A Synthesis of Mobile Learning Research Implications: Agricultural Faculty and Student Acceptance of Mobile Learning in Academia

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Abstract

Mobile technology is pervasive in our daily lives. The use of mobile devices is changing the educational model in traditional classrooms and eLearning classrooms. Mobile learning is the use of mobile technology to deliver educational content and is a growing educational tool in our educational institutions. A synthesis of research on the implications of mobile learning was conducted. The synthesis found students are accepting of mobile technology and their lives, as the technology is widespread throughout society. Factors such as self-efficacy and technology acceptance are driving mobile learning use. Further research on what mobile learning means in terms of educational practices, as well as student and teacher acceptance is needed. Understanding acceptance and practice in regards to mobile learning will inform instructors as they try to implement the technology in teaching.

Introduction

People around the globe have integrated mobile technology into their daily lives. The United Nations Educational, Scientific and Cultural Organization (2011) found mobile networks serve 90% of the world and 80% of people living in rural areas. Lee et al. (2010) defined mobile technology as portable devices, like smartphones or tablet devices, allowing users to access and share data wirelessly. Ng and Nicholas (2009) suggested mobile technology is changing the classroom, as students and instructors are freed from a dependence on traditional educational procedures for learning.

Mobile technology provides asynchronous and portable functions for users to engage in various tasks unencumbered by location and time limitations. Users' mobile devices are providing anytime, anywhere services ranging from commerce to entertainment to information (López-Nicolás et al., 2008). The U.S. has seen mobile technologies become commonplace in the lives of its citizens. The Pew Research Center's Internet & American Life Project (2012) found almost half of all adults in the U.S. have a smartphone and smartphone users outnumber more basic phone users. Mobile technology is shifting the paradigm for how people conduct business, have fun, and communicate with others. The ubiquitous nature of mobile devices has allowed users access to a marketplace with any time or place access (Varnali and Toker, 2010).

Mobile Learning

Mobile learning is increasing in popularity as students increasingly have mobile devices, but there has been little in the way of research into their adoption of mobile learning compared to eLearning (Park et al., 2012). Liaw et al. (2010) suggested mobile learning is the use of mobile technology for educational engagement. Park (2011) found mobile devices' ubiquity gives educational practitioners and researchers the ability to use it in a variety of instructional settings. Shen et al. (2009) reported observation, assessment, and evaluation are needed to make sure of mobile technology's appropriate use in instructional settings.

The desire for learner-centered opportunities to meet the needs of today's learners is increasing the scope of mobile learning. Nordin et al. (2010) suggested many theories of learning are tied to the traditional classroom setting but mobile learning bypasses the traditional classroom, meaning mobile learning needs its own theories. Mobile learning will be more accessible for researchers and educators to understand if a framework encompassing definitions, approaches, and theories is developed to guide mobile learning practices (Keskin and Metcalf, 2011). Nordin et al. (2010) found many theories of learning are tied to the traditional classroom setting but mobile learning bypasses the traditional classroom, meaning mobile learning needs its own theories.

Trebbi (2011) reported the influence of information technology on educational practices is creating a new frontier for learning, with novel roles for teachers and students. Demirbilek (2010) suggested the growing nature of mobile devices in educational settings has created an important need to examine educators' perceptions of the use of mobile technology for learning purposes. Uzunboylu and Ozdamli (2011) recommended teacher

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attitudes toward mobile learning be understood in order to successfully employ it in instructional environments. Mohamad et al. (2012) recommended research-based mobile learning and teaching policies and procedures to assist teachers.

Mobile Technology and Agricultural Education

Agricultural education researchers have examined mobile technology in diverse learning environments. Researchers should examine agricultural education students' acceptance and willingness to use mobile learning in the classroom (Irby and Strong, 2013). Rhoades et al. (2008) reported agricultural education students perceive the Internet as an easier to use technological tool to advance their learning in academic settings. Agricultural education researchers have not examined students' acceptance and use of mobile technologies in coursework. Agricultural education faculty should further examine student's use of mobile technologies in coursework (Strong et al., 2012). The study was conducted to examine the literature regarding students and teacher's acceptance and use of mobile technology in academic environments. The purpose of this study is to synthesize research in regards to mobile learning and provide a greater insight into mobile learning in agricultural education.

Purpose and Objectives

The study synthesized selected research studies related to mobile technology in academic environments. The study was conducted to provide a more thorough understanding of the issue. More specifically, this study sought to:

1. Search for literature on the acceptance and use of mobile technology in educational environments;
2. Search for literature on the adoption of mobile technology in institutions;
3. Search for literature on students' self-efficacy in relation to mobile learning; and
4. Develop a synthesis of the findings.

Materials and Methods

The theoretical framework of the study was created from social cognitive theory, the diffusions of innovations, the technology adoption model, and the unified theory of acceptance and use of technology. The methodology of the study was conducted through integrative inquiry.

Social Cognitive Theory and Self-Efficacy

Bandura (1986) developed social cognitive theory to explain human behavior as an interaction of personal characteristics, perceptions, practices, and the environment. Self-efficacy explains how individuals handle different tasks. Bandura (1977) defined self-efficacy as one's willingness to believe they can handle different challenges. Individuals with low self-efficacy avoid new and difficult tasks, while individuals with high self-efficacy will engage such tasks (Bandura, 1977).

Mobile technology use and self-efficacy have been examined in research studies. Self-efficacy was found to be a moderator on the adoption of mobile commerce services (Islam et al. 2011). Mobile service data usage by Americans and Koreans was studied with a framework based on self-efficacy and the technology acceptance model (Yang, 2010). Self-efficacy has been used to examine students' attitudes toward mobile learning (Yang, 2012).

Diffusions of Innovations

Rogers' (2003) diffusion of innovations has been used to study innovations in a variety of areas. Rogers (2003) found an innovation has five attributes: relative advantage, compatibility, complexity, trialability, and observability. Relative advantage is the extent people believe an innovation is better than the one currently in use. Compatibility is how an innovation is compatible with people's belief and value systems. Complexity is how difficult people find an innovation to use or understand. Trialability refers how people can try out an innovation before deciding to adopt the innovation. Observability is the extent to which people can view the innovation's results (Rogers, 2003).

The diffusion of innovations has been used to examine the adoption of instructional technology innovations like eLearning and mobile learning. Duan et al. (2010) used Rogers' innovation characteristics to frame a study on the adoption of eLearning. Shippee and Keengwe (2012) utilized the diffusion of innovations to examine the factors necessary for the successful implementation of mobile learning. The diffusion of innovations served as the framework for a literature review covering mobile learning trends (Hung and Zhang, 2012).

Technology Acceptance Model

Davis (1989) created the Technology Acceptance Model (TAM) as an information systems model indicating how users accept and use technology. Perceived usefulness and perceived ease of use are two important components of this model. How an individual believes a technology system would increase his or her job functioning is known as perceived usefulness. An individual's perception of the amount of effort needed to use a technology system is known as perceived ease of use. Perceived usefulness and perceived ease of use can be used to determine a user's intention to use a technology system (Davis, 1989).

Technology usage in educational settings has been examined through the use of the technology acceptance model. Perceived usefulness and perceived ease of use were key determinants in users' behavioral intention to use the computers (Teo et al., 2009). The technology acceptance model has also been used for researching eLearning systems acceptance. The technology acceptance model can be utilized to study instructor acceptance of eLearning systems (Yuen and Ma, 2008). Mobile technology use has been examined through the use of the technology acceptance model. Chen et al.

(2011) used the technology acceptance model to frame a study on learner attitudes in a mobile learning setting. Gao et al. (2011) extended the technology acceptance model to develop an instrument to gauge mobile services acceptance.

Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) described a user's behavioral intention to use an information system and was built upon concepts explored in social cognitive theory, diffusion of innovations, and the technology acceptance model (Venkatesh et al., 2003). Venkatesh et al. (2003) suggested UTAUT explains user intentions to use an information system and the subsequent usage behavior through four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is the benefit a user expects from an information system. Effort expectancy is the effort a user expects to exert when using an information system. Social influence is how a user perceives others' use of an information system. Facilitating conditions reference the infrastructure a user thinks is necessary to use an information system. The UTAUT has been used to frame studies on users' continuing relationships with mobile providers (Zhou, 2013), individuals' use of mobile devices for internet access (Zhou, 2011), and to investigate mobile learning intention among university students (Lowenthal, 2010).

Integrative Inquiry

The study used a process of selecting and synthesizing literature known as integrative inquiry. Marsh (1991) identified integrative inquiry as one of the most complex models of practical inquiry that may be initiated. An integrated inquiry is a research synthesis of integrative knowledge that gathers information from various sources that are relevant to a specified audience. Through the implementation of an integrative inquiry, current or previous studies are synthesized for knowledge that will help address contemporary deficiencies and illuminate potential solutions (Marsh, 1991). An integrative inquiry gathers studies of a specific topic, reviews them individually, organizes them in order to distinguish and compare related questions, and analyzes and develops implications about what is known and what needs investigating (Marsh, 1991).

Marsh (1991) described the process of combing and combining current and completed studies for knowledge to inform decision making as integrative inquiry. Integrative inquiry is used to produce knowledge beneficial to policymaking respective of context (Marsh, 1991). Roberts (as cited in Marsh) delineated six steps for directing an integrative inquiry. The six steps were employed to conduct this study and were as follows:

1. Identify the need, conduct preliminary search, clarify request;
2. Conduct the search of and retrieval of studies;
3. Selecting, screening, and organizing studies;
4. Determine the conceptual framework and fitting it to the information from the analysis; fit analysis information;
5. Develop the synthesis and interpretation into a material product; and
6. Delivering the results of synthesis (Roberts, as cited in Marsh, p. 277-279).

Integrative inquiries have been utilized to study a variety of research topics respective of context. de Gea et al. (2012) used an integrative review process to examine empirical research involving the nursing education and ICTs. Donner (2008) conducted a review of literature regarding mobile use in the developing world to fit a framework for mobile use determinants. Isaak-Ploegman and Chinien (2009) conducted an integrative review to develop an instructional design process for the differing cognitive styles in distance-learning environments. Parr and Edwards (2004) implemented an integrative inquiry to synthesize research on inquiry-based instruction and the problem-solving approach. The study used data gathered from refereed journal articles in the areas of information technology and agricultural education. Limits were instituted to confine the review of literature to the years of 2004 – 2013 given the technological context of the literature.

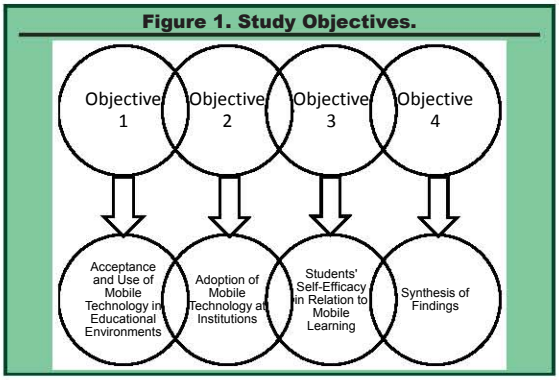
Results and Discussion

The results of the integrative inquiry yielded several factors surrounding the development of mobile learning in academic settings. Findings are presented per research objective (Figure 1).

Objective One

The first objective was to canvass the literature related to the acceptance and use of mobile technology in educational environments. Aubusson et al. (2009) found mobile learning could transform instructor learning and gives educators new means to use the classroom for observation, sharing, and teaching. Rogers et al. (2010) found mobile devices can use many forms of graphical representation to allow students to increase knowledge in more effective manner. The use of iPads can increase teacher productivity and learning (Kearney and Maher, 2013). Schuck et al. (2012) found mobile learning can increase teaching effectiveness and mobile technology use would benefit professional learning communities.

Figure 1. Study Objectives.



Mobile learning educators and developers must understand student acceptance when designing mobile learning content (Iqbal and Qureshi, 2012). Stockwell (2008) found users engage novel technologies with varying degrees of interest, skills, and ideas leading to varying technological acceptance rates. Kennedy et al. (2010) found various factors may affect students' technology experiences and preferences, meaning a full range of information about their use of technology are needed. Students with the time and access to mobile devices can use mobile learning to engage in student-centered, authentic learning (Cochrane and Bateman, 2010).

Educators and instructional designers must ensure mobile learning provides productive learning outcomes for students (Chuang, 2009). Wang and Shen (2012) suggested mobile learning should provide satisfying scholastic experiences as part of its facilitation of perpetual learning. Dale and Pymm (2009) suggested mobile learning will need to prove its value as a learning tool as the increasing acceptance of mobile devices in our society is blurring the relationship between work and play. Idrus and Ismail (2010) found mobile devices erase restrictions by becoming one with the learner, making the concept of learning more applicable. A model of adoption is needed to help determine the demographic factors surrounding students' acceptance of and willingness to use mobile learning (Yadegaridehkordi and Iahad, 2012).

Mobile technology offered agricultural educators the means to disseminate information in a more efficient manner. Agricultural science and technology teachers had positive perceptions in regards to use of mobile technology like iPods and mp3 players to improve student engagement (Murphrey, Miller and Roberts, 2009). The use of mobile technology can decrease the resources needed to communicate and share information (Aker, 2011). An online resource guide to increase agricultural knowledge of cotton was found to be valuable and useful by users (Cooper-Jennett et al., 2010).

Mobile learning has surfaced in literature involving extension education studies. Carter and Hightower (2010) suggested Extension's use of mobile learning should be studied due to mobile technology's global reach. The creation of mobile learning applications could be advanced through the sharing of the applications with Extension Systems across the nation (LaBelle, 2011).

Objective Two

The second objective of the study was to search the literature related to the adoption of mobile technology at institutions. Young adults have made mobile technologies part of their everyday routines. Huang et al. (2013) reported 87% of college students own a portable computing device and 55% have a smartphone. Mobile devices provide important information conduits for college students. Mobile communication technologies are commonplace on college campuses and vital to students' maintenance of interpersonal relationships (Chen and Katz, 2009).

Lu (2012) states several higher education institutions face difficulty in creating and implementing eLearning and mobile technology systems into current campus information systems due to the relatively new adoption of eLearning and m-learning technologies. Experienced eLearners are more likely to find mobile learning more accommodating than those without eLearning experience (Yadegaridehkordhi and Iahad, 2012). Mobile learning offers value to educational institutions in the form of credibility and cost effectiveness (Mohammad et al., 2012). Gu et al. (2011) found through the use of sound instructional design processes to create educational content, mobile learning can enable lifelong learning.

McContha et al. (2008) found the increase of wireless networks across higher education institutions has created the infrastructure for mobile learning to be adopted by educators. Mobile devices are very popular in colleges and universities and could become an essential tool for learning (Shin et al., 2011). College and university campuses have populations particularly open to the use of mobile learning. Matias and Wolf (2013) suggested most people will soon be getting online through their mobile devices, and educators should embrace the chance to augment student learning outcomes by successfully using mobile technology in educational settings. Cheon et al. (2012) suggested higher education students' greater use of mobile devices compared to primary and secondary students may lead to quicker adoption in college and university settings.

Objective Three

The third objective of the study was to search the literature related to students' level of self-efficacy in regards to mobile learning. Goode (2010) suggested students' technology knowledge is initially formed by educational engagement at home and in school, with reinforcement by higher education experiences. Peng et al. (2009) found mobile learning offers amazing technical abilities for students. Mobile learning faces difficulties due to the various mobile devices used and educational adaptation issues but offers learners distinctive opportunities for educational engagement (Elias, 2011). Kulksa-Hume (2010) found mobile learning can challenge educators as they must comprehend students' needs in a more productive and accessible way due the technology creating a focus on learning over teaching. Careful development of learning techniques for mobile learning is needed to ensure its educational advantages and avoid it being an obstacle for learning (Koszalka and Ntloedibe-Kuswani, 2010).

Approaches for agricultural educators to improve student's self-efficacy with mobile learning have been studied. Mobile learning should be demonstrated as an extension of students' current mobile technology use to reduce their perception of mobile learning being a difficult task, and thus, provide opportunities to increase self-efficacy (Irby and Strong, 2013). Agricultural information experts have exhibited positive attitudes towards the

use of mobile learning in various areas of agricultural education (Yaghoubi et al., 2010).

Objective Four

The fourth objective was to develop a synthesis of the findings. The advent and omnipresence of mobile learning is shifting the educational environment. The use of an integrative inquiry identified produced a review of studies addressing the potential benefits of mobile learning, the acceptance and adoption of mobile technology, and the relationship between self-efficacy and mobile learning acceptance and adoption.

How mobile learning is similar and dissimilar to eLearning is still being understood. Literature on the acceptance and use of mobile learning in educational environments suggests the use of mobile learning offers potential benefits, requires new instructional design ideas, and more research on its acceptance and adoption. Literature on the acceptance and adoption of mobile technology suggests the technology is widely used with a majority of college students relying on the technology in a variety of ways. Literature on students' self-efficacy and mobile learning suggested a need to study to relationships between the two factors in terms of mobile learning acceptance and adoption.

Bandura's (1986) self-efficacy, Rogers' (2003) diffusion of innovations, Davis' (1991) TAM, and Venkatesh et al.'s (2003) UTAUT may provide researchers potential constructs to understand mobile learning acceptance among students and instructors.

Self-efficacy is how willing individuals are to attempt a particular task based on perceived difficulties associated with the task (Bandura, 1977). The literature suggests mobile technology is commonplace among college students and their use of the technology is frequent. Mobile learning may be perceived as a more attractive task by highly self-efficacious students but not those with low self-efficacy. Students with low self-efficacy may be wary of confronting even a familiar technology like mobile technology.

Rogers' (2003) characteristics of an innovation and innovation adoption process are part of the theory of the diffusion of innovations. Students could decide to adopt mobile learning if they are made aware of its relative advantage compared to traditional learning as the literature suggests mobile learning offers learning benefits due to its ability to occur at any time or location. The literature suggests college students are accepting of mobile technology in their lives, thus possibly allowing them to realize the compatibility of mobile learning with their current mobile technology usage.

TAM and the UTAUT respectively explain the adoption and acceptance of technology among users (Davis, 1991; Venkatesh et al., 2003). TAM served as part of the foundational basis for UTAUT, which explains the acceptance of an information system. UTAUT also built upon ideas of social cognitive theory and the diffusions of innovations. Literature suggests mobile technology has been accepted among college students and is an adopted form of technology. College students' acceptance and adoption of mobile technology could lead to their eventual adoption and acceptance of mobile learning.

Summary

The data indicated more research needs to be conducted on mobile learning acceptance and the potential benefits to students and teachers. Agricultural educators and researchers should further research mobile learning acceptance in the context of self-efficacy and the UTAUT. Future studies should examine the interaction between self-efficacy, performance expectancy, effort expectancy, behavioral intention, and facilitating conditions.

Instructor and student perceptions and adoption of mobile learning need to be understood with greater clarity. Educators should investigate student acceptance of mobile learning when creating content for mobile devices (Iqbal and Qureshi, 2012). The acceptance and attitude of instructors toward mobile learning must be studied for successful use in instruction (Uzunboylu and Ozdamli, 2011). Understanding these relationships may increase understanding of mobile learning acceptance among educators and students and offer approaches to enhance student learning.

Research into mobile learning is needed to develop processes for teachers to reach learners' through this technology (Mohamad et al., 2012). Researchers can use a Delphi panel made up of experts in agricultural education; to determine the competencies needed for agricultural educators to effectively utilized mobile learning technology. Wang and Shen (2012) recommended new design procedures and techniques for mobile learning.

Proper instructional design for mobile learning can ensure its ability to create lifelong learning opportunities (Gu et al., 2011). Agricultural education faculty could allow students to use their mobile devices to complete class learning objectives. Instructors should demonstrate the usefulness and ease of use of mobile learning by demonstrating educational activities such as turning in assignments and giving presentations through mobile technology to increase student self-efficacy. Agricultural education faculty could use mobile technologies in novel ways by creating learning opportunities that embrace the positive characteristics of mobile learning through experiential learning activities. Instructors should implement mobile learning experiences by utilizing the ubiquitous strengths of the mobile technology to cultivate opportunities for student engagement and learning.

Literature Cited

Aker, J.C. 2011. Dial "A" for agriculture: A review of information and communication technologies for agricultural extensions in developing countries. Agricultural Economics 42: 631-647. DOI: 10.1111/j.1574-0862.2011.00545.x

Aubusson, P., S. Schuck and K. Burden. 2009. Mobile learning for teacher professional learning: Benefits, obstacles, and issues. ALT-J: Research in Learning Technology 17(3): 233-247. DOI: 10.1080/09687760903247641

Bandura, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review 84(2): 191-215. DOI: 10.1037/0033-295X.84.2.191

Bandura, A. 1986. Social foundations of thought and action: A social cognitive theory. Prentice-Hall: Englewood Cliffs, NJ.

Carter, H. and L. Hightower. 2009. Using mobile technology in an extension leadership development program. Journal of International Agricultural and Extension Education 16(2): 103-111. DOI:10.5191/jiaee.2009.16205

Chen, Y.F. and J.E Katz. 2009. Extending family to school life: College students' use of the mobile phone. International Journal of Human Computer Studies 67: 179-191.DOI:10.1016/j.ijhcs.2008.09.002

Chen, T.S., P.S. Chiu, Y.M. Huang and C.S. Chang. 2011. A study of learners' attitudes using TAM in a context-aware mobile learning environment. International Journal of Mobile Learning and Organisation 5(2): 144-158. DOI: 10.1504/IJMLO.2011.041567

Cheon, J., S. Lee, S.M. Crooks and J. Song. 2012. An investigation of mobile learning readiness in higher education based on the theory of planned behavior. Computers & Education 59: 1054-1064. DOI: 10.1016/j.compedu.2012.04.015

Chuang, K.W. 2009. Mobile technologies enhance the e-learning opportunity. American Journal of Business Education 2(9): 49-53.

Cochrane, T. and R. Bateman. 2010. Smartphones give you wings: Pedagogical affordances of mobile web 2.0. Australasian Journal of Educational Technology 26(1): 1-14.

Cooper-Jennet, K., C. Akers, D. Doerfert and T. Chambers. 2010. Usability evaluation of an online media resource guide. Journal of Agricultural Education 51(1): 43-54. DOI:10.5032/jae.2010.01043

Dale, C. and J.M. Pymm. 2009. Podogogy: The ipod as a learning technology. Active Learning in Higher Education 10(1): 84-96. DOI: 10.1177/1469787408100197

Davis, F.D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13(3): 319–340. DOI: 10.2307/249008

de Gea, J.M.C., J.L.F. Alemán and A.B.S. García. 2012. Computer-based nursing education: An integrative review of empirical studies. Journal of Nursing Education and Practice 2(3): 162-172. DOI: 10.5430/jnep.v2n3p162

Donner, J. 2008. Research approaches to mobile use in the developing world: A review of the literature. The Information Society 24(3): 140-159. DOI: 10.1080/01972240802019970

Duan, Y., Q. He, W. Feng, D. Li and Z. Fu. 2010. A study on take-up intention from an innovation adoption perspective: A case in China. Computers and Education 55(1): 237-246. DOI: 10.1016/j.compedu.2010.01.009

Elias, T. 2011. Universal instructional design principles for mobile learning. International Review of Research in Open and Distance Learning, 12(2), 145-156.

Gao, S., J. Krogstie and K Siau. 2011. Developing an instrument to measure the adoption of mobile services. Mobile Information Systems 7(1): 45-67. DOI: 10.3233/MIS20110110

Goode, J. 2010. The digital identity divide: How technology knowledge impacts college students. New Media & Society 12(3): 497-513, DOI:10.1177/1461444809343560

Gu, X., F. Gu and J.M. Laffey. 2011. Designing a mobile system for lifelong learning on the move. Journal of Computer Assisted Learning 27: 204-215. DOI: 10.1111/j.13652729.2010.00391.x

Huang, W.H.D., D.W. Hood and S.J. Yoo. 2013. Gender divide and acceptance of collaborative web 2.0 applications for learning in higher education. Internet and Higher Education 16: 57-65. DOI: 10.1016/j.iheduc.2012.02.001

Hung, J.L. and K. Zhang. 2012. Examining mobile learning trends 2003–2008: A categorical meta-trend analysis using text mining techniques. Journal of Computing in Higher Education 24(1): 1-17. DOI: 10.1007/s12528-011-9044-9

Idrus, R.M. and I. Ismail. 2010. Role of institutions of higher learning towards a knowledge based community utilizing mobile devices. Procedia Social and Behavioral Sciences 2: 276602770. DOI:10.1016/j.sbspro.2010.03.412

Iqbal, S. and I.A. Qureshi. 2012. M-learning adoption: A perspective from developing country. The International Review of Research in Open and Distance Learning 13(3): 147-164.

Irby, T.L. and R. Strong. 2013. Agricultural education students' acceptance and self-efficacy of mobile technology in classrooms. NACTA Journal 57(1): 82-87.

Isaak-Ploegman, C.M. and C. Chinien. 2009. The implications of cognitive style to adult distance education. In R. Maclean and D. Wilson (Eds.), International handbook of education for the changing world of work (pp. 2679-2695). Netherlands: Springer

Islam, M.A., M.A. Khan, T. Ramayah and M.M. Hossain. 2011. The adoption of mobile commerce service among employed mobile phone users in Bangladesh: self-efficacy as a moderator. International Business Research 4(2): 80-89. DOI: 10.5539/ibr.v4n2p80

Kearney, M. and D. Maher. 2013. Mobile learning in math teacher education: Using iPads to support pre-service teachers' professional development. Australian Educational Computing 27(3) 76-84.

Kennedy, G., T. Judd, B. Dalgarnot and J. Waycott. 2010. Beyond natives and immigrants: Exploring types of net generation students. Journal of Computer Assisted Learning 26: 332-343. DOI: 10.1111/j.1365-2729.2010.00371.x

Koszalka, T.A. and G.S. Ntloedibe-Kuswani. 2010. Literature on the safe and disruptive learning potential of mobile technologies. Distance Education 31(2): 139-157. DOI: 10.1080/01587919.2010.498082

Keskin, N.O. and D. Metcalf. 2011. The current perspectives, theories, and practices of mobile learning. The Turkish Online Journal of Educational Technology 10(2): 202-208.

Kukulska-Hulme, A. 2010. Mobile learning as a catalyst for change. Open Learning 25(3), 181-185. DOI: 10.1080/02680513.2010.511945

LaBelle, C. 2011. Place-based learning and mobile technology. Journal of Extension 49(6): 1-6. http://www.joe.org/joe/2011december/iw1.php

Lee, J.H ., J.H. Kim and J.H. Hong. 2010. A comparison of adoption models for new mobile media services between high- and low-motive groups. International Journal of Mobile Communications 8(5): 487-506. DOI: 10.1504/IJMC.2010.034934

Liaw, S.S., M. Hatala and H.M. Huang. 2010. Investigating acceptance toward mobile learning to assist individual knowledge management. Computers & Education 54, 446-454. DOI:10.1016/j.compedu.2009.08.029

López-Nicolás, C., F.J. Molina-Castillo and H. Bouwman. 2008. An assessment of advanced mobile services acceptance: Contributions from TAM and diffusion theory models. Information & Management 45: 359-364. DOI:10.1016/j.im.2008.05.001

Lowenthal, J.N. 2010. Using mobile learning: Determinates impacting behavioral intention. The American Journal of Distance Education 24; 195-206. DOI: 10.1080/08923647.2010.519947

Lu, H.K. 2012. Learning styles and acceptance of e-learning management systems: An extension of a behavior intention model. International Journal of Mobile Learning and Organisation 6(3/4): 246-259. DOI: 10.1504/IJMLO.2012.050044

Marsh, C.J. 1991. Integrative inquiry: The research synthesis. In E. C. Short (Ed.), Forms of curriculum inquiry (pp. 271-283). Albany, NY: State University of New York Press.

Matias, A. and D.F. Wolf. 2013. Engaging students in online course through the use of mobile technology. Cutting-edge Technologies in Higher Education 6(D): 115-142. DOI:10.1108/S2044-9968(2013)000006D007

McContha, D., M. Praul and M.J. Lynch. 2008. Mobile learning in higher education: An empirical assessment of a new educational tool. The Turkish Online Journal of Educational Technology 7(3): 1-7.

Mohamad, M., F. Maringe and J. Woollard. 2012. Mobile learning in Malaysianschools: Opportunities and challenges of introducing teaching through mobile phones. International Journal for e-Learning Security 2(1/2): 133-137.

Mohammad, N.M.N., M.N. Mamat and P.M. Isa. 2012. M-learning in Malaysia: Challenges and strategies. Procedia Social and Behavioral Sciences 67: 393-401. DOI: 10.1016/j.sbspro.2012.11.343

Murphrey, T.P., K.A. Miller and T.G. Roberts. 2009. Agricultural science and technology teachers' perceptions of ipod and mp3 technology integration into curricular and cocurricular activities. Journal of Agricultural Education 50(4): 110-119. DOI: 10.5032/jae.2009.04110

Ng, W. and H. Nicholas. 2009. Introducing pocket PCs in schools: Attitudes and beliefs in the first year. Computers & Education 52: 470-480. DOI:10.1016/j.compedu.2008.10.001

Nordin, N., M.A. Embi and M.M. Yunus. 2010. Mobile learning framework for lifelong learning. Procedia Social and Behavioral Sciences 7: 130-138. DOI: 10.1016/j.sbspro.2010.10.019

Park, S.Y., M.W. Nam and S.B. Cha. 2012. University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. British Journal of Educational Technology 43(3): 1-14. DOI: 10.1111/j.14678535.2011.01229.x

Park, Y. 2011. A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. International Review of Research in Open and Distance Learning 12(2): 78-102. DOI: hdl.handle.net/10515/sy52j68h9

Parr, B. and M.C. Edwards. 2004. Inquiry-based instruction in secondary agricultural education: Problem-solving - An old friend revisited. Journal of Agricultural Education 45(4): 106-117. DOI: 10.5032/jae.2004.04106

Peng, H., Y.J. Su, C. Chou and C.C. Tsai. 2009. Ubiquitous knowledge construction mobile learning re-defined and a conceptual framework. Innovations in Education and Teacher International 46(2): 171-183. DOI: 10.1080/14703290902843828

Pew Research Center's Internet and American Life Project. 2012. Forty-six percent of American adults are smartphone owners. Washington, DC: Smith.

Rogers, E.M. 2003. Diffusion of innovations (5th ed.). New York, NY: Free Press.

Rogers, Y., K. Connelly, W. Hazlewood and L. Tedesco. 2010. Enhancing learning: A study of how mobile devices can facilitate sensemaking. Personal Ubiquitous Computing 14: 111-124. DOI: 10.1007/s00779-009-0250-7

Rhoades, E.B., T. Irani, R. Telg and B.E. Myers. 2008. Internet as an information source: Attitudes and usage of students enrolled in a college of agriculture course. Journal of Agricultural Education 49(2): 108-117. DOI:10.5032/jae.2008.02108

Schuck, S., P. Aubusson, M. Kearney and K. Burden. 2012. Mobilising teacher education: A study of a professional learning community. Teacher Development iFirst: 1-18. DOI: 10.1080/13664530.2012.752671

Shen, R., M. Wang, W. Gao, D. Novak and L. Tang. 2009. Mobile learning in a large blended computer science classroom: System function, pedagogies, and their impact on learning. IEEE Transactions on Education, 52(4), 538-546. DOI: 10.1109/TE.2008.930794

Shin, Shin, Choo and K. Beom. 2011. Smartphones as smart pedagogical tools: Implications for smartphones as u-learning devices. Computers in Human Behavior 27: 2207-2014. DOI:10.1016/j.chb.2011.06.017

Shippee, M. and J. Keengwe. 2012. Learning: Anytime, anywhere learning transcending them boundaries of the educational box. Education and Information Technologies 1-11. DOI: 10.1007/s10639-012-9211-2

Stockwell, G. 2008. Investigating learner preparedness for and usage patterns of mobile learning. ReCALL 20(3): 253-270. DOI:10.1017/S0958344008000232

Strong, R., T.L. Irby, T. Wynn and M.M. McClure. 2012. Investigating students' satisfaction with eLearning courses: The effect of learning environment and social presence. Journal of Agricultural Education 53(3), 98-110. DOI: 10.5032/jae.2012.03098

Teo, T., C.B. Lee, C.S. Chai and S.L. Wong. 2009. Assessing the intention to use technology among pre-service teachers in Singapore and Malaysia: A multigroup invariance analysis of the technology acceptance model (TAM). Computers and Education 53: 1000-1009. DOI: 10.1016/j.compedu.2009.05.017

Trebbi, T. 2011. The potential of ICT for a new educational paradigm: Toward generalizing access to knowledge. American Journal of Distance Education 25(3): 152-161. DOI: 10.1080/08923647.2011.589759

UNESCO. 2011. UNESCO mobile learning week report. Paris, France: UNESCO HQ

Uzunboylu, H. and S. Ozdamli. 2011. Teacher perception for m-learning: Scale development and teachers' perceptions. Journal of Computer Assisted Learning 27: 544-556. DOI: 10.1111/j.1365-2729.2011.00415.x

Varnali, K. and A. Toker. 2010. Mobile marketing: The-state-of-the-art. International Journal of Information Management 30: 144-151. DOI: 10.1016/j.ijinfomgt.2009.08.009

Venkatesh, V., M.G. Morris, G.B. Davis and F.D. Davis. 2003. User acceptance of information technology: Toward a unified view. MIS Quarterly 27(3): 425-478. DOI: 10.2307/30036540

Wang, M. and R. Shen. 2012. Message design for mobile learning: Learning theories, human, cognition and design principles. British Journal of Educational Technology 43(4): 561-575. DOI: 10.1111/j.1467-8535.2011.01214.x

Yadegaridehkordhi, E. and N.A. Iahad. 2012. Influences of demographic information as moderating factors in adoption of m-learning. International Journal of Technology Diffusion 3(1): 8-21. DOI: 10.4018/jtd.2012010102

Yaghoubi, J., B. Khosravipour and N. Foroosshani. 2010. Application of mobile learning in agricultural education: Case study of Khuzestan, Iran. 2010 Conference on International Research on Food Security, Natural Resource Management, and Rural Development, 1, Zurich: Switzerland.

Yang, K. 2010. The effects of technology self-efficacy and innovativeness on consumer mobile data service adoption between American and Korean consumers. Journal of International Consumer Marketing 22(2): 117-127. DOI: 10.1080/08961530903476147

Yang, S.H. 2012. Exploring college students' attitudes and self-efficacy of mobile learning. The Turkish Online Journal of Educational Technology 11(4): 148-154.

Yuen, A.H.K. and W.W.K. Ma. 2008. Exploring teacher acceptance of e-learning technology. Asia-Pacific Journal of Teacher Education 36(3): 229-243. DOI: 10.1080/13598660802232779

Zhou, T. 2011. Understanding mobile Internet continuance usage from the perspectives of UTAUT and flow. Information Development 27(3) 207-218. DOI: 10.1177/0266666911414596

Zhou, T. 2013. Understanding continuance usage of mobile services. International Journal of Mobile Communications 11(1): 56-70. DOI: 10.1504/IJMC.2013.050995