Study Mode Does Not Matter: MLearning Can Support Internal and Distance Learners

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Additional information is available at the end of the chapter

1. Introduction

It is no longer news that the permeation statistics for mobile phones in developing countries of Africa has surpassed industry analysts' predictions. Also research is increasingly showing that mobile devices can be used to provide learning support services. The use of mobile devices for accomplishing learning activities has been termed mobile learning (mLearning). Since owners of mobile devices move with them wherever they go, mLearning offers anytime anywhere learning. Mobile devices, among others may include: mobile phones, smart phones, PDAs (personal digital assistants), BlackBerries, GPS (global positioning system) receivers, clickers, tablet PCs, as well as iPods and MP3 players (Kukulska-Hulme & Traxler, 2005).

Anytime anywhere learning has been associated with a study mode referred to as distance learning (Commonwealth of Learning, 2004). The phrase 'study mode' conjures several meanings. In this paper, the phrase is used to connote two different ways of delivering tuition to learners, namely: campus-based and distance-based study modes.

In the campus-based study mode, also known as the conventional study mode, learners are required to attend a fulltime education at their main campuses. Campus-based learners here in this paper referred to as 'internal' learners, are obliged to adhere to an orchestrated timetable of study in the classrooms and partake of the same learning activities at the same time. In majority of instances, internal learners are faced with similar learning conditions, can meet and interact with their lecturers and fellow learners in a face to face fashion and have limited roles and responsibilities outside schooling.

On the other hand, in the distance-based study mode, learners are separated by time and space from their lecturers and campuses (Aguti, 2009, Commonwealth of Learning, 2004). The communication and interaction between the learners themselves and the learners and their lecturers is bridged using print or electronic media (Commonwealth of Learning, 2004). Mobile devices can form part of the electronic media to be used in bridging the gap

(Traxler, 2007). People choose to study at a distance because they can not afford to attend a fulltime education at campus due to the multiple roles and responsibilities they hold in society. The multiple roles and responsibilities dictate the need to move from one place to another so as to accomplish societal demands. Consequently, distance learners are inherently 'mobile'.

For the reason that distance learners are 'mobile', some authors have tended to draw a conclusion to the effect that mLearning is only suited for distance learners or learning that occurs outside class (Sharples, Taylor & Vavoula, 2005). In support of this conclusion, Brown (2005) conceptualized that mLearning is subset of electronic learning (eLearning) which in-turn is a subset of distance learning. Electronic learning is learning using an "educational environment which utilizes any electronic media tool as a part of the instruction" (Caudill, 2007, p.3). Thus mLearning is part and parcel of eLearning.

As a learning model, mLearning is still in its infancy and not many educational institutions in developing countries of Africa have integrated it in their learning management systems. Consequently, there is a vacuum in research to show that mLearning is not suitable for in-the-classroom activities for internal learners. In this paper, evidence is adduced to show that distance and internal learners in Uganda are faced with similar learning conditions that favor or constrain the uptake of mLearning and that both categories of learners have equally partaken or not partaken of mLearning. This evidence is inline with the prediction made at the end of 2009 that in 2010, the classroom would not escape the phenomenon of mLearning.

> … smart phones would [permeate] the classroom… Most would agree that trying to keep mobile technology out of the classroom is impossible, so the best approach is that of constructing channels to direct mobile technology usage in constructive directions.
>
> (Brown & Diaz, 2010, p.3).

This means that mLearning will creatively be used to support both distance and internal learners. These two learner categories operate from different learning contexts whose significance on mLearning uptake is little understood. The goal of this paper is to establish the association between study mode with different learning contexts including: the type of the learner's location (urban, semi-urban or rural), noise levels of the learner's usual learning environment and availability of mobile and Internet connectivity and power supply with a view of determining their significance on uptake of mLearning by the two categories of learners in Uganda. To achieve our goal we hypothesized as follows:

H_o: Unlike internal learners, distance learners are majorly located in rural and semi-urban areas where the main communication device is the mobile phone.

H_o: Internal learners live in noisier urban environments than distance learners who live in less noisier rural or semi-urban locations that are conducive for audio mLearning.

H_o: Internal and distance learners operate in conditions of similar mobile network connectivity and hence none of them has leverage over the other in as far as mobile network connectivity for mLearning is concerned.

H$_0$:   Internal and distance learners operate in conditions of similar tethered Internet connectivity and hence none of them has leverage over the other in as far as tethered Internet connectivity for mLearning is concerned.

H$_0$:   Internal and distance learners operate in conditions of similar electric power supply and hence none of them has leverage over the other in as far as electric power supply for mLearning is concerned.

H$_0$:   Both internal and distance learners have learning activities that can be ported onto mobile devices.

This paper is organized in six sections. The first section introduces the paper. The second section provides a review of related literature. The third section provides the methodology we employed. Results of the study are presented and discussed in fourth and fifth sections of the paper respectively. Our concluding remarks and areas for future research are given in the sixth section.

2. Related literature

2.1. Study modes

To provide a clear understanding of the study modes focused on in this article, we briefly review the concepts of distance and internal learning.

Distance learning is a study mode where learning takes place away from one's mother institution using print-based and electronic learning materials (Aguti, 2009; Commonwealth of Learning, 2004). Distance learners are separated by time and space from their lecturers and mother institutions. Sometimes, distance learners may or may not have any face-face contact with their fellow learners and lecturers (ibid). Distance learners have multiple roles and responsibilities and thus learning forms just part of their daily activity cocktail (Commonwealth of Learning, 2004). Because of the multiple roles and responsibilities, they are usually not confined in one place. They move from one learning context to another. Distance learning can be partaken of in a synchronous or asynchronous form (Keegan, 1990). The major problem in distance learning is learner isolation (ibid). With introduction of strong support services entailing use of virtual interaction and collaboration, learner isolation can be overcome (Commonwealth of Learning, 2004). At Makerere University in Uganda, distance learning is sometimes referred to as external learning with the opposite being internal learning (Aguti, 2009).

Internal learning can variously be expressed. Phrases such as classroom-based learning, campus-based learning, conventional learning, intra-mural learning, traditional learning, and so on, can all be used to refer to internal learning (Aguti, 2009). Internal learners have large segments of time to dedicate to their studies while distance learners distribute their time in multiple social, economic, political and academic obligations. Internal learners are not as varied as those of distance learners (Traxler, 2007). Just like in distance learning mode, technology supported learning has also found its way in internal learning (Aguti & Fraser, 2007). Indeed, soon or later the boundary separating internal and distance learning in

terms of technology supported learning will blur. Dual mode universities in developing countries of Africa have installed learning management systems to be used by both internal and distance learners. Likewise, mLearning apps are being developed for distance and internal learners. Both distance and internal learners can partake of mLearning though using different blends of mobile technologies (Brown & Diaz, 2010). Distance learners are likely to have a mobile phones and a desktop computer in their offices. Internal learners on the other hand are likely to have a mobile phone and a laptop computer (ibid). This technology blend makes mLearning possible in either group.

3. MLearning and study mode

MLearning is a form of eLearning that has usually been associated with supporting on-the-go learners (Brown, 2005; Sharples, Taylor & Vavoula, 2005). However, this view point is becoming null and void "given the great interest in using mobile devices to improve learning within all learning settings, including the classroom, in the field and in informal adult learning settings" (Dyson *et al*., 2009, p.251). Even if this is the case, the magnitude of use of mLearning by learners other than distance learners in their authentic contexts is not well studied. MLearning is majorly being implemented through projects supporting out-of-class learning activities with little mainstreaming of those projects into the conventional educational practice (Traxler, 2007). Conventional educational practices are influenced by prevailing environmental contexts (Uden, 2007). Similarly, mLearning supporting conventional educational practices is likely to be influenced by different environmental contexts.

MLearning among internal learners can be used in the provision of summaries of classroom discussions, reminders/alerts to various learning events and requirements, information about lectures and examinations venues, motivational messages, reference lists and hints on approach to questions, requirements for attending a given lecture, self evaluation via sequenced multiple choice quizzes and reflective learning using simulated classroom/laboratory activities recorded as MP3 files or video clips (Naismith *et al*. 2006). These same services can be enjoyed by distance learners on their mobile phones.

In Dyson *et al*. (2009), four case studies for embedding mLearning into conventional educational practices, namely: 1) mobile supported fieldwork, 2) interactive mLearning in large lectures, 3) using mobile technology to learn about mobile technology and 4) Podcasts of lecture summaries have been reported. These and other similar projects face several challenges. According to Dyson *et al*. (2009, p.251), a key challenge is the "feasibility of mLearning from the lecturer's viewpoint in terms of the effort required to introduce and then maintain the activity". Another challenge is the cost of mLearning. According to Traxler (2007), many mLearning projects have failed to live beyond the lifespan of their initial funding. Other challenges include: invasion of faculty's privacy at will and at anytime, changing the mindsets of education stakeholders to believe in mLearning and increased workload to the faculty (Brown & Diaz, 2010). Mobile devices still have technological limitations that may constrain their use in mLearning. Highly mobile devices

have tiny keyboards, limited screen sizes, inadequate storage capacities and are multi-varied in terms of their models and operating systems (Grant *et al*. 2007).   Research from the pedagogical and technical angles is going on to mitigate many of these challenges (Brown & Diaz, 2010).

4. Theorizing about learning and learning context

Learning occurs in different contexts. Context is information which describes the situation of a learner in a given location (Uden, 2007). It "… is typically the location, identities of nearby people, objects and changes to objects" (Zhang, 2003. p.7). When students fully understand their learning contexts, they are likely to achieve more learning experiences than if they did not (Prosser & Trigwell, 1999). They will be able to learn from their own experience of action in the real world, reflect on those experiences to achieve abstract conceptualization of concepts and later experiment with the concepts derived (Kolb, 1984).

Learning context can further be theorized around the situated (Lave & Wenger, 1991) and constructivist (Bruner, 1966) learning theories. The situated learning theory provides a framework for understanding how learning occurs in different learning environments. It posits that "learning is not merely the acquisition of knowledge by individuals, but instead a process of social participation" (Naismith *et al*., 2006, p.13) and interaction with ones existing environment. The learning process is thus influenced by the learner's environs, learning resources and tools at their disposal and communities of practice (Lave & Wenger, 1991).

The situated learning theory concurs with the socio-cultural theory which permits learners to work collaboratively in groups so as to share learning experiences in their communities of practice (Nie, 2007). It is also inline with the constructivist learning theory (Bruner, 1966) which permits learners to actively build new knowledge by incorporating into their existing knowledge-base concepts derived from their educational experience. However, critiques of the constructivist learning theory such as Prawat and Floden (1994) have advocated for social constructivist learning theory (Vygotsky, 1978) because it recognizes that learning occurs in communities of practice.   Prawat and Floden (1994) posit that knowledge creation is shared rather than an individual experience. This implies that knowledge is a social product generated through interplay of several minds. Tools and raw materials for creating this social product can arise from technologies that encourage interaction and collaboration. Mobile devices are good examples of such technologies. With mobile devices such as smart phones, learners can construct their own knowledge and share it freely with peers at anytime in anyplace. This, in mLearning, is referred to as "participatory simulations" (Naismith *et al*., 2006, p.2). Participatory simulation encourages learners to actively participate in the learning process.

Collaborative assignments completed by distance learners located in different contexts tend to be rich in content because they are built based on information collected from different contexts. Collaborative engagements enable learners to co-create new knowledge (Doos *et al*., 2005). Just pushing content onto learners' mobile devices without ensuring interactive and collaborative engagement, would be similar to putting old wine in new bottles because

it would entrench the transmission model of education (Brown & Diaz, 2010). The learner's authentic context determines the level of interaction and collaboration (Lehsten *et al*., 2010).

In developing countries, the role of authentic context or location related context such as the type of learner's usual learning locations, the noise levels of learner's usual learning location, availability of mobile network connectivity, availability of tethered Internet connectivity and presence of electric power supply need to be studied to ascertain their role in uptake of mLearning amongst distance and internal learners. Location aware learning can be used to characterize the situation of different learners (Lehsten *et al*., 2010). Characterization of distance and internal learners for mLearning based on the location context is studied in this paper.

5. Methodology

This paper is drawn from part of the data collected by the corresponding author for his PhD research titled '*Deploying and Utilising Learning Objects on Mobile Phones'*. In this PhD, guidelines for developing and evaluating mLearning environments are espoused. Since Design Research (Wang & Hannafin, 2005) was the main methodology used in undertaking the PhD research, the data used in this paper was collected to provide an initial understanding of the problem in the *Awareness of the Problem* process step. Design researchers follow five iterative process steps when developing or evaluating artefacts, including: *Awareness of the Problem, Suggestion, Development, Evaluation* and *Conclusion* (Wang & Hannafin, 2005). Design research is; "… a systematic but flexible methodology aimed [at improving] educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (Wang & Hannafin, 2005, p.6). Design Research combines research, design and practice (ibid).

The research part of the Design Research methodology underpinned the *Awareness of the Problem* process step which in-turn underpinned the data collection for this paper. Data was collected through a survey. A survey approach was preferred because the target population could not be found in a single location. The study population was undergraduate distance and internal learners of Makerere University in Uganda. Makerere University delivers its programmes through internal and distance learning modes; hence it is a dual mode University (Aguti, 2009).

The sample size (n) was determined using Calder's (1998) sample size determination formula.

$$n = \frac{(desired\ confidence\ level)^2 * (s\tan dard\ deviation)^2}{(desired\ level\ of\ precision)^2}$$

At a confidence level of 95 Percent (p<0.05) or a value of 1.96 in normally distributed data, standard deviation of 4 (derived from an earlier study on the same population with regard to the standard deviation of the time used to complete a research report) and a level of

precision of 0.5, a minimum sample size of 246 was determined. Due to the high rate (80.0 Percent) of non-response in surveys (Burgess, 2001) the minimum sample size was multiplied by five (5) so as to cater for the 80.0 Percent non-response. The survey was therefore distributed to 1,230 respondents who were selected using multi-stage sampling method involving cluster sampling at stage one and stratified random sampling at stage two. The population was clustered along the study mode characteristic. Distance learners formed cluster one while internal learners formed cluster two. After the survey, 446 responses were returned representing a response rate of 36.3 Percent. Hence the total number of responses (N) was 446. In instances where there was non-response, N was less than 446.

Using comparative analysis approach, the hypotheses in the study were tested through variable cross-tabulation in which the Pearson Chi-Square was run to generate the phi-value (p-value) for determining level of association. When $p > 0.05$, the null hypothesis was accepted, meaning that there was no significant association between the variables being compared. When $p<0.05$, the null hypothesis was rejected, meaning that there was a significant association between the variables cross-tabulated.

6. Results

The study was scoped within five location-based learning context variables/conditions, namely: type of learner's usual learning locations, the noise levels of learner's usual learning location, availability of mobile network connectivity, availability of tethered Internet connectivity and presence of electric power supply. We describe the five aforementioned learning context variables before associating each of them with the study mode variable so as to determine which mode would best be suited for mLearning under the location context in question.

7. Describing the location-based learning context variables

Type of Learners' Usual Learning Locations: The learner's usual learning location connoted a place where a learner resided and undertook their usual learning activities. The study showed that 78.0 Percent of the learners resided and undertook their usual learning activities in urban areas. Semi-urban and rural areas, hosted 11.4 Percent and 10.5 Percent respectively of the learners.

Noise Levels of Learners' Usual Learning Locations: Noise pollution is said to have a negative effect on audio-based mLearning. The study showed that a big proportion of learners (59.4 Percent) were located in areas that were sometimes noisy. A few learners (2.2 Percent) lived and undertook their learning activities in contexts that where always noisy while a moderate number (38.3 Percent) enjoyed very quiet contexts.

Mobile Network Connectivity: MLearning mainly hinges on the mobile network connectivity. When asked to indicate their views on the statement, 'mobile network connectivity is present to you at all times', 28.4 Percent and 42.7 Percent of the learners strongly agreed and agreed respectively to it. Only 18.7 Percent and 10.2 Percent

respectively disagreed and strongly disagreed to the statement. This implies that 71.1 Percent of the respondents did not experience any intermittence in mobile network connectivity as opposed to 28.9 Percent who did.

Tethered Internet Connectivity: Inadequacies presented by lack of tethered Internet connectivity can be bridged by mobile Internet. Indeed, tethered Internet was scarce amongst respondents. About 42.4 Percent and 34.5 Percent of the respondents disagreed and strongly disagreed respectively to the statement that 'tethered Internet is available to you at all times'. Only 17.2 Percent and 6.9 Percent agreed and strongly agreed respectively to the latter statement. Even if mobile Internet comes in handy as a solution for bridging the digital divide created by lack of or limited tethered Internet connectivity, only 7.8 Percent of the learners used their mobile phones to access the Internet.

Electric Power Supply: Electric power supply is needed to power communication infrastructure such as transmission masts and computers and charging mobile device batteries. Whereas about 97.0 Percent of the learners owned mobile phones, not all of them had national electric power supply in their usual learning environments. A good proportion of learners (62.8 Percent) contended that power supply was not available to them at all times. Only 37.2 Percent of the learners had constant power supply.

8. Study mode, learning contexts and mLearning

In another paper, we have studied the significance of the learning environment (context) on mLearning (Muyinda *et al., in press*). In the present paper, we have extended that study by establishing the significance of learning environment (context) on study mode with a view of determining the interplay of the two variables on mLearning uptake. This is done by testing the six hypotheses stated in this study.

H_0:   **Unlike internal learners, distance learners are majorly located in rural and semi-urban areas where the main communication device is the mobile phone.**

This hypothesis was tested by cross-tabulating study mode variable with the type of learner's usual learning environment and generating the Pearson Chi-Square statistic (phi = p-value) from the association. The results are shown in *Table 1* below.

Study Mode	Type of Usual Learning Environment			Total
	Rural	Urban	Semi-urban	
Distance	21.1% (n=46)	55.5% (n=121)	23.4% (n=51)	n=218
Internal	4.4% (n=10)	75.0% (n=171)	20.6% (n=47)	n=228
Total	12.6% (n=56)	65.5% (n=292)	22.0% (n=98)	N=446

Percentages are calculated row wise and p=0.532

Table 1. Study mode and Location of Learners' Usual Learning Environment

Whereas it has always been the general belief that most distance learners in Uganda are based in rural areas, findings in *Table 1* above have proved otherwise. The majority of

distance learners (55.5 Percent) were based in urban settings and only 21.1 Percent were based in rural areas. Semi-urban areas such as trading centers were a base for 23.4 Percent of the distance learners. The study having been conducted in an urban setting of Makerere University, which is located in the city of Kampala, Uganda, explains the large proportion of internal learners (75.0 Percent) who were based in urban settings. The 20.6 Percent and 4.4 Percent of internal learners who reported as having been in semi-urban and rural environments respectively are a case of students who commuted to Makerere University on a daily basis from surrounding districts and suburbs of Kampala. A p-value of 0.532 shown in *Table 1* above indicates that there was no significant association between study mode and the type of learners' usual learning environment. We therefore reject the null hypothesis and conclude that distance learners in Uganda are not necessarily located in rural and semi-urban areas where the main communication device is the mobile phone. They are also to be found in urban areas where other ICTs other than the mobile phone are commonly found. This shows that Uganda is not meeting the goal of distance learning which is to extend learning to learners in their homes and workplaces. It is apparent that as soon as students are admitted to the distance education programme, they relocate from their different areas of aboard to Kampala. For instance, one of the distance learners said, "I do not have a job, so I relocated to Kampala to concentrate on my studies".

H_0:   **Internal learners live in noisier urban environments than distance learners who live in less noisier rural or semi-urban locations that are conducive for audio mLearning.**

A cross-tabulation of study mode and noise levels of learners' usual learning environment generated the p-value for testing this hypothesis. As has already been established, about 61.6 Percent of the learners experiences some form of noise pollution in their usual learning environments. The magnitude of this noise pollution among distance and internal learners has been determined in *Tables 2 , 3* and *4* below.

Study mode	Noise levels of learners' usual learning environment			Total
	Is always quiet	Is sometimes noisy	Is always noisy	
Distance	39.0 (n=85)	59.2 (n=129)	1.8 (n=4)	n=218
Internal	37.7 (n=86)	59.6 (n=136)	2.6 (n=6)	n=228
Total	38.3 (n=171)	59.4 (n=265)	2.2 (n=10)	N=446

Percentages are calculated row wise and p=0.029

Table 2. Study Mode and Noise Levels of the Learners' Usual Learning Environments

Learning concentration often requires quiet learning environments. Moreover, voice communication via mobile phones is greatly hindered in contexts with high noise levels. In *Table 2* above, a p-value of 0.029 was generated in a cross-tabulation of study mode with noise levels of the learners' usual learning environment. This p-value (0.029) indicates that the study mode is significantly associated with the noise levels in the learners' usual learning environment. It is evident from *Table 2* above that there were slightly more internal students (62.2 Percent) in sometimes noisy or always noisy locations than distance learners

(61.0 Percent). This was because the majority (95.6 Percent) of internal learners were based in urban or semi-urban areas (*See Table 1*) that tend to be noisier than rural areas as is depicted in *Table 3* below.

Location of learners' usual learning environment	Noise levels of learners' usual learning environment			*Total*
	Is always quiet	**Is sometimes noisy**	**Is always noisy**	
Rural	48.9% (n=23)	51.1% (n=24)	0.0% (n=0)	n=47
Urban	39.1% (n=136)	58.0% (n=202)	2.9% (n=10)	n=348
Semi-Urban	23.5% (n=12)	76.5% (n=39)	0.0% (n=0)	n=51
Total	38.3% (n=171)	59.4% (n=265)	2.2% (n=10)	N=446

Percentages are calculated row-wise

Table 3. Location of Learners' Usual Learning Environments and Noise Levels

From *Table 3* above, the truism that urban or semi-urban settings are noisier than rural areas is echoed. No respondent from a rural setting reported having a usual learning environment which was always noisy. There was an almost equal distribution of respondents from rural areas who reported having an environment which was always quiet (48.9 Percent) or sometimes noisy (51.1 Percent). The majority of learners (60.9 Percent) from urban settings reported that their environment was sometimes noise (58.0 Percent) and always noisy (2.9 Percent). Similarly the majority (76.5 Percent) of learners who hailed from semi-urban settings sometimes experienced noisy learning environments. Urban or semi-urban settings are nosier than rural settings. This conclusion is justified by the Pearson Chi-Square test results obtained from a cross-tabulation of the location of learners' usual learning environments and noise levels in those environments as is seen in *Table 4* below.

Test Statistic	Value	Degrees of Freedom	Asymptotic Significance (2-sided)
Pearson Chi-Square	10.318[a]	4	0.035
Likelihood Ratio	12.643	4	0.013
N of Valid Cases	446		

[a] 2 cells (22.2 Percent) have expected count less than 5. The minimum expected count is 1.05.

Table 4. Location of Learners' Usual Learning Environment and Noise Levels

A p-value of 0.035 at 4 degrees of freedom in *Table 4* above indicates that noise levels are significantly associated with the location of the learners' usual learning environments. This finding is collaborated with findings in *Table 3* above which also indicate that urban settings are noisier than rural ones. This could be attributed to the more traffic, people and economic activities found in urban settings than rural settings.

The findings in *Tables 2, 3* and *4 above* justify acceptance of the null hypothesis that internal learners live in noisier environments than distance learners. This implies that distance learners are well suited to partake of mLearning based on audio-based learning objects than their counterparts the internal learners because audio-based learning objects are suitable for quiet contexts.

H₀: **Internal and distance learners operate in conditions of similar mobile network connectivity and hence none of them has leverage over the other in as far as mobile network connectivity for mLearning is concerned.**

MLearning thrives best in environments with mobile network connectivity conditions. Whether internal or distance learners lived and operated in areas with or without mobile network connectivity conditions formed a research question that is answered in *Tables 5* and *6* below.

Study mode	Mobile network connectivity is present at all times				
	Strongly disagree	**Disagree**	**Agree**	**Strongly agree**	*Total*
Distance	9.8% (n=21)	20.5% (n=44)	43.7% (n=94)	26.0% (n=56)	n=215
Internal	10.5% (n=24)	17.1% (n=39)	41.7% (n=95)	30.7% (n=70)	n=228
Total	10.2% (n=45)	18.7% (n=83)	42.7% (n=189)	28.4% (n=126)	N=443

Percentages are calculated row-wise and Chi-Square p=0.062

Table 5. Study Mode and Availability of Mobile Network Connectivity

From *Table 5* above, 69.7 Percent and 71.4 Percent of distance and internal learners respectively agreed or strongly agreed that mobile network connectivity was present at all times in their usual areas of aboard. It means that distance and internal learners are almost equally served with mobile network connectivity. This is also evidenced by a p-value of 0.062 in *Table 5* above which indicates that learners' study mode did not have significant association with availability of mobile network connectivity. This means that both internal and distance learning students can equally be reached through mLearning.

The permeation of mobile network connectivity in rural, semi-urban and urban settings was also studied. Whereas the urban-based learners reported slightly higher availability of mobile network connectivity, *Table 6* below indicates that there was an almost equal level of agreement among rural (41.3 Percent) and urban (42.8 Percent) based learners to the question that mobile network connectivity was available at all times in their areas of aboard.

Location of learners' usual learning environment	Mobile network connectivity is present at all times				
	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**	*Total*
Rural	15.2%(n= 7)	23.9% (n=11)	41.3% (n=19)	19.6% (n=9)	n=46
Urban	9.5% (n=33)	16.8% (n=58)	42.8% (n=148)	30.9% (n=107)	n=346
Semi-urban	9.8% (n=5)	27.5% (n=14)	43.1% (n=22)	19.6% (n=10)	n=51
Total	10.2% (n=45)	18.7% (n=83)	42.7% (n=189)	28.4% (n=126)	N=443

Percentages are calculated row-wise and Chi-Square p=0.136

Table 6. Learners' Usual Learning Environment and Mobile Network Connectivity

A p-value of 0.136 in *Table 6* above indicates that there was no significant association between location of the learners' usual learning environment and availability of mobile network connectivity. We can conclude then that mobile network connectivity has permeated almost equally in urban, semi-urban and rural areas of Uganda. Thus we accept the null hypothesis that internal and distance learners experience similar mobile network connectivity conditions which have a significant influence on mLearning uptake.

H_0:   **Internal and distance learners operate in conditions of similar tethered Internet connectivity and hence none of them has leverage over the other in as far as tethered Internet connectivity for mLearning is concerned.**

MLearning can be integrated into online learning management systems which are usually deployed through tethered Internet backbones. Availability of tethered Internet connectivity can thus be a necessary condition for the installation of mLearning. Do internal and distance learning students experience similar tethered Internet connectivity conditions? *Tables 7, 8* and *9* below provide an answer to this question and hence test the hypothesis above.

| | Tethered Internet connectivity is present at all times | | | | |
Study mode	Strongly disagree	Disagree	Agree	Strongly agree	Total
Distance	43.3% (n=93)	38.6% (n=83)	14.0% (n=30)	4.2% (n=9)	n=215
Internal	26.3% (n=60)	46.1% (n=105)	20.2% (n=46)	7.5% (n=17)	n=228
Total	34.5 %(n=153)	42.4% (n=188)	17.2% (n=76)	5.9% (n=26)	N=443

Percentages are calculated row-wise and Chi-Square p=0.329

Table 7. Study Mode and Availability of Tethered Internet Connectivity

From *Table 7* above, it is evident that Internet connectivity was present at all times to just a few learners. Only 14.0 Percent and 4.2 Percent of distance learners agreed and strongly agreed respectively to the statement that tethered Internet connectivity was present to them at all times. Similarly, a small proportion of 20.2 Percent and 7.5 Percent of internal learners agreed and strongly agreed respectively to the statement that tethered Internet connectivity was present to them at all times. Generally speaking, Internet connectivity was always available to only 23.1 Percent of the learners. When this is compared with mobile network connectivity in *Table 6* above, it can be concluded that mobile network connectivity was more readily available to learners than tethered Internet connectivity. However, neither distance nor internal learners were advantaged over the other in terms of access to tethered Internet. This is evidenced by the p-value of 0.329 in *Table 7* above which indicates that there was no significant association between study mode and availability of tethered Internet connectivity. Since mobile network connectivity is more pervasive than tethered Internet connectivity, mLearning applications are more likely to permeate to many learners in Uganda than those based on online learning based learning management systems which heavily depend on tethered Internet for connectivity.

Just like in the case of mobile network connectivity, it was important to compare the location of the learners' usual learning environment with availability of tethered Internet

connectivity so as to determine the type of location where tethered Internet connectivity is most prevalent. The results are presented in *Table 8* below.

Learners' usual learning environment	Tethered Internet connectivity is present at all times				Total
	Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**	
Rural	76.1% (n=35)	10.9% (n=5)	10.9% (n=5)	2.2% (n=1)	n=46
Urban	28.0% (n=97)	47.4% (n=164)	17.3% (n=60)	7.2% (n=25)	n=346
Semi-urban	41.2% (n=21)	37.3% (n=19)	21.6% (n=11)	0.0% (n=0)	n=51
Total	34.5% (n=153)	42.4% (n=188)	17.2% (n=76)	5.9% (n=26)	N=443

Percentages are calculated row-wise and Chi-Square p=0.329

Table 8. Learners' Usual Learning Environments and Availability of Internet Connectivity

Contrary to the common belief that urban based learners have readily available Internet connectivity, the statistics in *Table 8* have indicated otherwise. A p-value of 0.329 in *Table 8* above indicates no significant association between location of learners' usual learning environment and availability of tethered Internet connectivity. Thus rural, semi-urban and urban based learners experienced similar availability or non-availability of Internet connectivity. We accept the null hypothesis that internal and distance learners experience similar tethered Internet connectivity conditions which have a significant influence on mLearning uptake.

About 78.0 percent of the learners either strongly disagreed (34.5 Percent) or disagreed (42.4 Percent) to the statement that Internet connectivity was available to them at all times. For those who had Internet connectivity, it was skewed more towards urban and semi-urban settings, that is to say, areas with electricity. This is explained by the strong association (p = 0.000) between electric power supply and Internet connectivity as seen in *Table 9* below.

H₀: **Internal and distance learners operate in conditions of similar electric power supply and hence none of them has leverage over the other in as far as electric power supply for mLearning is concerned.**

Electric power is necessary for powering the telecommunication infrastructure and charging mobile device batteries. As can be seen in *Table 9* below, electric power supply was significantly associated with tethered Internet connectivity (p = 0.000).

Test Statistic	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	119.913[a]	9	0.000
Likelihood Ratio	96.788	9	0.000
N of Valid Cases	442		

[a] 1 cells (6.3 Percent) have expected count less than 5. The minimum expected count is 2.71.

Table 9. Power Supply and Internet Connectivity

Interestingly, when a Chi-Square test was undertaken between availability of electric power supply and mobile network connectivity, a non-significant result (p=0.301) was returned. This result concurs with results in our earlier study in which we found that mLearning could overcome the constraints that lack of electricity imposes on eLearning (Muyinda *et al.*, 2010). This is because telecommunication companies have setup transmission masts in rural areas that are powered by diesel generators and mobile device users in areas with no electricity can charge them using solar power, car chargers, batteries and generators. But which of the different modes of study is more privileged than the other in terms of electric power supply? This question is answered in *Table 10* below.

Study mode	Power supply is availability all the time				Total
	Strongly Disagree	Disagree	Agree	Strongly Agree	
Distance	30.2 % (n=65)	40.5 % (n=87)	20.5 % (n=44)	8.8 % (n=19)	n=215
Internal	15.8 % (n=36)	39.5 % (n=90)	32.9 % (n=75)	11.8 % (n=27)	n=228
Total	22.8 % (n=101)	40.0 % (n=177)	26.9 % (n=119)	10.4 % (n=46)	N=443

Percentages are calculated row-wise and p=0.199

Table 10. Study Mode and Availability of Electric Power Supply

From *Table 4.10* above, there was no significant association (p=0.199) between study mode and availability of electric power supply. This means that both internal and distance learners faced similar conditions in as far as electric power supply was concerned. Power load shedding in Uganda was a common phenomenon. Rosters of power load shedding were published daily in local newspapers. However, intermittence or complete lack of electric power supply was more common in rural or semi-urban areas than urban ones. This is evidenced by the significant association between location of learners' usual learning environment and availability of power supply in *Table 11* below.

Location of learners' usual learning environment	Electric power supply is availability all the time				Total
	Strongly Disagree	Disagree	Agree	Strongly Agree	
Rural	58.7% (n=27)	15.2% (n=07)	15.2% (n=07)	10.9% (n=05)	n=46
Urban	17.6% (n=61)	42.8% (n=148)	28.3% (n=98)	11.3% (n=39)	n=346
Semi-urban	25.5% (n=13)	43.1% (n=22)	27.5% (n=14)	3.9% (n=02)	n=51
Total	22.8% (n=101)	40.0% (n=177)	26.9% (n=119)	10.4% (n=46)	N=443

Percentages are calculated row-wise and p=0.000

Table 11. Location of Learners' Usual Learning Environments and Availability of Power Supply

From *Table 11* above, a p-value of 0.000 was generated in a cross-tabulation of location of learners' usual learning environment with availability of electric power supply. This p-value (0.000) indicates that the location of the learners' usual learning environment is strongly significantly associated with availability of power supply. The results show that power

supply was more available in urban (39.6 Percent) and semi-urban (31.4 Percent) settings than rural (26.1 Percent) areas. However, even where power supply was available, its supply was intermittent as 62.8 Percent of the learners surveyed either strongly disagreed (22.8 Percent) or disagreed (40.0 Percent) to the statement that power supply was available to them at all times.

From findings in *Tables 9, 10* and *11,* both distance and internal learners experienced similar electric power supply connectivity conditions which effectively affirm the hypothesis that internal and distance learners operate in conditions of similar electric power supply and hence none of them has leverage over the other in as far as electric power supply for mLearning is concerned.

H_o: **Both internal and distance learners have learning activities that can be ported onto mobile devices.**

There exists a host of possible mLearning activities that can be ported onto mLearning. According study revealed that the number one candidate mLearning activities were those that learners accomplished while they were outside the classroom. These activities were either direct learning activities or activities meant to plan and support direct learning activities.

While outside the classroom, both internal and distance learners participated in collaborative and interactive learning (41.0%), co-curricular/extra-curricula activities (20.0%) and independent research (16.0%). They also completed theoretical, practical and field course works and assignments (8.0%) and watched/listening to educative and entertaining music, news and movies (6.0%). Some learners engaged in work related activities (4%), consulted their lecturers (7.0%), acquainted themselves with the university environment (1.0%) and took computer lessons (1.0%). All these activities can be variously supported through mLearning.

Other learning activities suggested in the study for possible porting in mLearning were: provision of summaries of classroom discussions, reminders/alerts to various learning events and requirements, information about lectures and examinations venues, motivational messages, reference lists and hints on approach to questions, requirements for attending a given lecture, self evaluation via sequenced multiple choice quizzes and reflective learning using simulated classroom/laboratory activities recorded as MP3 files or video clips. Other classroom-based mLearning examples include: sharing of files using Bluetooth, anonymous voting and playing short demonstrations of experiments.

9. Discussion

9.1. Distance learning in Uganda

The purpose for which the distance learning programmes were started in Uganda was "… to provide access to a cross-section of clients, including adults working and living in the countryside" (Aguti, 2009, p.219). This study has established that only 21.1 percent of the

distance learners where resident in the countryside (rural areas). The majority 55.5% lived in the capital city of Kampala while 23.4 Percent lived in semi-urban areas. Distance learners preferred to live in Kampala because, "this is where I will get easy access to reading materials and my professors at Makerere University", said one of the distance learners. This shows that the distance learning student support system in Uganda is not decentralized. This forces the students to relocate to Kampala hence turning distance learning programmes into 'on-campus-based' distance learning programmes. The recommendations here would be to put in place systems that permit decentralization of student support systems. MLearning is one such support systems.

9.2. Study mode and MLearning

Since both internal and distance learners live and operate mainly from urban based environments, they experience noise pollution associated with urban environments. From this study, it was established that noise pollution has a significant effect on mLearning based on audio-based learning objects. This presents the need to design multiple learning objects for mLearning so as to cater for different noise levels in different study environment. Since a good proportion of internal (75.0 Percent) and distance (55.5 Percent) learners live in urban areas which tend to be noisier than rural or semi-urban areas, mLearning based on audio learning objects would not be suitable for them. MLearning based on text or video learning objects will be appropriate. Our reasoning is inline with the requirements of location-based learning as is espoused in Lehsten *et al*. (2010). According to Lehsten *et al*. (2010, p.269), "the approach for the place limit [would be] to integrate the location into the learning process". Location aware mLearning systems come in handy.

Wherever they were located, distance and internal learners were almost equally served with mobile network connectivity because it had permeated almost equally in urban, semi-urban and rural areas of Uganda. Mobile network connectivity was more readily available to both internal and distance learners than tethered Internet connectivity. Since mobile network connectivity is a necessary condition for mLearning, both distance and internal learners can equally be supported through mLearning. Similarly, since tethered Internet connectivity is not readily available to both internal and distance learners, applications based on tethered Internet connectivity are not readily accessible by both internal and distance learners. For example, mLearning applications which are integrated within online learning management systems (whose connectivity backbone is mainly tethered Internet) can not easily be partaken of by both internal and distance learners.

The study has revealed that both internal and distance learners experience similar electric power supply connectivity conditions. They both experience intermittence in power supply or complete lack of it. Whereas electric power supply based on the national grid is very critical to conventional eLearning, this study and others (Muyinda *et al*. 2010) have established that it is not very critical to mLearning. Mobile phone batteries can easily be charged using alternative power sources.

9.3. MLearning activities

Internal and distance learners can all be supported through mLearning. Both internal and distance learners interact and collaborate with each. mLearning abets interactive and collaborative learning. When learners collaborate and interact with each other, they create new knowledge (Fisher & Baird, 2007; Uden, 2007; Vygotsky, 1978). In Doos *et al*. (2005), workers collaboratively engaged each other to co-create new knowledge for new product development. Likewise, in this study, it was established that learners collaboratively accomplished group assignments, which indicates that there was collaborative and interactive learning.

The study further revealed that several learning support activities could be ported onto mLearning for distance and internal learners. These include: provision of summaries of classroom discussions, reminders/alerts to various learning events and requirements, information about lectures and examinations venues, motivational messages, reference lists and hints on approach to questions, requirements for attending a given lecture, self evaluation via sequenced multiple choice quizzes and reflective learning using simulated classroom/laboratory activities recorded as MP3 files or video clips. Studies such those in Brown & Diaz (2010), Dyson *et al*. (2009), Lehsten *et al*. (2010), Traxler (2007) and others give these and many more as possible mLearning activities. The common thread in many of the mLearning activities is that they are mainly teaching and learning support activities. For that reason, mLearning is also underpinned by the learning and teaching support theory (Naismith *et al*., 2006). The learning and teaching support theory (Naismith *et al*., 2006), posits that learning is not only about providing learners with content but is coupled with a great deal of learner and learning resources coordination. This necessitates support systems in learning and teaching not only for distance learners but also for internal learners. Just like any other technology use in the classroom, for example use of laptop in the classroom, negotiated use mLearning devices in the classroom by internal learners need to be negotiated (Brown & Diaz, 2010). This will dispel fears accruing from disruption caused by the devices to classroom learning.

Generally speaking, mLearning activities tend to be of short durations (Brown & Diaz, 2010). This augurs well with on-the-go learners who do not have enough time for sustained long duration checks on their mobile devices. The short duration of mLearning dictates the need to devise appropriate "pedagogies and learning opportunities that are unique to this type of technology rather than attempting to translate what is currently done with laptops onto the mobile device" (Brown & Diaz, 2010, p.9).

10. Conclusion and future work

Although there has been a claim that mLearning is mainly suited for distance learners, this study has disputed this claim. MLearning is capable of supporting both distance and internal learners. All that matters is a consideration for the different contexts that each of these two categories of learners experience before appropriate mLearning pedagogies can be designed for each of them. We disclaim however, that not all context variables have been

considered in this study. There exist other context variables such as government and institutional policy on mLearning, public and learners' opinions towards mLearning, cost, available resources, societal ethics, age, etc. that could influence uptake of mLearning by internal and distance learners. Futures studies should explore these.

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