Zimbabwe and will be adopted by this country's other educational institutions. The m-learning model will provide guidelines for instructional designers and lecturers when designing m-learning activities, blending these with existing teaching and learning practices. Also, the universities, the education department of the Zimbabwean government and other stakeholders will benefit from this model. This model will enable students to experience dynamic learning anywhere anytime.

V. PROPOSED MODEL

The initial proposed m-learning model for Zimbabwe higher education will be drawn from existing frameworks in developing countries similar to Zimbabwe [5]-[9] and other m-learning studies [41][49][51].When reviewing m-learning studies, some studies emphasis on technical design and development of technologies. Some studies do not include challenges to m-learning implementation and do not explain the importance of learning theories in supporting m-learning. Although there are varied characteristics of m-learning and different factors that influence m-learning adoption, it is essential to examine the factors that influence m-learning adoption and the characteristics of m-learning. The factors and characteristics impact m-learning implementation and adoption especially where m-learning is in its infancy. The proposed model depicted in Figure 1 comprises the challenges of m-learning, factors that influence m-learning adoption, the key characteristics of m-learning, and pedagogy.
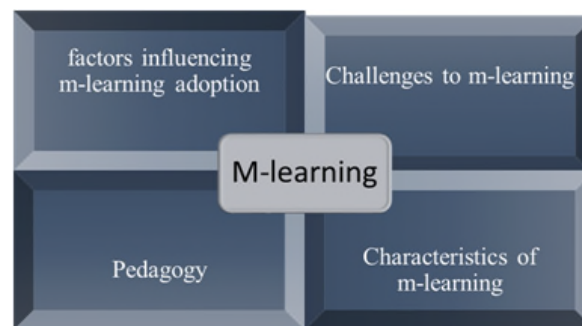

Figure 1. Proposed M-learning Model

A. Factors influencing m-learning adoption

There are a number of factors that influence m-learning implementation and adoption. Previous research has shown that m-learning has become attractive because of cheaper costs of mobile devices coupled with the increased capabilities of these devices [51]. There is a suggestion that the key factor in adopting m-learning in developing

countries hinges on socio-cultural factors [52]. The study will investigate the various factors that affect m-learning adoption and implementation in developing countries, and seek to find how these factors interact with each other in influencing m-learning implementation and adoption.

B. Challenges to m-learning

In the proposed research model, the researcher has taken into account the challenges associated with m-learning. The researcher understands that these challenges can impede the effective design and implementation of m-learning in Zimbabwe. Literature shows that infrastructure is a major obstacle when implementing m-learning. This study will seek to identify and address challenges that can hinder m-learning implementation in Zimbabwe.

C. Characteristics of m-learning

The characteristics of m-learning will be identified in terms of tertiary institutions in Zimbabwe in order to produce an m-learning model for this country. Some key characteristics for m-learning from extant literature are: ubiquity, mobility, training and support, collaboration, blending, context, and communication [5]-[9] [48] [53].

D. Pedagogy

A study by P. Ramsden [54] indicates that there is a relationship between students' perceptions of their learning environment and their approach to learning. M-learning implementation should therefore take into consideration the learners' perceptions of their learning environments as they can potentially influence m-learning adoption. Early m-learning research was not explicitly grounded in learning theories [55]. It is likely that effective integration of mobile technologies with education will depend on whether m-learning has been based on sound learning theories.

VI. CONCLUSION

Although the benefits of m-learning have been widely publicised, there is a scarcity of empirical research on m-learning for tertiary institutions from developing countries, particularly in Africa. M-learning adoption and implementation by universities is technically complex given that the learning involves students, instructors, content and institutions. In developing countries like Zimbabwe, the implementation of m-learning is a complex process, made increasingly so by considerations of infrastructure and culture. It is anticipated that the proposed model will capture the various aspects of m-learning in the context of a developing country and that this model will serve as a conceptual foundation for future research in m-learning in Zimbabwe universities and tertiary institutions in other developing countries.

REFERENCES

[1]   A. Al-Hunaiyyan, R. A. Alhajri, and S. Al-Sharhan, "Perceptions and challenges of mobile learning in Kuwait," *Journal of King Saud University - Computer and Information Sciences*, 2016.

[2]   G. P. Kabanda, "Technology Affordances and Diffusion for Mobile Connectivity and Applications in Zimbabwe," International Journal of Emerging Technology and Advanced Engineering, 6 (6), p. 13-23, 2014

[3]   R. Misra and S. Srivastava, "M-education in India: an effort to improve educational outcomes with a special emphasis on Ananya Bihar," *On the Horizon,* vol. 24, no. 2, pp. 153-165, 2016.

[4]   J. Osakwe, N. Dlodlo, and N. Jere, "Where learners' and teachers' perceptions on mobile learning meet: A case of Namibian secondary schools in the Khomas region," *Technology in Society*, 2016.

[5]   O. Adesope, S. Olubunmi, and J. McCracken, "Implementing mobile learning in developing countries: Prospects and challenges." *EdMedia: World Conference on Educational Media and Technology*, pp. 1249-1254. Association for the Advancement of Computing in Education (AACE), 2007.

[6]   A. Barker, G. Krull, and B. Mallinson, "A proposed theoretical model for m-learning adoption in developing countries." *Proceedings of mLearn*, vol. 2005, p. 4th. 2005.

[7]   T. H. Brown, "Towards a model for m-learning in Africa," *International journal on ELearning,* vol. 4, no. 3, pp. 299, 2005.

[8]   M. Ford and A. Botha, "A pragmatic framework for integrating ICT into education in South Africa." *IST-Africa, 2010*, pp. 1-10. IEEE, 2010.

[9]   K. Masters, "Low-key m-learning: a realistic introduction of m-learning to developing countries." *Sixth Conference on Communications in the 21st Century: Seeing, Understanding, Learning in the Mobile Age, Budapest.* 2005.

[10]   M. O. M. El-Hussein and J. C. Cronje, "Defining Mobile Learning in the Higher Education Landscape," *Educational Technology & Society,* vol. 13, no. 3, pp. 12-21, 2010.

[11]   Y.M. Huang, W.-Y. Hwang, and K.-E. Chang, "Guest Editorial-Innovations in Designing Mobile Learning Applications," *Educational Technology & Society,* vol. 13, no. 3, pp. 1-2, 2010.

[12]   Y. Laouris and N. Eteokleous, "We need an educationally relevant definition of mobile learning. In mLearn 2005:4th World conference on mLearning" *Proceedings of mLearn*. (Vol. 2005).

[13]   H. Peng, Y. J. Su, C. Chou, and C. C. Tsai, "Ubiquitous knowledge construction: Mobile learning re-defined and a conceptual framework," *Innovations in Education and Teaching International,* vol. 46, no. 2, pp. 171-183, 2009.

[14]   D. E. Öngen, Ç. Hürsen, M. Halat, H. Boz, M. Hashemi, M. Azizinezhad, V. Najafi, and A. J. Nesari, "2nd World Conference on Psychology, Counselling and Guidance - 2011What is Mobile Learning? Challenges and Capabilities," *Procedia - Social and Behavioral Sciences,* vol. 30, pp. 2477-2481, 2011/01/01, 2011.

[15]   K. Alsaadat, "Mobile learning and university teaching." *International Conference on Education and New Learning Technologies (EDULEARN09)*. Vol. 6, 2009.

[16]   G. J. Hwang and C. C. Tsai, "Research trends in mobile and ubiquitous learning: A review of publications in selected

journals from 2001 to 2010," *British Journal of Educational Technology,* vol. 42, no. 4, pp. E65-E70, 2011.

[17]   A. Kukulska-Hulme, *Mobile learning: A handbook for educators and trainers*: Psychology Press, 2005.

[18]   J. Traxler, "Defining mobile learning." *IADIS International Conference Mobile Learning*, pp. 261-266. 2005.

[19]   A. Botha, J. Batchelor, J. Traxler, I. de Waard, and M. Herselman, "Towards a mobile learning curriculum framework," *Proceedings of IIMC International Information Management Corporation. IST-Africa*, 2012.

[20]   N. Pachler, B. Bachmair, and J. Cook, *Mobile devices as resources for learning: Adoption trends, characteristics, constraints and challenges*: Springer, 2010.

[21]   M. Sharples, I. Arnedillo Sánchez, M. Milrad, and G. Vavoula, "Mobile Learning: Small devices, Big Issues. Book chapter to appear in Technology Enhanced Learning: Principles and Products, Kaleidoscope Legacy Book," Springer-Verlag, Berlin, 2008.

[22]   D. E. Bloom, D. Canning, and K. Chan, *Higher education and economic development in Africa*: World Bank Washington, DC, 2006.

[23]   T. Gylfason, "Natural resources, education, and economic development," *European economic review,* vol. 45, no. 4, pp. 847-859, 2001.

[24]   P. P. Saviotti, A. Pyka, and B. Jun, "Education, structural change and economic development," *Structural Change and Economic Dynamics,* vol. 38, pp. 55-68, 9//, 2016.

[25]   P. Mupfiga and M. Chirimumimba, "Application of mobile computing in tertiary institutions: case study of Midlands State University," 2015.

[26]   S. Mavellas and M. Samuel, "Investigating The Use Of Mobile Computing In Zimbabwe Polytechnics: Case Of A Polytechnic In Zimbabwe," *International Journal of Scientific & Technology Research,* vol. 4, no. 7, pp. 121-125, 2015.

[27]   Y. Mehdipour and H. Zerehkafi, "Mobile learning for education: Benefits and challenges," *International Journal of Computational Engineering Research,* vol. 3, no. 6, pp. 93-101, 2013.

[28]   J. H. Valk, A. T. Rashid, and L. Elder, "Using mobile phones to improve educational outcomes: An analysis of evidence from Asia," *The International Review of Research in Open and Distributed Learning,* vol. 11, no. 1, pp. 117-140, 2010.

[29]   J. Traxler, "Mobile learning: Shaping the frontiers of learning technologies in global context," *Reshaping Learning*, pp. 237-251: Springer, 2013.

[30]   B. Handal, J. MacNish, and P. Petocz, "Adopting mobile learning in tertiary environments: Instructional, curricular and organizational matters," *Education Sciences,* vol. 3, no. 4, pp. 359-374, 2013.

[31]   J. B. Ferreira, A. Z. Klein, A. Freitas, and E. Schlemmer, "Mobile Learning: Definition, Uses and Challenges," *Increasing Student Engagement and Retention Using Mobile Applications: Smartphones, Skype and Texting Technologies*, pp. 47-82, 2013.

[32]   D. Parsons, H. Ryu, and M. Cranshaw, "A Study of Design Requirements for Mobile Learning Environments." *Advanced Learning Technologies, 2006. Sixth International Conference on*. IEEE, pp. 96-100, 2006.

[33]   B. Jin and J. F. Pena, "Mobile communication in romantic relationships: Mobile phone use, relational uncertainty, love, commitment, and attachment styles," *Communication Reports,* vol. 23, no. 1, pp. 39-51, 2010.

[34]   H. Thinyane, "Are digital natives a world-wide phenomenon? An investigation into South African first year students' use and experience with technology," *Computers & Education,* vol. 55, no. 1, pp. 406-414, 2010.

[35]   A. Y. Chang, R. Littman-Quinn, D. Ketshogileng, A. Chandra, T. Rijken, S. Ghose, A. Kyer, A. K. Seymour, and C. L. Kovarik, "Smartphone-based mobile learning with physician trainees in Botswana," *International Journal of Mobile and Blended Learning (IJMBL),* vol. 4, no. 2, pp. 1-14, 2012.

[36]   S. Ekanayake and J. Wishart, "Identifying the potential of mobile phone cameras in science teaching and learning: A case study undertaken in Sri Lanka," *Innovations in Mobile Educational Technologies and Applications*, pp. 162-177: IGI Global, 2013.

[37]   L. E. Armey and L. Hosman, "The centrality of electricity to ICT use in low-income countries," *Telecommunications Policy,* vol. 40, no. 7, pp. 617-627, 7//, 2016.

[38]   J. Traxler, "Mobile learning in international development," *Global mobile learning implementations and trends*, pp. 45, 2013.

[39]   L. Adam, N. Butcher, F. Tusubira, C. Sibthorpe, and D. Souter, "Transformation-Ready: The strategic application of information and communication technologies in Africa," *Education sector study. Washington, DC: The World Bank Retrieved from worldbank.org/EXTINFORMATIONANDCOMMUNICATIONAND TECHNOLOGIES/Resources/282822-1346223280837/RegionalTradeandIntegration_Fullreport. pdf*, 2011.

[40]   N. Y. Asabere, "Benefits and challenges of mobile learning implementation: Story of developing nations," *International Journal of Computer Applications,* vol. 73, no. 1, 2013.

[41]   Y. C. Hsu and Y.-H. Ching, "A review of models and frameworks for designing mobile learning experiences and environments," *Canadian Journal of Learning and Technology*, 2015.

[42]   S. A. Shonola and M. Joy, "Mobile learning security issues from lecturers' perspectives (Nigerian universities case study)," *EDULEARN14 Proceedings*, pp. 7081-7088, 2014.

[43]   G. Kambourakis, "Security and Privacy in m-Learning and Beyond: Challenges and State-of-the-art," *International Journal of u-and e-Service, Science and Technology,* vol. 6, no. 3, pp. 67-84, 2013.

[44]   G. Orr, "A review of literature in mobile learning: Affordances and constraints." *Wireless, Mobile and Ubiquitous Technologies in Education (WMUTE), 2010 6th IEEE International Conference on*, pp. 107-111. IEEE, 2010.

[45]   F. B. Osang, J. Ngole, and C. Tsuma, "Prospects and challenges of mobile learning implementation in Nigeria: Case study National Open University of Nigeria (NOUN)." *International Conference on ICT for Africa*, pp. 20-23. 2013.

[46]   T. D. Cochrane, "Critical success factors for transforming pedagogy with mobile Web 2.0," *British Journal of Educational Technology,* vol. 45, no. 1, pp. 65-82, 2014.

[47]   A. Herrington and J. Herrington, "Authentic mobile learning in higher education," 2007.

[48]   U. Imtinan, V. Chang, and T. Issa, "Common Mobile Learning Characteristics--An Analysis of Mobile Learning Models and Frameworks," *International Association for Development of the Information Society*, 2013.

[49]   Y. Liu, H. Li, and C. Carlsson, "Factors driving the adoption of m-learning: An empirical study," *Computers & Education,* vol. 55, no. 3, pp. 1211-1219, 2010.

[50]   M. Sharples, P. Lonsdale, J. Meek, P. Rudman, and G. N. Vavoula, "An evaluation of MyArtSpace: A mobile learning service for school museum trips," 2007.

[51]   S. Iqbal and I. A. Qureshi, "M-learning adoption: A perspective from a developing country," *The International Review of Research in Open and Distributed Learning,* vol. 13, no. 3, pp. 147-164, 2012.

[52]   J. Keengwe and M. Bhargava, "Mobile learning and integration of mobile technologies in education," *Education and Information Technologies,* vol. 19, no. 4, pp. 737-746, 2014.

[53]   F. Ozdamli and N. Cavus, "Basic elements and characteristics of mobile learning," *Procedia-Social and Behavioral Sciences,* vol. 28, pp. 937-942, 2011.

[54]   P. Ramsden, *Learning to teach in higher education*: Routledge, 2003.

[55]   J. Traxler and A. Kukulska-Hulme, "Evaluating mobile learning: Reflections on current practice," 2005.