

Designing a Mobile Learning System for Higher Education: A Literature Review

Yusufu Gambo

International PhD Student, De Montfort University, Leicester, United Kingdom

P1306369x@myemail.dmu.ac.uk

Abstract. The proliferation of portable electronic devices and wireless networking is creating a change from e-learning to m-learning especially in higher education, and it increases collaborations, interactions, anywhere, anytime, student centre learning etc. Furthermore, Mobile learning gives learners possibilities to carry out learning tasks with or without connectivity to a virtual learning environment. Using appropriate communications channels supported by mobile devices, students are able to interact with fellow students as well as with teachers. Additionally, mobile devices support interactive educational systems with emphasis on the learner-to-content interaction. However, in designing learning activities for mobile devices there is a need to establish an appropriate theoretical framework (Baharom, 2013, Thomas, 2005; Collis & Moonen, 2001). The aim of this paper is to present a research framework and literature review for mobile learning environment. The work is grounded in social constructivist theory, and associated learning theory of Conversational in order to derive attributes. These attributes are: conversation, collaboration, creativity, content, context, technology, users, and pedagogy (Baharom, 2013; Prasertsilp, 2013; Mohammed and Alameen, 2014). Through these attributes, an iterative framework for a mobile learning environment is proposed to support teachers and instructional designers to create educational values, and provide students with a quality in mobile learning environment. In turn, this will to improve both instructors' teaching and students' learning experiences. Primary data collection and analyses will be conducted at Adamawa State University, Mubi, Nigeria to determine students' readiness and institutional support for a mobile learning intervention.

Keywords: Mobile, Learning, higher education, social constructivism, conversation

1.0 INTRODUCTION

The advancement of Information and communication technology especially mobile and wireless networks have enhanced the ability of many users to have access to information anywhere and anytime. The proliferation and affordability of mobile devices and wireless networks have had a tremendous impact on education especially in the area of research, teaching and

learning. Mobile learning is becoming more and more accepted in higher education, and is generally described as personalize, anytime, anywhere learning experiences.

Mobile learning is the ability to obtain or provide educational contents on personal pocket devices such as PDAs, smartphones and mobile phones. Educational contents refers to digital learning assets which includes any form of content or media made available on a personal device (Robert & Kelly, 2012 and Costabile, et al., 2008).

Mobile technology has been used and experimented in many institutions around the world and it has been found to be useful in enhancing learning experiences such as Abilene Christian University (USA) provided iPhones to incoming students in their connected campus project; in UK, university-wide initiatives being implemented by Oxford University, Bath University and the Open University; Queensland University of Technology have reported implementations of mobile learning initiatives; and in Canada, Athabasca University, has also implemented campus-wide mobile applications with their library information system (Johnson et al., 2009).

There have been several pilot projects on different forms of m-learning across the length and breadth of the African continent, all in anticipation of seeking ways of integrating mobile technologies into education either as a complementary or comprehensive learning platform for teaching and learning that will engages the interest of user (Traxler et al., 2006; Willems, J., 2005). Some institutions including university of Pretoria in South Africa (Ally, 2009; Keegan, 2005), Makerere University in Uganda (Kajumbula, 2006), and University of Ibadan, University of Ilorin, and other private universities used mobile phones for project based learning by undergraduate students (Utulu, 2012 and Adedoja, 2012) in Nigeria among others.

A challenge for a mobile learning is the design of the information capturing procedure. Learners have their own learning preferences, so learners may use a mobile device differently depending on their learning behavior or learning culture. For example, learners may prefer to do one or more of the following as part of their learning process: take pictures, record videos, write notes, or create their own blogs. Due to the variety of available media, students can learn in different ways based on their preferred learning styles. Thus, it is essential to understand the context of use of mobile technology to facilitate students' learning as a key factor for designing a mobile learning model (Prasertsilp, 2013 and Mohammed & Alameen, 2014).

There are few research information on mobile learning design and conceptual frameworks on how mobile technology could be integrated into the main stream of education in Nigeria to support students learning engagement. The aim of this paper is to explore the theoretical basis and to offer a proposed framework for testing a mobile learning environment. The remaining sections

are as follows: Section 2 theoretical framework, section 3 proposed framework for a mobile learning environment, and section 4 conclusion and further research.

2.0 THEORETICAL FRAMEWORK

Learning theories are classified into behaviourist, cognitive, constructivist approaches (Naismith et al, 2004 and Mileva et al, 2008). The major differences among these learning theories concepts resides in how different people learn (Leidner & Jarvenpaa, 1995).

Behaviorism according to Skinner (1963), is a learning theory that focuses on observable behaviors and discounts any independent activities of the mind. Furthermore, it defined learning as the acquisition of new behaviors based on environmental conditions; cognitivism is a part of learning theories that are based on an information processing theory which deals with how people perceive, learn, remember, and think about information, it focuses on information process rather than behaviour (Norman, 1980). While Social constructivist opined that knowledge is constructed by individuals based upon their own prior experiences, in a particular context (Sharples, 2000; Honebein, Duffy & Fishman, 1993).

According to Mileva et al., (2008), Prasertsilp, (2013), and Mohammed & Alameen, (2014), the constructivist is most helpful in terms of describing learning with mobile technologies. Piaget, (1973) and Sharples, (2000) suggested that people construct their own understanding and generate their own rules and mental models from their experiences. Therefore, drawing on the constructivist learning theory, and that learning commences with a learner in a social, cultural, and technological environment, mobile learning design activities are grounded in social construction theory and the associated learning theory of Conversation are used in order to derive attributes for proposing a model of designing a mobile learning environment. Marwan E. et al., (2014) opined that social constructive and conversational learning models suggest that material should be personalized, allowing the users to filter information and collaborative allowing users to reflect on the information for proper use and retention; in order to have a greatest effectiveness, a user need to provide information and allowed to seek support when needed. Furthermore, Motiwalla (2007) suggests that these educational concepts should be applied to an m-learning framework together with the thoughtful instructional design in a mobile application.

2.1 Social Constructivist theory

Social constructivism sees knowledge as socially constructed and learning as essentially a social process. It is mediated through cultural tools, above all by language, which needs to be the learner's first language or at least one very familiar to them, and facilitated by drawing on examples or contexts familiar to the learners so that meaning making is prioritized (Vygotsky, 1986). Vygotsky extends constructivism by including the role of some actors and

culture in development into an active social process in learning (Dewey, 1916; Vygotsky, 1978). Furthermore, studies on motivation and increased use of student discussion in the classroom are grounded in the theories of social constructivism (Prasertsilp, 2013; Sivan, 1986; Alavi, 1994).

Mobile learning activities extend traditional learning into anywhere, anytime interactions and communications of everyday life. Thus, in a mobile learning environment, a teacher can conduct class by allowing students to apply new information and experiences to their existing knowledge through conversation and collaboration with their classmates, and student may gain new knowledge and skills in both formal and informal learning processes (Prasertsilp, 2013, Mohammed & Alameen, 2014).

Learners learn best when given the opportunity to learn skills and theories in the context in which they are used, and construct their interpretation in order to improve their skill, knowledge and experiences, and mobile learning activities provides such opportunities.

2.2 Conversational theory

Conversation Theory spans epistemology, educational technology, and cybernetics, and sees learning is a continual conversation, with the external world and its artefacts, with oneself, and also with other learners and teachers. The most successful learning comes when the learner is in control of the activity, able to test ideas by performing experiments, ask questions, collaborate with other people, seek out new knowledge, and plan new actions, and further acknowledged to be an elaborate and difficult construct (Sharples, et al., 2002).

Sharples (2000) considers Conversation Theory, as proposed by Pask (1976), as a primary element to mobile learning, to be supplemented by a detailed analysis of the cognitive, social, and cultural aspects of learning (Jarvis, et al., 1998). Pask (1976) describes conversational theory as learning in terms of conversations between different entities of knowledge. Furthermore, Pask purposefully draws no distinction between people and interactive systems, such as computer applications; this has the advantage that the theory may be applied equally to human teachers and learners as to computer-based teaching and learning support systems and conversation between teachers and learners, and learners with themselves, as well as with technologies.

Therefore, conversational theory could apply to design, and evaluating the impact of mobile learning environment on learners through conversation with teachers and colleagues, and mediating tools to both improve the design and learning experiences.

3.0 PROPOSED ITERATIVE FRAMEWORK FOR A MOBILE LEARNING ENVIRONMENT

Designing a Mobile learning intervention is a challenging task because many theoretical concepts, and design principles could be used to provide a guide to achieve the goals of mobile learning integration into teaching and learning activities due to the ubiquitous, personalized, and contextual nature of mobile learning. Social construction of knowledge, and associated learning theory of Conversational were reviewed in order to derive attributes for a mobile learning environment.

Many studies on mobile learning based on different contents and context have been reported such as social constructivist design (Baharom, 2013), social constructive knowledge and activity theory design (Prasertsilp, 2013; Mohammed & Alameen, 2014), mobile learning and higher education settings (Verdejo, et al., 2007; Whittlestone, et al., 2008). Effective and successfully building mobile learning applications depends on the subjects, learners, levels of learning, and contexts in which they are being used (Prasertsilp, 2013).

There are a number of mobile learning initiatives in Nigeria, but an underlying principle for the use of mobile devices in education has yet to be articulated. Few of the studies focus on opportunities, challenges and modelling of mobile learning in education in Nigeria such as Umar & Okeke, (2012), Mbanusi, (2012), Oladipo et al.'s (2012), application of wireless technologies into education in Nigeria (Boyinbode & Akinyede, 2008), Interactive Mobile Learning System in the Classroom (Boyinbode and Fasunon, 2015).

This paper derived some common attributes from social constructivist theory, and associated theory of conversational and proposed an iterative design framework for a mobile learning to support teachers and instructional designers to create educational values and provide students with a quality in mobile learning environment to improve their instructing and learning experiences. These attributes are: conversation, collaboration, creativity, content, context, technology, users, and pedagogy.

Conversation is an important factor in increasing learner's engagement, mobile technologies directly support conversation between teachers and students, and also provide communication channels and collaboration among classmates as they utilize the contents of the mobile learning environment within the context (culture & learning styles) of students in the learning environment. The context is created by people in interaction with other people, with their surroundings and with everyday tools. Traditional classroom learning is founded on a stable context, by setting up a fixed location with common resources, a single teacher, and an agreed upon curriculum. Mobile learning removes all these things and enhances the interrelated aspects of mobility. The mobility helps students to expand learning space from formal learning taken in the classroom to informal learning taken in the workplaces they prefer.

The “mobile” in mobile learning can be defined as both the mobility of learners and mobility of technology. Thus, mobile learning can occur while people on the move and utilize mobile devices to facilitate informal learning during the gaps of daily life. Also, mobile learning means gaining knowledge from portable tools and resources that are available in a handy lightweight device (Kakihara & Sorensen, 2002; Prasertsilp, 2013).

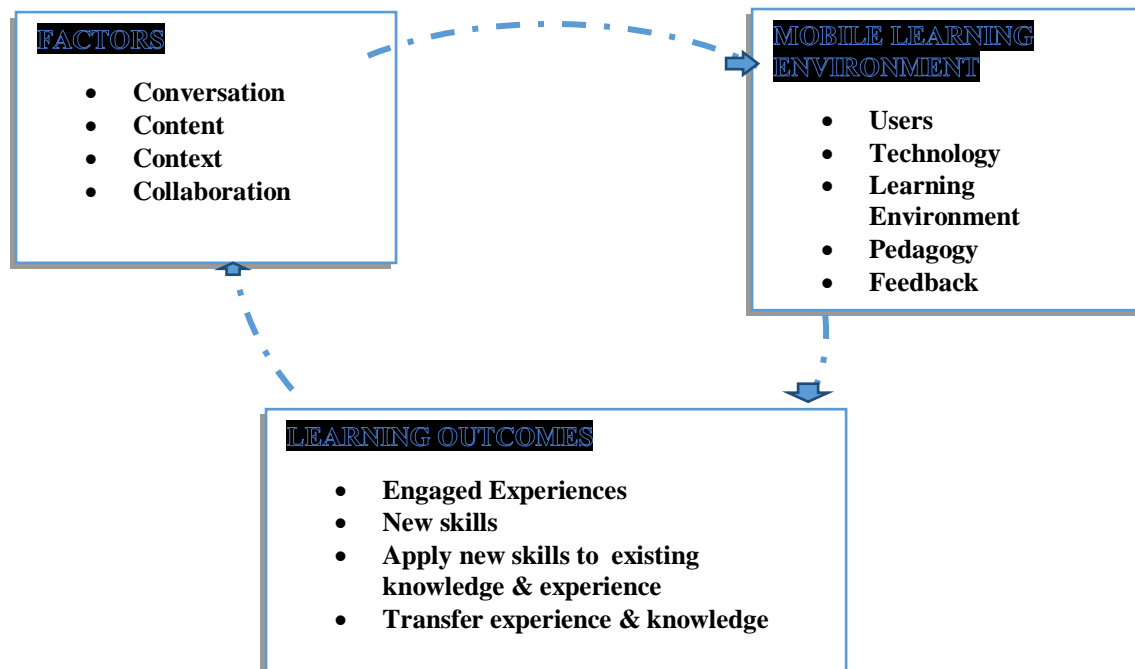


Figure 1: Proposed iterative framework for a mobile learning environment

Naismith & Corlett (2006) suggest that an effective design of mobile learning applications needs to: (i) create quick and simple interactions that can help the learner in responding to information in a timely manner, (ii) prepare flexible materials that can be accessed across contexts and serve an individual’s learning needs, (iii) consider special capabilities of mobile devices that might add to the learner’s experience, such as the use of audio and user anonymity, and (iv) use mobile technology to facilitate learning, especially making use of the features in current mobile devices for voice communication, note-taking, photography, and time management . In addition, they highlighted five critical success factors for mobile learning projects. These are: access to technology, connectivity, integration, ownership, and institutional support.

These critical factors are important for mobile learning intervention so that learners can use different mobile devices for learning in a blended learning environment to complement traditional learning environment.

4.0 CONCLUSION AND FURTHER RESEARCH

The Mobile learning iterative design framework was built on social constructivist theory, and associated theory of conversational. There may be other theories that might be integrated in this research, such as activity, cognitive theory and socio-technical theory.

Researchers propose that the achieved design system should aim to the joint optimization of the technical subsystem and social subsystem. Both the devices and tools of technical subsystem and the employee's skills and attitudes of social subsystem are critical factors of the organization. As a result, the design of a mobile learning system needs to consider that all the subsystems are working in harmony (Bostrom & Heinen, 1977).

The iterative design framework for a mobile learning environment derived from the common characteristics of the theories above impacted on the context (learning styles & culture) in association with the support and policies of the learning environment. The new iterative framework for a mobile learning environment could be measure by prototyping, and evaluating using appropriate pedagogy to determine users' satisfaction and learning engagement.

Despite the limitations of mobile learning devices such as small screens, limited storage capacities, and short battery life, these drawbacks are outweighed by the advantages that mobile learning can provide. If mobile learning allows students to easily access to information, then it will bring value to their learning experience (Afolabi, 2014; Prasertsilp, 2013). This new framework will be valuable to researchers in prototyping a mobile learning application, and create institutional support for its implementation.

REFERENCES

1. Adedola G. (2012), The Future of Mobile Learning in the Nigerian Education System, IST-Africa 2012 Conference Proceedings, Paul Cunningham and Miriam Cunningham (Eds), IIMC International Information Management Corporation, 2012,
2. Afolabi O. (2014), On Cloud Computing in Mobile Learning, International Journal of Information Engineering and Applications, Vol.4 (5), Pp. 83-85
3. Ally, M. (2009). Mobile Learning: Transforming the Delivery of Education and Training. Athabasca University Press. PP10-35
4. Alavi, M. (1994), Computer-mediated collaborative learning: An empirical evaluation". MIS Quarterly 18 (2)
5. Bukie and Ngole(2014).Mobile Learning Implementation: Readiness of the National Open University of Nigeria, International Journal of Emerging technology and Advanced Engineering, Vol.(4)11
6. Boyinbode and Fasunon (2015), International Journal of Services, Science and Technology, 8(4)
7. Costabile, M. et al., (2008). Explore! Possibilities and Challenges of Mobile Learning. CHI 2008 Proceedings, Florence, Italy.
8. Johnson, L. et al., (2009) 'The 2009 Horizon Report'. Austin, Texas: The New Media Consortium.
9. Dewey, J. (1916). Democracy and education: An introduction to the philosophy of education. The Macmillan Company.
10. Hofstede, G. (1986). Cultural differences in teaching and learning. International Journal of Intercultural Relations, 10(3), 301-320.
11. Fezile Ozdamli / Procedia - Social and Behavioral Sciences 31 (2012)
12. Kajumbula, R. (2006). The effectiveness of mobile short messaging service (SMS) technologies in the support of selected distance education students of Makerere University, Uganda. Retrieved from <http://pcf4.dec.uwi.edu/viewpaper.php?id=98> [Accessed 4th June, 2013]
13. Jarvis, Pet al., (1998). Theory and Practice of Learning in Prasertsilp P. (2013): Mobile Learning: Designing a Socio-Technical Model to Empower Learning in Higher Education, LUX: A Journal of Trans

- disciplinary Writing and Research from Claremont Graduate University, Vol.(2)1
14. Keegan, D. (2005). The incorporation of mobile learning into mainstream education and training. In World Conference on Mobile Learning, Cape Town. Retrieved from <http://www.mlearn.org/mlearn2005/CD/papers/keegan1.pdf> [Accessed 30th March, 2014]
 15. Leidner, D. E., and S. L. Jarvenpaa. 1995. The use of information technology to enhance management school education: A theoretical view. *MIS Quarterly* 19 (3): 265-91.
 16. Oladipo et al., (2012). Leveraging on the Affordance of Mobile Phones in Nigeria for MLearning Modeling, *International Journal of Information and Communication Technology Research*, Vol.2 (7)
 17. Naismith, L., and D. Corlett (2006). Reflections on success: A retrospective of the mLearn conference series 2002-2005, in Prasertsilp P. (2013). *Mobile Learning: Designing a Socio-Technical Model to Empower Learning in Higher Education*, LUX: A Journal of Trans disciplinary Writing and Research from Claremont Graduate University, Vol.(2)1
 18. Prasertsilp P. (2013). *Mobile Learning: Designing a Socio-Technical Model to Empower Learning in Higher Education*, LUX: A Journal of Trans disciplinary Writing and Research from Claremont Graduate University, Vol.(2)1
 19. Pask, A. (1976). *Conversation Theory: Applications in Education and Epistemology* in Prasertsilp P. (2013): *Mobile Learning: Designing a Socio-Technical Model to Empower Learning in Higher Education*, LUX: A Journal of Trans disciplinary Writing and Research from Claremont Graduate University, Vol.(2)1
 20. Piaget, J. (1973). *The child and reality: Problems of genetic psychology*. New York: Grossman.
 21. Mohammed I. & Alameen A. (2014), *Designing An Effective Mobile-learning Model By Integrating Student Culture*, *International Journal of Computer Science and Security (IJCSS)*, Vol.8(3).
 22. Motiwalla, L.F., "Mobile learning: A framework and evaluation. *Computers & Education*", pp. 581–596, 2007
 23. Marwan E et al., (2014). Development of Mobile EEF learning (MEEFLS) for Mobile Implementation in Kolej Poly-Tech, Mara, (KPTM), World Academy of Science, Engineering and Technology *International Journal of Computer, Information Science and Engineering* Vol:8 No:4, 2014
 24. Norman, D. (1980). Twelve issues for cognitive science. *Cognitive Science* 4 (1)

25. Traxler, John, & Leach, J. (2006). Innovative and sustainable mobile learning in Africa. In *Wireless, Mobile and Ubiquitous Technology in Education, 2006. WMUTE'06. Fourth IEEE International*
26. Robert, J. M. and Kelly, J. F. (2012). "E-learning As a Career Path in Information Systems Curricula: A Blue Ocean Opportunity," *American Journal of Business Education*, Vol. 5, No. 2, 103-114.
27. Sharples, M., et al., (2010), A theory of learning for the mobile age". *Medienbildung in Neuen Kulturräumen*: 87-99
28. Sharples, M. et al., (2002). The Design and Implementation of a Mobile Learning Resource in Prasertsilp P. (2013): *Mobile Learning: Designing a Socio-Technical Model to Empower Learning in Higher Education*, LUX: A Journal of Trans disciplinary Writing and Research from Claremont Graduate University, Vol.(2)1
29. Skinner B. (1963). Are theories of learning necessary? Bobbs-Merrill
30. Sharples, M. (2000). The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34, 177-193.
31. Umar A. & Okeke U. (2012). M-Learning in Nigerian Universities: Challenges and Possibilities, *Global Awareness Society International 21st Annual Conference - New York City, May 2012*
32. Utulu, C. (2012). Use of mobile phones for project based learning by undergraduate students Nigerian private Universities. *International Journal of Education and Development using Information Communication and Technology*. Vol. 8. No. 1 (2008). pp. 1 – 15
33. Vygotsky, L. S. 1978. *Mind in society*. Cambridge, MA: Harvard University Press.
34. Willems, J. (2005). Flexible Learning: Implications of „whenever“ „wherever“, and whatever“. *Distance Education*, 26(3), 429-435.

Yusufu Gambo is a lecturer II at the Adamawa State University Mubi, Nigeria. He received his B.Tech and MSc. degrees in Operations Research from Modibbo Adamawa University of Yola in 2001 and Information Technology

from Stirling University, Scotland in 2011, respectively, and presently he is an International PhD student at De Montfort University, Leicester, England. He has some publications in national and international journals. His current research interests include mobile-cloud learning, mobile-web computing, & Information System.