Conceptual Framework for the Adoption of Cloud-Based Mobile Learning in Higher Education

Yusufu Gambo[1] and Mshelia Peter Y[2]

Department of Computer Science Adamawa State University, Mubi-Nigeria
ICT Unit University of Maiduguri
Contact:*Yusufu.gambo@gmail.com*

ABSTRACT

Cloud based system in learning has become an important feature in educational system. More and more educational facilities are now employing electronic learning and mobile learning technologies to provide a better and more effective learning experience to learners. Despite a number of studies that explain the collaborative learning experiences' influence on technology, there is a lack of an integrative view that explains the influence of collaborative learning experience on the cloud-based mobile learning behavioural intention. This paper aims at filling this gap and research by developing an integrated conceptual framework for the adoption of cloud-based mobile learning system in higher education. The findings of this research will have important implications and great value to the research community, higher education and ICT providers, in terms of formulating better strategies for cloudbased mobile learning adoption and to support teaching and learning in Higher Education in the developing countries

KEYWORDS: Cloud, Mobile, Learning, UTAUT, Higher Education, adoption, Collaborative, Intention

Introduction

With the advancement in the field of information and communications technology (ICT) the traditional methods of learning are being complemented by the modern ones. One of such modern method of learning is the "Cloud education" (Wang & Ng, 2012). In most of the educational institutions, classrooms are now equipped with electronic learning (e-learning) and mobile learning (M-learning) leading to a better and more effective learning experience. In addition to classroom effectiveness, the mobile learning system allows the students to learn anywhere regardless of the location (Galih, 2003). While the mobile learning system has many advantages, it has some drawbacks also. A major drawback of mobile learning system is power and storage limitation. The limited storage available to students in mobile devices limits their access to educational material (Galih, 2013). This issue can be resolved by using cloud. In cloud system, the user data and/or applications can be stored on internet in a central location and can be easily accessed anytime using a browser (Blain, 2012). The use of cloud system to store data at a remote location not only helps in solving storage issue but also secures the data in case the mobile device containing the data is corrupted or lost

Cloud learning can be defined as "*a shared pool of learning courses, digital assets and resources, which instructors and learners can access via computers,*

laptops, IP-TVs, mobiles and other portable devices" (Wang & Ng, 2012; 149). With the cloud system, learners can connect to internet and use the resources online any time anywhere. Wang and Ng (2012) have defined the four characteristics of cloud learning; storage and sharing, universal accessibility, collaborative interactions, learner centered. Storage and sharing provides infinite storage capacity and the resources stored over internet can be shared by different users. Universal accessibility allows the users across different regions, different platforms to access the same data and resources. Collaborative interactions enable users to build common knowledge through these interactions. Learner centered characteristic mean that learners can choose the resources that are suitable for them and keep track of their learning progress.

The understanding of individual acceptance and use of information technology is one of the most matured areas in information systems research. Different theoretical models have been employed to explain technology acceptance. Among various adoption models, Unified theory of acceptance and use of technology (UTAUT) (Zhou et al. 2010, Cruz eta. 2014, Ramayasa & Bali, 2015) are widely adopted to explain factors for technology acceptance. UTAUT was originally developed to explain employee technology acceptance and use; it will be critical to examine how it can be extended to the context of learning in cloud based system.

While there have been studies to explain the collaborative learning experiences' influence on technology mediated learning environments (Brusilovsky & Vassileva, 2003; Chen *et al.*, 2005, Dahlstrom2012, Luna *et al*. 2015), there is a lack of an integrative view that explains the influence of collaborative learning experience on the cloud-based mobile learning adoptionas moderating factors.

Therefore, the objective of this paper is to develop a research framework for the adoption of cloud-based mobile learning system in higher education in terms of the effects of collaborative learning have on learners in acceptance stage. The question raised in this paper is "How collaborative learning experiences moderate acceptance of cloud based mobile learning in higher education? Bringing an answer to this question would allow academics to introduce mobile devices, explore and asses learning opportunities. The aim of this study is to shed light on this research question, and to formulate a starting point of cloud based mobile learning acceptance in higher education.

The remainder of the paper is organized as follows. In section 2, introduce the relationship between cloud based mobile learning & collaborative experiences. Section 3 discussed the relevant theoretical framework. In section 4 described the research model. Section 5 discussed the proposed research hypotheses. Finally, conclusion and further work in section 6.

Research Background

Since last few years, cloud based mobile learning has been implemented and since then it has been studied and researched by many scholars. Rao *et al.* (2010) have analyzed the impact of cloud computing through mobile learning, Zhao (2010) contributed by coming up with a cloud computing technology using a smartphone software. Lim *et al*. (2015) employed quantitative approach in an

exploratory study to find the benefit and challenges of using cloud computing in Swedish schools. The findings indicated that the main benefits of cloud computing are the ability to allow learners to access data and software anywhere as long as there is Internet access and the ability to facilitate sharing of learning materials and data. However, not every learner has access to the same facilities and resources. Some learners have better infrastructure and instructional materials available while others have difficulty in acquiring the basic learning materials (Kay *et al*., 2013).

Benson & Morgan, (2013) investigates wireless and cloud applications on students' experience and ubiquitous learning at Kingston University, UK. They have successful migrated to mobile virtual environment and effective use of cloud computing. Despite the challenges of security concerns, the studies show successfully migration and increase access to learning among users. However, the study couldn't account how cloud-based mobile learning should be used to support teaching and learning and what influence students to use the new technology. Further, Butoi *et al.,* (2013) implemented a prototype of cloud-based mobile learning system application in a Romanian University. Despite some challenges such as links failure and limited bandwidth, the study shows students increase in learning, but could not account for what influenced the students

In a similar study, Cao *et al.* (2013), investigated quantitatively the adoption of cloud storage by students in China. The findings showed that perceived risks, perceived cost, personal innovativeness, performance expectancy, effort expectancy, social influence, and facilitating conditions affect the students' adoption of cloud storage. Further, Hashim & Hassan (2015) uses UTAUT to investigate factors influencing individual users in universities in Iraq to adopt cloud based system. The survey revealed that performance expectancy, effort expectancy, social influence and facilitating condition are top on factors influence users to use the technology. In addition, Chang *et al.,* (2016) examined how cloud-based mobile learning (m-learning) affects students' perceptions of innovative environments, and their creative performance. A total of 123 university students served as research participants, and underwent either an experimental or control learning session. The results of the study indicated cloud-based m-learning has significant effects on overall perceptions of innovative environments that include features such as motivation from organizations, motivation from supervisors, team support, sufficient resources, and challenging work.

It appears from the literature that research on the adoption of cloud based mobile learning by higher education at the individual perspectives is scarce and limited in scope. From the existing studies, no mentioned of how collaborative learning experiences as a moderators of user experiences to determine whether it is a salient effect (Bhattacherjee, 2001 & Chen *et al.,* 2011). Hence, this conceptual paper to proposedcollaborative experiences in the user adoption model to understand its effects.

Collaborative Learning

In the current era, where the world has become a global place, it has become easier to interact with people more frequently than before. This has led to increased diversity in work place and therefore educational institutes now also focus

on preparing their students for the diverse environment in the professional world by making them work together in teams and peers. Collaboration becomes an essential competency in the current knowledge society. Collaborative learning is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product.

According to Luna *et al*. (2015), the collaborative work by the students using cloud tools achieved 90% of the process in the specified time while the traditional method achieved only 44% in the same time. This indicates that collaborative experiences can enhance learners' style and behavioral intention to accept and continue the use of applications.

Technology Adoption Theory

The review of previously published literature showed that various fields have opted for technology adoption including IT professionals (Phaphoom *et al.*, 2015), organizations (Gupta *et al*., 2013; Güner & Sneiders, 2014), education (Van Der Schyff & Krauss, 2014; Lim *et al*., 2015). Different models have been presented by scholars to facilitate the understanding of the factors that affect the move to the cloud based system and explain the variation in the adoption. However, from the user perspectives the most commonly used theoretical are TAM (Technology Acceptance Model), TRA (Theory of Reasoned Action), TPB (Theory of Planned Behaviour), UTAUT (Unified Theory of Acceptance and Use of Technology Models (Cruz *et al.* 2014, Hashim & Hassan (2015, Ramayasa & Bali, 2015). This conceptual paper aimed at extending UTAUT in order to understand user acceptance technology.

Technology Acceptance

The Theory of Reasoned Action (Fishbein and Ajzen 1975) and the Theory of Planned Behavior (Ajzen 1991) have been used successfully to assess technology adoption. TRA states that there are four constructs that a user has in actual behavior since the behavioral intention is positively influenced by beliefs, attitude, normative beliefs and subjective norm. TPB states that the attitude toward the behavior, subjective norm, and perceived behavioral control determine behavior intention and in consequence behavior. Technology Acceptance Model (TAM) is an adaptation of TRA and proposes that the acceptance of a technology in the workplace is influenced by the perceived usefulness and ease of use for the technology use (Davis 1989). Researchers have also confirmed that these models are useful explaining technology adoption by teachers and students in educational contexts (Lai et al. 2012; Sun et al. 2008). Further, some researchers have considered that technology acceptance should be studied considering more variables, for this reasons two more models emerged: Technology Readiness and Acceptance Model (TRAM) and Unified Theory of Acceptance and Use of Technology (UTAUT). TRAM includes individual beliefs to understand how people embrace and use new technologies for home and work measured by optimism, innovativeness, discomfort and insecurity (Parasuraman 2000). UTAUT provides a model to assess the

likelihood of adoption for a new technology; it emerged from eight different technology acceptance models (Venkatesh et al. 2003). It was formulated with four core determinants of intention and usage (performance expectancy, effort expectancy, social influence and facilitating conditions) and four moderators of key relationships (age, gender, experience and voluntariness of use). This model explains better the cloud based mobile learning acceptance compared with TAM since it considers individual variables that influence adoption. UTAUT has been used to investigate different mobile adoptions such as tablet PC (Anderson et al. 2006; El-Gayar and Moran 2006), ML (Jairak et al. 2009), smartphones (Pitchayadejanant 2011; Shin et al. 2011), mobile services, (Carlsson et al. 2006; Cruz, etal. 2014), cloud based mobile learning (Hashim & Hashim, 2015).

The diversity of models for individual technology acceptance suggests the maturity of this topic on IS research. Acceptance models have been used in work context where the use of technology is mandatory. Among the technology adoption models, UTAUT was used to test acceptance in different time periods considering work and non-work contexts (Venkatesh, Thong, Chan, et al., 2011). To understand the consumer, use on technology an extension of the original version generated the UTAUT2 model (Venkatesh and Thong 2012). While UTAUT implicitly deals with the intention including experience as a moderator (Shin et al., 2011), it is imperative to considerextending the model to build this research.

Research Conceptual Framework

A number of learning systems have been presented by researchers; however, none has been implemented on a large scale. These intelligent learning systems can help in sharing resources among different platforms as well as enhance the collaborative learning services to meet the different needs of learners. The objective of an intelligent and effective learning system is to facilitate the learners with a collaborative learning environment based on the cognitive abilities, knowledge level, and learning objectives of the learner. An intelligent learning system should ideally be comprised of dynamic learning content, learning diagnosis, and automatic selection of learning strategies (Wang & Ng, 2012). However, we see a lack of these components in the learning systems that are in place today (Wei & Zhang, 2009).

Venkatesh *et al.,* (2003) found that a UTAUT model having constructs, expected performance, effort expectancy, social influence, and facilitating conditions performs better than other models. This model was later extended by Venkatesh *et al.,* (2012) to include other constructs like price value, hedonic motion and habit. We use this model as the basis and extend it to incorporate collaborative experiences in thisphase of the intelligent learning experience.
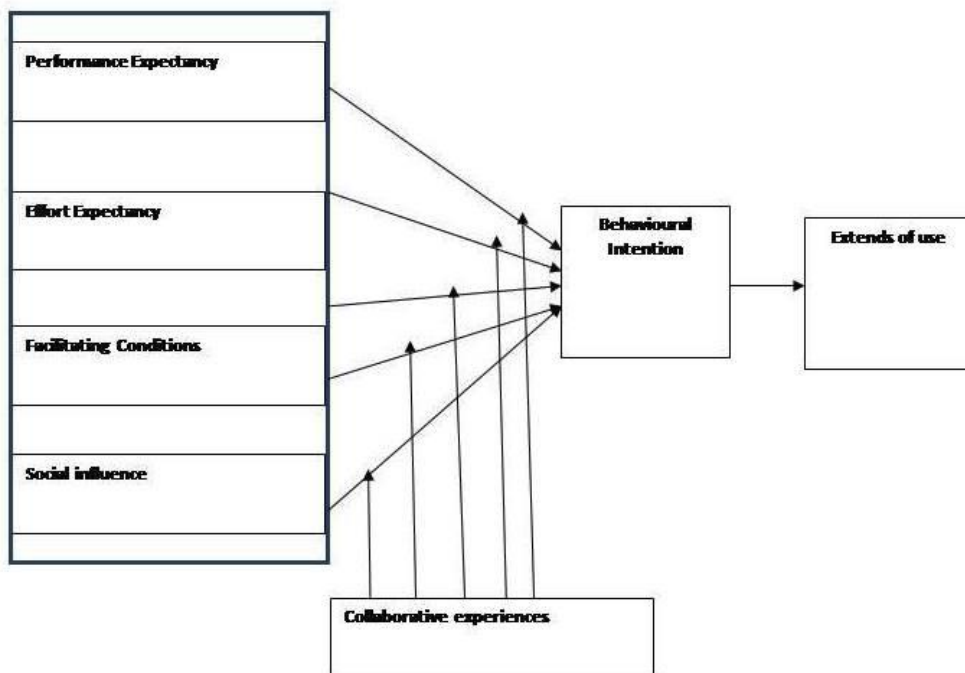
Figure 1: Conceptual Research Model

The integrated conceptual framework presents in Figure 1 focuses on four determinants that influence the use behavior in the acceptance stage. These four determinants are performance expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). The collaborative learning experiences will regulate the learning efficiency achieved due to the influence of these four determinants on use behavior and shape the behavioral intention of the learner. According to the framework, after the influence of the four determinants in the presence of collaborative learning experiences, it will lead user to use the technology.

Proposed Research Hypotheses
Based on the framework presented in figure 1, the study aims toanalyze the extent of influence that these determinants have on the use behavior as well extend of use. The importance of g collaborative learning experience has already been established by scholars. This study intends to understand the role of this learning experience in motivating the user to reach the adoption. The study sets to test the following hypothesis:

Acceptance factors
Performance Expectancy
Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in job performance (Venkatesh et al. 2003)
H1: Performance expectancy has a positive effect on behavioral intention.

Effort Expectancy
Effort expectancy is defined as the degree of ease associated with the use of the system (Venkatesh et al. 2003).
H2: Effort expectancy has a positive effect on behavioral intention.

Social Influence
Social influence is defined as the degree to which an Individual perceives that important others believe he or she should use the new system. In mandatory settings, social influence appears to be important only in the early stages of individual experience with the technology, with its role eroding over time and eventually becoming non-significant (Venkatesh et al. 2003).
H3: Social influence has a positive effect on behavioral intention.

Facilitating Conditions
Facilitating conditions are the resources, facilities and infrastructure available to support users in usingsystem (Venkatesh et al. 2003). In this research, availability of internet access will influence user adoption of cloud based mobile learning. Thus
H4: Facilitating condition has positive influence on user intention to adopt cloud based mobile learning.
H5: Facilitating condition has positive influence on the extend of use of cloud based mobile learning

Behavioral Factors
Behavioural Intention
According to Theory of Planned Behavior, an individual's behavior can be explained by his or her behavioral intention that refers to the individual's decision to perform a specific behavior in the future (Chatzoglou et al., 2009). In this model and consistent with the adoption theory, we expect that behavior intention and use would have a significant influence on cloud based mobile learning usage.
H6: Behavioural Intentionhave direct influence on extend of use

Moderators Factor
Collaborative Experiences
Collaboration becomes an essential competency in the current knowledge society. Collaborative enable users to build common knowledge through these interactions. It provides learner centered characteristic, that is; the learners can choose the resources that are suitable for them and keep track of their learning progress (Wang and Ng. 2012. This indicates that collaborative experiences can enhance learners' style and intention to use cloud based mobile learning. Thus:

H7: The influence of performance expectancy on behavioral intention will be moderated by personalized experience on cloud based mobile learning

H8: The influence of effort expectancy on behavioral intention will be moderated by collaborative experience on cloud based mobile learning

H9: The influence of social influence on behavioral intention will be moderated by collaborative experience on cloud based mobile learning

H10: The influence of facilitating condition on behavioral intention will be moderated by collaborative experience on cloud based mobile learning

Conclusion and Further Research

This paper provides insight on how toincorporate cloud computing based mobile learning in to learning. This research focused on the influence of collaborative learning experiences on behavioral intentions during the acceptance stage. Although a handful of studies have examined issues related to cloud based system adoption among user, many of them have been limited in scope. The role of collaborative experiences which is inherited in cloud based system is rarely studied in user acceptance factors. The framework will provide basis for the researcher to validate and test the hypothesis by collecting primary data from higher education system in Nigeria.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211

Anderson, J.E., Schwager, P.H. and Kerns, R.L. (2006). The Drivers for Acceptance of Tablet PCs by Faculty in a College of Business. Journal of Information Systems Education, 17(4), 429–440

Basha, D., Umar, M., and Abbas M. (2014). Mobile Applications as Cloud Computing: Implementation and Challenges. International Journal of Information and Electrical Engineering, 4(1)

Benson, V. and Morgan S. (2013). Students Experiences and Ubiquitous learning in higher education: Impact of Wireless and cloud applications. Creative Education, 4(8A).

Blain, J. (2012). Learning and Development in The Cloud-Opportunities and Watch Outs, www.cegos.com,

Chen, S; Min L; Huanming Z. 2011. Research of mobile learning system based on cloud computing, "eEducation, Entertainment and e-Management (ICEEE), International Conference on IEEE

Cao, Y., X. Bi, L. Wang, 2013. A Study on User Adoption of Cloud Storage Service in China: A Revised Unified theory of Acceptance and Use of Technology Model. In Information Science and Cloud Computing Companion (ISCC-C)

Carlsson, S.A. 2008. *An Attention-based view on DSS*, In F. Adam and P. Humphreys (eds.): Encyclopedia of Decision Making and Decision Support Technologies, Hershey, PA: Idea Publishing Group

Chen, C.-M., Lee, H.-M., & Chen, Y.-H. (2005). Personalized e-learning system using item response theory. *Computers and Education*, 44(3), 237–255

Chen, S; Min L; Huanming Z. 2011. *Research of mobile learning system based on cloud computing*, "eEducation, Entertainment and e-Management (ICEEE), International Conference on IEEE, vol., no., pp.121-123, 27-29

Cruz, Y., Boughzala, I. and Assar, S. (2012). *Opportunities and obstacles for mobile learning in a Business School*. In International Conference on Communications and Information Technology (ICCIT), June 2012, 58–61. http://dx.doi.org/10.1109/ICCITechnol.2012.6285824

Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-339

El-Gayar, O.F. and Moran, M. (2006). College students' acceptance of tablet PCs: an application of the UTAUT model. Dakota State University, 820.

Galih, S. 2003. *Mobile Cloud based learning material repository using Android and Google drive application*. The second international conference on Digital Enterprise and Information Systems – Malaysia.

Güner, E., & Sneiders, E. (2014). *Cloud Computing Adoption Factors in Turkish Large Scale Enterprises. In Pacific Asia Conference on Information Systems.* AIS Electronic Library (AISeL).

Gupta N and Thakur S. (2014). The Factors Affecting Adoption of Cloud Computing Technology in Education Institutions, *International Journal of Advanced Research in Computer and Communication Engineering,* 3(6)

Horton, W. (2000). *Designing web-based training: How to teach anyone anything anywhere anytime?* John Wiley & Sons, Inc.

Hashim, S. and Othman, M. (2014). Cloud Computing Adoption by Universities: Concepts and Review. International Journal of Science and Research

Jain, P. Rane D. and Patidar, S. 2011. *A survey and analysis of cloud model-based security for computing secure cloud bursting and aggregation in renal environment*. Information and Communication Technologies (WICT), 2011 World Congress on, Mumbai, 2011, pp. 456-461

Kay, J. Reimann, P. Diebold, E. and Kummerfeld, B. 2013. MOOCs: So Many Learners, So Much Potential ...," *Intelligent Systems, IEEE*, Vol. 28, No.3, pp.70-77, May-June 2013.

Lim, N., Grönlund, Å.& Andersson, A. (2015). Cloud computing: The beliefs and perceptions of Swedish school principals. *Computers & Education*, 84, 90-100.

Lai, C., Wang, Q. and Lei, J. (2012). What factors predict undergraduate students' use of technology for learning? A case from Hong Kong. Computers & Education, 59(2), 569–579.

Limayem, M., Hirt, S. G., Cheung, C. M. K. (2007). How habit limits the predictive power of intention: the case of information systems continuance. *MIS Quarterly*, 31 (4), 705–737.

Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction decisions. *Journal of Marketing Research*, 17 (4), 460–469

Papanikolaou, K. A., & Grigoriadou, M. (2002). Towards new forms of knowledge communication: The adaptive dimension of a web-based learning environment. *Computers and Education*, 39, 333–360.

Phaphoom, N., Wang, X., Samuel, S., Helmer, S., & Abrahamsson, P. (2015). A survey study on major technical barriers affecting the decision to adopt cloud services. *Journal of Systems and Software*, 103, 167-181.

Picoto, W. Crespo. N. Kahn. F. 2013. *Cloud Computing Usage and Organizational Mobility - An Empirical Assessment*.

Rao, N.M., Sasidhar, C., Kumar, V.S. 2010. Cloud Computing Through Mobile Learning, *International Journal of Advanced Computer Science and Applications*, Vol.1, No. 6, Pp. 42-46, December 2010

Sarrab, M., Elbasir, M., Alnaeli, S. 2016. Towards a quality model of technical aspects for mobile learning services: An empirical investigation. *Computers in Human Behavior*, 55.A. 100-112

Shin, D. (2015). Beyond user experience of cloud service: Implication for value sensitive approach. *Telematics and Informatics*, 32(1), 33-44

Van der Schyff, K., & Krauss, K. E. (2014). Higher education cloud computing in South Africa: towards understanding trust and adoption issues. *South African Computer Journal*, 55, 40-55.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478.

Venkatesh, V., Thong, J.Y.L. and Xu, X. (2012). Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. *MIS Quarterly*, 36 (1), 157-178

Wang M, and Ng. J. W. P. 2012. *Intelligent Mobile Cloud Education: Smart Anytime-Anywhere Learning for the Next Generation Campus Environment*. Intelligent Environments (IE), 2012 8th International Conference on, Guanajuato, 2012, pp. 149-156.

Zhao, W. 2010. *Improving Computer Basic Teaching through Mobile Communication and Cloud Computing Technology*, International Conference on Advanced Computer Theory and Engineering (ICACTE), 2010