Mobile Applications to Enhance Versatility of Mobile Learning in Higher Education

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Abstract

In recent times, despite the fact that Mobile learning or m-learning is a relatively new concept, it has become a buzz word in academic, researchers and companies developing learning systems and instructional materials. Unfortunately, standards and platforms like those that exist in e-learning are still evolving. One thorny issue is that of m-examinations. Although in e-learning setup supervised examination rooms/center, have worked well the ability to authenticate the candidate doing an examination in unsupervised environment on remote place is limited. Moreover, the requirement of Internet access throughout the examination session and particularly for the student to be able to submit his answers is also a major limitation. This study was not only an effort to remove the two limitations, but also to do so on the mobile learning environment. The study investigated the concept of sending by email a locked examination as an android mobile application. The student would then download and install the App in their smart devices a few minutes, days or even weeks but will not be able to run the App until the instructor sends a key to the registered student's mobile phone number in the device to unlock the examination App installed in their phones two or three minutes before the examination start time.

The approach used in this study was mixed methods. The first method was experimental where a mobile examination application was developed in Android. Then the mobile examination application was send by email to the 60 students who participated so that they could download it in their smart devices. The second method was a questionnaire survey to capture the student's perception. The findings of the study show that the effect of Organizational Support (OS), Availability of ICTs (ICT) and Effort Expectancy (EE) on Behavioral intention to use M-learning and particularly m-examination was significant. The findings of this research will not only help m-learning practitioners develop m-learning examinations and promote this new IT to potential users, but also provide insights into research on m-examination acceptance.

Key Words: M-Learning, e-Learning, m-Examination, Mobile, Mobile Application.

1. Introduction

The mobile revolution has swept across the landscape of spheres of human life and more so in the education sector. During the last decade, due to enormous changes in the mobile industry, mobile usage has become a necessity for the common man. Endowed with several advanced features and convergence of all forms of media like internet, radio, television etc. it has increased the potential of mobile devices that can perform a variety of functions in every sphere of life.

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Mobile learning is not just a fad, but is instead a transformative breakthrough both for learning, and the learning organization and has many opportunities (Haag & Alexandria, 2011). Mobile learning means both augmenting formal learning, and moving to performance support, informal, and social learning as well. The actual implementation of m-Learning is growing faster in some capabilities than others. One of the capability that has not grown as fast is the pedagogy in m-Learning and particularly m-examination. Indeed, it is a fact that in today's world, the more and more rapid development of ICT contributes to the increasing abilities of the mobile devices (cell phones, smart phones, PDAs, laptops) and wireless communications. In turn these are the main parts of the mobile learning. Consequently, the implementation of mobile learning is necessary to use a corresponding system for the management of such type of education (Georgieva, 2006).

The value of mobile technologies has made a real time contribution to not only human life but also in the teaching and learning experience and making it both self-evident and unavoidable. Mobile learning methods offer valuable possibilities for learners in remote and distant parts of the world (Georgieva, 2006). There are several definitions of mobile learning. According to Attewell, Savill-Smith and Doucha (2009) a broad definition of m-Learning is the "exploitation of ubiquitous handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning. Learners involved may or may not be mobile. Learning can take place in any location, and at any time, including traditional learning environments, such as classrooms, as well as other locations including the workplace, at home, community locations and in transit".

2. Problem Statement

Whether we like it or not, whether we are ready for it or not, mobile learning represents the next step in a long tradition of technology mediated teaching (Wagner, 2005). Moreover several researchers have stated that the usage of mobile learning tools is an interesting area of research that is worth to be investigated (Sarrab, Al-Shihi, & Rehman, 2013). One of the thorny issues in research is that of authentication and authorization in m-learning as well as in e-learning particularly for distance education (Kambourakis, Security and Privacy in m-Learning and Beyond: Challenges and State-of-the-art, 2013). A recent attempt to address this issue is the recent research works examining the potential use of public key cryptography in e-learning (Kambourakis, Kontoni, Rouskas, & Gritzalis, 2007). While Public key infrastructure (PKI) and attribute certificates (ACs) can provide the appropriate framework to effectively support authentication and authorization services, offering mutual *trust* to both learners and service providers, they have two shortcomings. First they have to operate on an efficient network and internet connectivity which is not always the case for most rural areas of developing countries. Second, their administrative overhead for diverse number of courses, learners and instructors could pose a challenge. Keys can be given to non-key holders particularly for examination. The current paper proposes the use of mobile application for examination and utilizes the power and potential and flexibly of mobile application running on smart mobile devices, where the exam application will only run after the devices receives the secret key send via SMS by the instructor to the registered device mobile numbers for a course. The study design differs from that of a recent study by Shanmugapriya and Tamilarasi, (2012) in that it does not need the m-

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examination to be runing on a server , or have internet connection throught the examination.

3. Literature Review

Despite the fact that many studies have been done which focus on this important field or briefly discussing the topic, these studies essentially all stress quantitative research methods, and either focus on technology acceptance model (TAM) (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh & Bala, 2008). Other studies have focused their attention on devices and instructional design (Attewell, Savill-Smith, & Douch, 2009). This study deviates from these by focusing on eprement of Mobile examinations or mobile tests and the challenges of security and athenticity. We have used a simple key that does not require too much effort to enforce, since its is send directrly to the Examination application in the mobile device of the registered student. This approach means that only registered devices and the respective GSM numbers in those devices will be able to run the examination appliation and hence allow the device owner to take the sheduled mobile examination.

Mobile learning might sound complex, but in principle it is simple: mobile learning lets students benefit from interacting with their course content, tests and examination on the devices that they use to connect with every other aspect of their lives, nearly 24/7. Offering your course material in such an easily accessible mode can improve your students' engagement and participation, and eventually make a positive influence on learning outcomes and retention. Mobile Learning can take place in two ways: (a) Outside the classroom—students learn in their own time. This can support the 'flipped classroom' model, and (b) Inside the classroom and during class time -This often works best when there is a 1-to-1 initiative, where students have a device each (such as a tablet or an iPad). Mobile technology is not meant to address every single piece of your e-learning course. It should be used smartly to handle key features – in other words, those which translate best to a mobile device. This study used the second approach above to implement m-Examination and collected student perceptions.

3.1 Proposed model for m-Examination

The model proposes a "Trigger and time based exam applications" to enforce authenticity and identification of distance and mobile examination on mobile devices. First, the registered students were put in a web database containing the student ID, Student Name, course code and name, and lecturer identification code.

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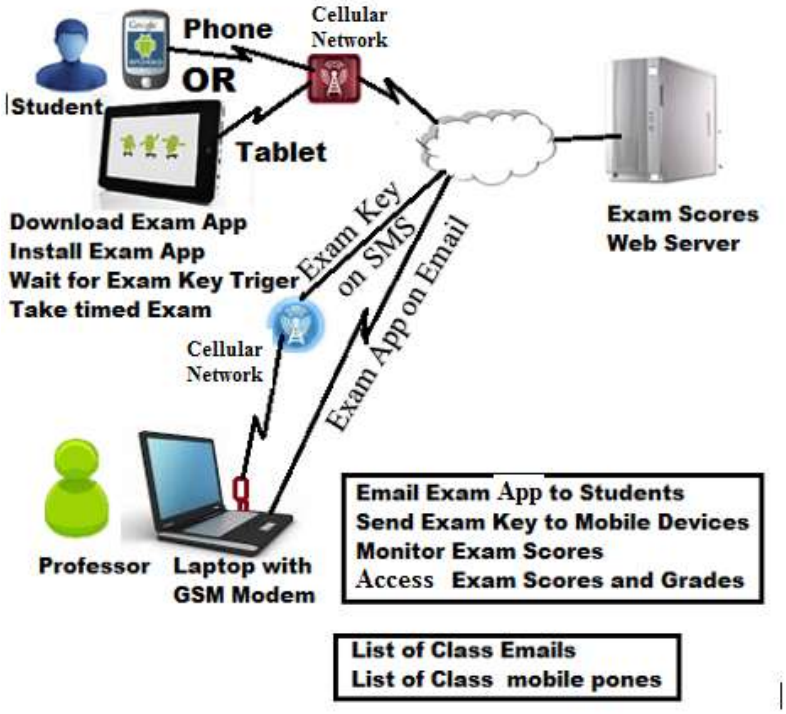

Figure 1. Mobile Examination Environment Scenario

The professors set the examination, the school examination center will put it in a mobile app using agreed templates. In the design, the examination application will need to be triggered by an SMS sent by the professor or exam center sent to the phone numbers of students register in that course a few minutes before the exam. This requires an Efficient SMS service system for bulk SMS sending. The experiment demonstrated the opportunities for innovation in the areas of remote exams environments. Indeed the flexibility that comes with mobile applications may include triggering the camera to take a snap shot photo randomly during a remote examination and sending that photo to an examination center for authentication. Additionally an application can be loaded to the devices to authenticate the candidate identity.

The examination was divided into three parts, each part consisted of 25 multiple choice questions and timed on 30 minutes exam time. Part one and two were used as control sets in this study. All students did the examination in a cohort manner, i.e. all starting with Part one of the examination on Blackboard, then Part two on paper and shading answers on scantron paper, and finally Part three examination was designed as a mobile Examination Application based on Android platform that could run on the majority of their mobile smart devices. After the examination, they all filled the perception survey questionnaire. Data was collected using ‘‘mobile learning systems” questionnaire from a sample consisting of 60 undergraduates students enrolled in Introduction to Information Systems classes at the United States International University in Nairobi, Kenya. Students were required to participate as part of their continuous assessment quizzes. This paper however focuses on part three of the examination and the data obtained from the survey questionnaire.

After the instructor send the key to the mobile examination application to mobile phone numbers of registered students, the students were able to run it and all they needed to do is to key in their

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student ID and instructor identification number say 1, 2, etc. to be able to post the grades to the correct instructor exam Porto. On completion the students pressed the submit button, or at the end of 30 minutes the application automatically submitted the result for them to a web database. The application gave immediate feedback to the student on their score say "your score is 20/25". If there was no immediate internet connection on the phone, the results were automatically submitted by the App at the earliest such connection was available. The instructor was able to view from the web server details and results of students that had submitted their examination. The data from the results of the examination, and that of the perception questionnaire were analyzed using the statistical package SPSS 20. Results differed significantly based upon the examination platform.

4. Method and Materials

4.1 Participants

The volunteer sample in this study (N = 60) consisted of 29 male and 31 female undergraduates enrolled in introduction information systems and applications classes at the united States International University in Kenya. Thirty-four students were first-year students, sixteen were second year, ten were third-year students.

4.2 4.2. Survey Instrument

A survey questionnaire instrument was used to collect data after the examination (see Appendix 1) to measure students' perceptions about mobile learning systems. This 31-item questionnaire focused on the usefulness of mobile learning for student studies. Each participant completed the survey after taking the mobile examination. The questionnaire addressed several dimensions including: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Perceived Playfulness (PU), Self-Management of Learning (SML), and Behavioral Intention to Use (BIU). Respondents rated each item on a 1–7 Likert scale from ''Very strongly disagree" (1) to ''very strongly disagree" (7). The validity of the measuring items was established by a review of literature in m-Learning. Selected items were adapted based upon their appropriateness for the study.

4.3 4.3. Procedure

The research used experimental design where the students that were registered in the course IST 1010 Introduction to information systems were asked to give their email address, phone number or the SIM card number of a devise that will run the mobile exam application. The mobile exam app was emailed to the students email so that they could download it in their mobile devices. They downloaded the app in their phones. The app was created such that it could not run without the phone receiving exam key that was used to as a trigger. The key was sent using an SMS containing only the exam key in the message content, and all the course student phone numbers in the recipient part. This was send about three or so minutes to the start of the exam. After receiving the exam key, the students they run the exam app.

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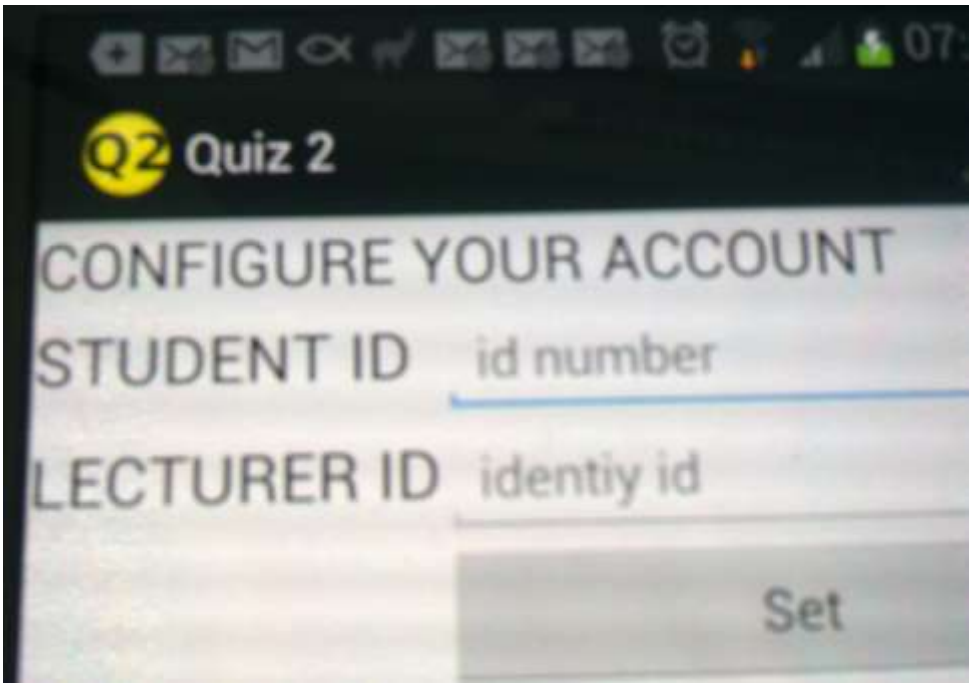

Figure 2: Mobile Phone interface of a running Mobile Exam App

When the app ran, the first thing the student will see is Figure 2 that will be used to set their ID number and key in the lecturer ID. These will help to sort the students' scores per class in the receiving webserver. It will also enable the lecturers to be able to view the scores only for their class. The collected data was analyses using the Statistical Package for Social Science (SPSS) Version 21. Factor analysis was conducted and thereafter regression analysis was conducted on the variables.

5. Results and Findings

Component factor analysis using varimax rotation was conducted on the multi-item constructs on a seven Likert Scale. The items that did not load on their constructs were dropped from further analysis. The results of regressing the other variable on Behavioral Intension to use (BIU) m-Learning produced the model summary shown in Table 1. The R-square value of 0.871 shows the "goodness of fit" of the model. It can be thought as a percentage. Thus R-square for this model is 0.871, which means that the predictor variables can explain 87.1% of the change/variations in Behavioral Intension to use m-Learning.

Table 1: Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.933[a]	.871	.867	4.66475	.871	232.085	7	241	.000	2.057

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a. Predictors: (Constant), SL, OS, PP, EE, PE, ICT, S

b. Dependent Variable: BIU

Further, Table 2, ANOVA, shows that the model can predict Behavioral Intension to use m-Learning of the students using predictor variables. The significance is .000, so we can reject the null hypothesis that "The model has no predictive value."

Table 2: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	35350.982	7	5050.140	232.085	.000[b]
	Residual	5244.140	241	21.760		
	Total	40595.122	248			

a. Dependent Variable: BIU

b. Predictors: (Constant), SL, OS, PP, EE, PE, ICT, S

Finally, the most important table is the coefficients shown in Table 3. The significance levels of Organizational Support (OS), Availability of ICTs (ICT) and Effort Expectancy (EE), are 0.033, 0.000, and 0.041 respectively, and are all <0.05 which indicates that we can reject the null hypotheses that OS, ICT, EE do not predict BIU. The model is given by Behavioral Intention to use (BIU) = -5.274 + 0.014*PP - 0.283*SI+ 0.021*PE -0.054*OS + 1.084*ICT + 0.044*EE + 0.280*SL+ error. Where PP represents Perceived Playfulness and SI is the Social Influence, while SL is Self-Management of Learning.

Table 3: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	-5.274	3.745		-1.408	.160	-12.651	2.103		
	PP	.014	.027	.012	.517	.606	-.039	.066	.987	1.013
	SI	-.283	.286	-.215	-.989	.324	-.846	.281	.011	87.909
	PE	.021	.016	.030	1.274	.204	-.011	.053	.984	1.016
	OS	-.054	.025	-.050	-2.141	.033	-.103	-.004	.972	1.029
	ICT	1.084	.027	.932	39.939	.000	1.031	1.138	.985	1.015
	EE	.044	.021	.048	2.053	.041	.002	.086	.995	1.005
	SL	.280	.263	.231	1.064	.289	-.238	.798	.011	87.865

a. Dependent Variable: BIU

6. Discussions

Having discussed the findings of the study, it is evident that the university students who participated in this research behavior in using mobile examinations are influenced by Organizational Support (OS), Availability of ICTs (ICT) and Effort Expectancy

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(EE). However, a third of the sample population did not have devices that were ready to run mobile applications at the time when this small scale study was conducted but were interested to be involved in. Essentially, all the respondents welcomed the integration of mobile examination in their degree course. As m-learning is still at the early stage in Kenya and more so in university education, participants are not sure as to how best to benefit from it. However they perceived the essence of having class notes in their mobile devices as very helpful. The respondents perceived that blended learning which involves face-to-face, web-learning and m-learning should be sustained as the mode of courses instruction delivery.

The findings of this study do not represent a whole picture of m-learning nor m-examination adoption among Kenyan university students nor community. Consequently there is need also to find the perception of the other two important groups namely., administrators and instructors or professors, whose responses need to be studied too. Each group is interdependent of one another. Administrators have a major role to play, apart from the needed buy-in, they should be ready to provide a strong support system in the campus which includes infrastructure such as free Wi-Fi and mobile phone gadgets for examination, human resource training for instructors or professors, adequate annual budget for m-learning and m-examinations, and inducements to encourage a greater achievement in the application of m-learning and m-examination at their universities. Professors too should be prepared in terms of instructional techniques which provide state-of-the-art but suitable way of using the mobile devices in their course instruction delivery model and also new sets of work principles or work ethics that may characterize the way they manage time effectively and communicate in m-learning settings (Hussin, Manap, Amir, & Krish, 2012). In summary, students might basically be ready for m-learning in this investigation but the administrators and professors might not; therefore it is proper to make a blanket claim that Kenyan Institutions of Higher Learning are ready for m-learning and m-examinations, until proven otherwise by further research (Corbeil & Valdes-Corbeil, 2007).

7. Conclusions and future challenges

This paper has presented a reflective overview of developments in mobile Examination using mobile applications and triggers. Native Mobile applications have been identified as a central construct in mobile examination developments, guiding projects to use mobile technologies to help provide remote examinations in secure context. Learners' personal contexts and convenient as well as interests in mode of taking examination almost anywhere is supported through mobile applications. Although the paper has only used trigger keys to allow legal students to do the examination, there is much ground to be covered to eliminate impersonation and other challenges of distance learning. One of this ground that will be tested in the next phase is the use of random camera picture of the candidate doing the examination.

The effect of Organizational Support (OS), Availability of ICTs (ICT) and Effort Expectancy (EE) on usage intention was significant across, it might be interesting to investigate whether this influence was moderated by other factors such gender. Availability of ICTs was more significant than Organizational Support (OS), The findings of this research will not only help practitioners develop better user-accepted examinations and promote this new IT to potential users, but also provide insights into research on m-examination acceptance.

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Biography

Jimmy is an Associate Professor of Information Systems, and the Current Dean, School of Science and Technology, USIU. He is the current Chairperson of Kenya Information Network Centre (KeNIC). He has over 20 years of university teaching, consultancy, and private practice. Jimmy's publication portfolio include nine published journal articles, ten papers presented and published in international conferences proceedings, Eight published teaching case studies, four computer text books for high school, five university courses laboratory manuals, and masters projects supervision. Due to his expertise in the area of business case writing, Jimmy was awarded the second position case writing competition winner in the Association of African Business Schools (AABS) Case writing competition in 2007. He is a fellow of the Higher Education Academy (UK) and a member of Association of Computing Machinery (ACM). His current research areas include: m-Learning, m-Health, Information security, Cloud Computing, Mobile Applications, and ICTs for development