

*M-Learning: A Proposed Pedagogical Model for Institutions of Higher Learning in Africa*

Eunice Maingi<sup>\*1</sup>, Grace Kihumba<sup>\*2</sup>, Joseph Sevilla<sup>\*1</sup>

<sup>\*1</sup>Strathmore University, Kenya, <sup>\*2</sup>Carnegie Mellon University, USA

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Abstract

Kenya was propelled onto the world stage with mobile phone technology after the successful implementation of mobile money transfer in 2007. Since then, researchers in Kenya and Africa at large started looking into the possibilities of a similar revolution in education. Kenya has a population estimated at 40 million people and there are 30 million active mobile phone numbers. On the contrary, Kenya has about 9 computers per 1000 people. Therefore, e-learning via computers has limited prospects. Furthermore, Internet access in Kenya is primarily via mobile devices. Internet-enabled phones as well as cheaper lower-end smart phones have become increasingly available in Kenya.

Strathmore University in Nairobi conducted an investigation into the applicability of mobile learning (m-learning) for the current institution pedagogy. First, an analysis of existing m-learning platforms was done, with a bias for Free and Open Source platforms that would be accessible in Africa. The project team then carried out a study among 531 students in order to establish their perceptions towards m-learning. A customized m-learning Moodle application was subsequently designed and 118 students used it for a weeklong pilot study. From the research findings, it was evident that exploiting m-learning in higher education institutions, in Kenya and the rest of Africa could result in a paradigm shift in the instructional practices used in developing countries. This paper discusses the future of m-learning in Africa and provides empirical evidence supporting its implementation at Strathmore University.

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## **1. Background**

### **1.1 Introduction**

The adoption of mobile technologies in Africa has been on the rise since 2007. Mobile penetration was recorded as 71.3 percent by December 2011 up from 67.2 percent recorded during the 2010/2011 period (Communications Commission of Kenya, 2011-2012). This reflects a 4.1 percent growth in three months. Mobile technologies have continued to facilitate solutions that transform the industries and society in sub-Saharan Africa. Now, more than ever before, there is a high affinity for mobile technologies for accomplishing communication, business, banking and educational related tasks (Paul B.M, 2010). The introduction of mobile technology throughout Africa has helped countries to skip several steps in the development process, which could have been much more prolonged (Davis, 2013).

Today mobile devices in the market are offered at increasingly affordable prices. The cheapest internet-enabled feature phone on the market now costs KES 2,500 (The Nokia 2730c). The cheapest smartphone retails at KES 7,000 (The Huawei IDEOS). Purchase of these devices has also grown, contributing to the rise in mobile internet access in Kenya. A research published by Research ICT Africa indicated that “in South Africa, Kenya, Nigeria, Tanzania and Rwanda, internet is accessed through the mobile phone by 70% of the internet users (Enrico Calandro, 2012). The availability and affordability of Internet access options in Kenya has increased. Smartphones, smart hand-held devices and feature phones have broadband capabilities. The cost of broadband access has become affordable owing to factors such as competition and government controls on network tariffs. The Communication commission of Kenya (CCK), through Determination No.2 of 2010 issued on 16<sup>th</sup> August 2010 announced a 50% reduction in the interconnection rates (Communications Commission of Kenya, 2010-2011). All these factors contribute to an opportunity that higher learning institutions could benefit from. Most students are already equipped with Internet-capable mobile devices and affordable internet access options on broadband, due to reduced internet and mobile device costs. The challenge is left to the education institutions to create programs that leverage mobile platforms to enhance students’ learning experiences.

Mobile learning is defined differently depending on the implementation strategy used. MoLeNET defines it as 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 (Mobile Learning Network (MoLeNET), 2010a). EDUCAUSE relates it to any educational interaction delivered through mobile technology and accessed at a student’s convenience from any location (EDUCAUSE, 2010). Keegan D. defines it as the provision of education and training on PDAs (including palmtops and handhelds), smartphones and mobile phones (Keegan, 2005).

## **1.2 Objectives**

1. To establish whether mobile devices offer a viable solution in supporting and enhancing the delivery of education in institutions of higher learning in Africa.
2. To establish the readiness of students to undertake mobile learning
3. To test a practical implementation of mobile learning in an institution of higher learning

## **1.3 Research questions**

1. Do mobile devices offer a solution to enhance the delivery of education in institutions of higher learning in Africa?
2. Do students have the right kind of phones to enable them undertake mobile learning?
3. What do students in Strathmore University think about mobile learning? Would availability of learning material in mobile accessible format impact student performance?
4. How can a mobile learning system be implemented in institutions of higher learning in Africa?

## **Scope of study**

The research was conducted at Strathmore University in Nairobi, Kenya. The institution has a population of about 4600 students taking full-time, part-time or distance learning programs. The following faculties participated in this research:

- Faculty of Information Technology (FIT)
- School of Management Commerce (SMC)
- School of Accountancy (SOA)
- School of Law (SOL)
- School of Humanities & Social Studies (SHSS)
- School of Finance and Applied Economics (SFAE)

## **Relevance of study**

Students in developing countries in Africa are more likely to have access to mobile phones than computer access (Merryl F., 2009). In Strathmore University, about 95% of the students own at least one mobile device (a phone, laptop, tablet etc.). This presents a great opportunity to improve the learning experience of students by using mobile devices.

## 2. Literature Review

### 2.1 Growth of Mobile Internet – World

In 2010, the ITU predicted that within the next five years mobile web access via laptops and smart mobile devices would overtake access via desktops. Earlier in 2009, the International Data Corporation (IDC), with reference to findings that indicated there were more than 450 million mobile Internet users worldwide, predicted that the number of mobile Internet users would pass the 1 billion mark by 2013 (UNESCO, 2011). The infographic below from Microsoft Tag provides a representation of a prediction that by 2014 mobile Internet will have taken over desktop Internet usage (Holly R., 2011).

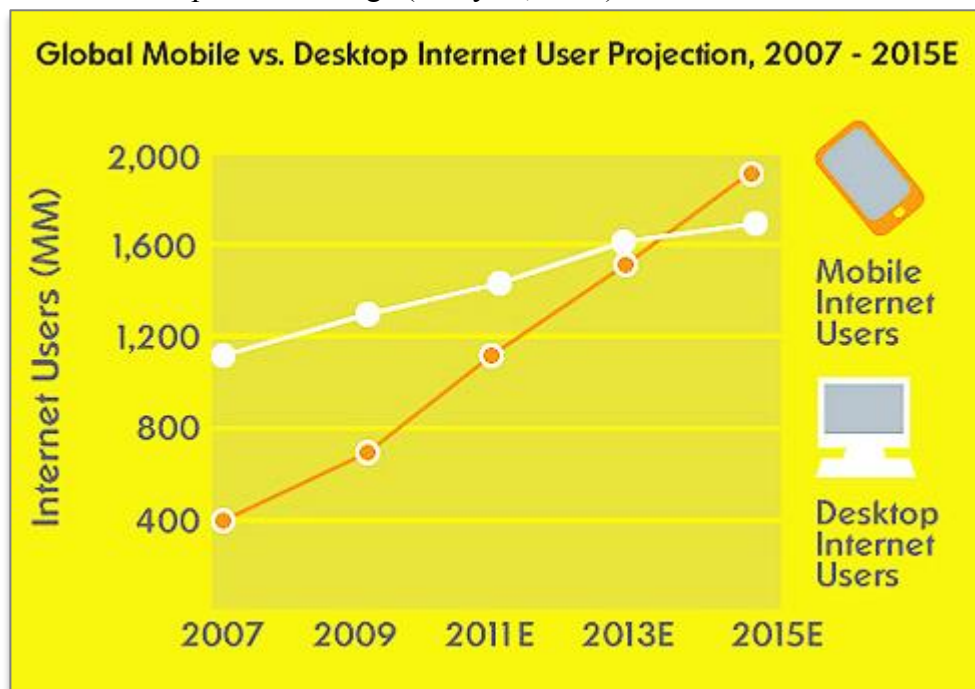


Figure 1: Global Mobile vs. Desktop Internet use Projection

Source:

[http://tag.microsoft.com/community/blog/t/the\\_growth\\_of\\_mobile\\_marketing\\_and\\_tagging.aspx](http://tag.microsoft.com/community/blog/t/the_growth_of_mobile_marketing_and_tagging.aspx)

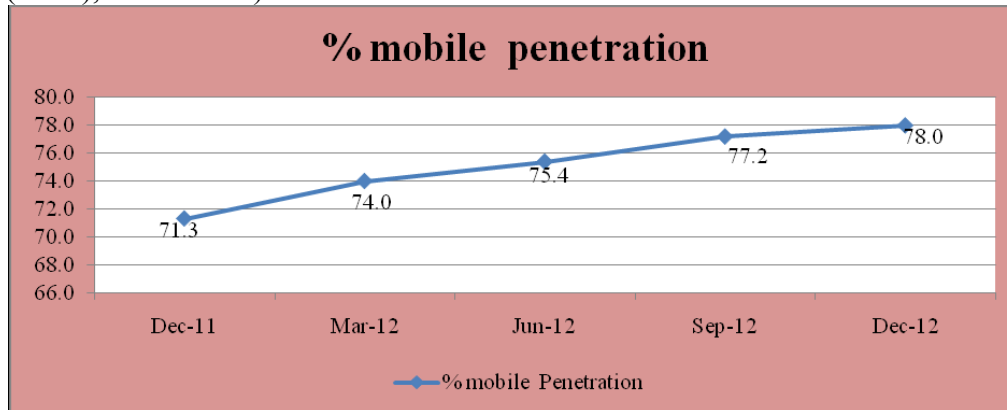
### 2.2 Growth of Mobile Internet in Africa

Africa is projected to report an additional 224 million mobile users over the next five years, bringing mobile phones to 68 % of the continent's population. Mobile phones in Africa are increasingly being used as a media to get information and to use value added services. Whether; checking market prices, transferring money or simply checking the latest news, Facebook or Wikipedia, mobile phones are transforming life in Africa. Their increased use has led to an increase in the demand of convenient mobile service provisions. These services include mobile money transfer, mobile banking and mobile ticketing. Inevitably, the African mobile Internet market is due for a major transformation. The number of mobile Internet subscribers in Africa has increased dramatically in the last 18 months, particularly in East Africa. In Kenya alone, mobile Internet subscribers grew from 1.5 Million in Q3 to 3.1 in Q4, 2009/2010 (Communications Commission of Kenya (CCK), 2009-2010). Smart phone and feature rich phones make up as much as 30% or more of the market in countries with higher numbers of mobile Internet subscribers (Rao, 2011).

### 2.3 Growth of Mobile Internet in Kenya

Mobile penetration reached 78% per 100 inhabitants by the end of the quarter under review up from 77.2% per 100 inhabitants recorded during the previous period (Sept 2012). This

represented an increase of 0.8 percentage points, compared to the same period the previous year, an increase of 6.7 percentage points was recorded (Communications Commission of Kenya (CCK), 2012/ 2014).



**Figure 2: Mobile Penetration – Kenya**  
Source: CCK Operators' Returns

As seen on the table below, Mobile Internet subscribers grew from 8.4 Million in Q3 to 9.4 Million in Q4 (Communications Commission of Kenya (CCK), 2012/ 2014).

| Internet/Data Subscriptions                             | Dec-12            | Sep-12            | Quarterly Variation (%) | Dec-11           | Annual Variation (%) |
|---|-------------------|-------------------|-------------------------|------------------|----------------------|
| <b>Total Internet Subscriptions</b>                     | <b>9,496,573</b>  | <b>8,519,148*</b> | <b>11.5</b>             | <b>5,423,428</b> | <b>75.1</b>          |
| <b>Mobile Data/Internet Subscriptions</b>               | <b>9,406,843</b>  | <b>8,436,578</b>  | <b>11.5</b>             | <b>5,376,050</b> | <b>75.0</b>          |
| <b>Terrestrial Wireless Data/Internet Subscriptions</b> | <b>23,814</b>     | <b>23,780</b>     | <b>0.1</b>              | <b>13,059</b>    | <b>82.4</b>          |
| <b>Satellite Data/Internet Subscriptions</b>            | <b>684</b>        | <b>531</b>        | <b>28.8</b>             | <b>811</b>       | <b>-15.7</b>         |
| <b>Fixed DSL Data/Internet Subscriptions</b>            | <b>10,807</b>     | <b>10,842</b>     | <b>-0.3</b>             | <b>11,016</b>    | <b>-1.9</b>          |
| <b>Fixed Fibre Optic Data/Internet Subscriptions</b>    | <b>54,400</b>     | <b>47,392</b>     | <b>14.8</b>             | <b>22,467</b>    | <b>142.1</b>         |
| <b>Fixed Cable Modem Subscriptions</b>                  | <b>25</b>         | <b>25</b>         | <b>0.0</b>              | <b>25</b>        | <b>0.0</b>           |
| <b>Total Internet Users<sup>8</sup></b>                 | <b>16,236,583</b> | <b>14,553,378</b> | <b>11.6</b>             | <b>8,936,165</b> | <b>81.7</b>          |

**Table 1: Internet subscriptions and internet users**  
Source: CCK Operators' Returns

Further breakdown break down of Mobile Data/ Internet Subscription per operator is as show on the table below

| Name of Operator                     | Dec-12           | Market Share (%) | Sep-12           | Market Share (%) |
|--------------------------------------|------------------|------------------|------------------|------------------|
| <b>Safaricom Limited</b>             | <b>6,830,796</b> | <b>72.6</b>      | <b>5,586,050</b> | <b>66.2</b>      |
| <b>Airtel Networks Kenya Limited</b> | <b>1,095,945</b> | <b>11.7</b>      | <b>1,278,013</b> | <b>15.1</b>      |
| <b>Telkom Kenya Limited (Orange)</b> | <b>853,962</b>   | <b>9.1</b>       | <b>948,847</b>   | <b>11.2</b>      |
| <b>Essar Telecom Kenya Limited</b>   | <b>626,140</b>   | <b>6.7</b>       | <b>623,668</b>   | <b>7.4</b>       |

**Table 2: Mobile Data/Internet Subscriptions by Operator**  
Source: CCK, Operators' Returns

### 3. Mobile Learning

The approach to mobile learning is gradually shifting from merely putting e-learning course materials into a smaller package so that they can be played on a mobile device. Rather, it is thinking differently about learners and the new possibilities that being both mobile and connected can offer to employees who want to learn something “on the fly” (Woodill, 2010). This can very well be applied to all people in organisations and institutions of learning.

#### 3.1 Mobile Learning Trends

Mobile learning these days is about more than just remote access; it is also a matter of flexibility (Cournoyer, 2013). Learning should be flexible and mobile. So much of what Millennials do now is “off the clock” (Cournoyer, 2013). Social learning should be

encouraged especially now with the increase in the use of social media platforms like Facebook, twitter etc., which can easily be accessed on mobile devices. Mobile applications are also growing in their flexibility of access and presentation of content, both online as well as offline. (Davis, 2012), talks highly about a mobile application named *Pocket* (Formerly *Read It Later*). This application allows users to store web content that they would like to access later. Users only need to ‘pocket’ the webpages and this application automatically synchronizes to their phones, tablets or computers so they can view it any time, even without internet connectivity.

### **3.2 Mobile Learning Myths**

These are a few concerns that have been raised about mobile learning. At times, mobile phones are perceived as being disruptive, addictive, increasing anti-social behaviour, harmful to health, or a means of accessing undesirable content. Below are a few other myths about m-learning, as identified during other mobile learning surveys elsewhere.

#### **1. Screen size is too small**

While mobile phones do not have screens as large as desktop computers, ‘mobile devices’ also include tablets and devices such as e-book readers. These screens are certainly large enough. Mobile devices with smaller screens are often used in different ways from more fixed technologies and are heavily context-aware (Belshaw, 2012).

#### **2. Consistency of mobile learning standards (or lack thereof)**

Initially, SCORM was seen as the de facto standard for e-learning products. With the development of HTML5, CSS3 and other frameworks, along with the various app stores (iOS, Android, BlackBerry), however, existing content is becoming a lot more mobile-friendly (Belshaw, 2012).

#### **3. Mobile devices distract students while learning**

Whilst it is true that mobile devices with notification features turned on can be detrimental to sustained concentration, the fault lies not in the mobile device but in its use. The appropriate use of technology in a given context is a socially-negotiated process (Belshaw, 2012).

#### **4. Mobile learning is all about learning on the move**

Mobile learning may be about the mobility of the learner, but this is to do with moving across contexts rather than accessing content while being on the move. This could be in a context that suits the individual learner, for example on public transport, waiting in a queue, or sitting in a favourite chair at home. Alternatively, it could be in a context more suitable and appropriate for teaching (Belshaw, 2012).

#### **5. Young people already know how to use mobile devices for learning**

The use of mobile devices by young people for social activities does not mean they know how to use them for learning. Educators should be aware of, and continue to experiment with, new ways of using mobile (and other) technologies for learning within their discipline (Belshaw, 2012).

#### **6. Mobile learning is only possible with ‘costly’ smartphones**

In contrast to other information and communication technologies (ICTs), mobile phones are already in the hands of students and teachers. This can represent less cost than equipping schools with computers. Mobile phones need to be seen as an opportunity to leverage existing technological uptake (UNESCO, 2011).

#### **7. Mobile devices are unreliable for learning as they are likely to be lost, broken or stolen.**

Mobile devices tend to be both expensive for their size (and therefore desirable to thieves) as well as being easy to lose or damage. The MoLeNET programmer, however, found that of 10,000 handheld devices purchased across various projects, less than 2% were damaged, lost or stolen. Just as it can be a good idea to have spare versions of older technologies such as

pens and books, so it is sensible to have spare mobile devices in the case of various eventualities (Belshaw, 2012).

#### **8. Nomophobia**

Nomophobia is considered a 'new-age' myth. Students respond to requests to shut off their phones with a sense of panic, a feeling that they will be cut off from their world of personal relationships. This feeling, taken to its extreme, has been dubbed "nomophobia," the fear of being forced to shut off a phone, or the obsessive worry of losing a phone. There is even a support web site for nomophobics (Belshaw, 2012).

#### 4. METHODOLOGY

This research study employed both primary and secondary research methods to explore the possibility of implementing a mobile learning platform on campus. Methods such as questionnaires, desktop research and focus group discussions aided the research process in gathering information.

Beginning in 2012, Strathmore University enrolled approximately 4600 students. A standard sample size formula was used to calculate the sample size.

$$SS = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)}$$

$X^2$  = The value of Chi-Square @ *d.f.* = 1 for desired confidence level  
.10 = 2.71 .05 = 3.84 0.1 = 6.64 0.001 = 10.83

$N$  = Population Size

$P$  = Population proportion (assumed to be .05)

$d$  = Degree of accuracy (expressed as a proportion)

##### Parameters Used:

- Total Population: 4600
- Sample Size: 531
- Confidence Level: 95%

#### 4.1 Questionnaires

Most of the information to be collected was statistical. Questionnaires were used mainly because the data collected was statistical in nature. The sample size of 531 students spread across different faculties was considerably large. Considering the short research period available, questionnaires were the most suitable tools to use and quite cost effective (Rao, 2008). A good number of questionnaires were completed online. Some were printed to facilitate the process of distributing them to students.

Moodle Questionnaire, an open source plug-in available for Moodle 1.x, 2.x platforms, was used to analyse the data collected from the questionnaires.

##### Questionnaire 1

As mentioned earlier, the target sample for the first questionnaire was 531 students. This figure was chosen as it would give the research a low margin of error since the chosen confidence level was 95%. The questionnaire was available both online (Strathmore e-learning website) and in hard copies.

Apart from demographics, Questionnaire 1 particularly investigated the aspects outlined below, which are born from our variables of interest in this research:

- ▶ The kind of mobile devices owned by students: Students were required to state the make and model of their phones, as well as the operating system it ran on (Android, Symbian, BlackBerry, etc.)
- ▶ The students' perception towards mobile learning and if they think it would boost their performance or change their study habits in anyway. We were also keen to know if they would prefer reading on mobile devices as opposed to reading on computers.
- ▶ Their expectations in regards to the kind of learning materials and formats (video, audio, formatted documents, flash animations, etc.).



► Of interest to us also was, the alternative methods they used to connect to the Internet on other devices they had (e.g. laptops, tablets, PCs, etc.) either while on campus or away from campus.

### **Questionnaire 2**

This questionnaire was in many ways similar to the first questionnaire. The only difference was that it focused on those students who were going to physically experience mobile learning. The lecturers who were willing to engage their class in this survey submitted their class notes for conversion, so that their students would be able to access the class material on their mobile phones. This questionnaire collected information about the kind of devices owned by students in these classes. This was a one-page questionnaire. Analysis of the data collected from the respondents was done on Moodle. Data collected from each class was analysed separately. This analysis informed the research about the specific number of students able to undertake mobile learning in each class by identifying those who had mobile devices with the capability to access the learning material created.

### **Questionnaire 3**

A third questionnaire aided the collection of feedback on the user experience, connectivity and students' perceptions after having a practical mobile learning experience. This questionnaire emphasised on the qualitative aspects of the research. Respondents were required to briefly explain their experiences so as to capture their perceptions. This questionnaire, however, had some quantitative areas which were analysed on the Moodle questionnaire platform.

## **4.2 Desktop Research and Application Testing**

Research on mobile learning implementations around the world, and especially within Africa, was conducted. The purpose of this was to gain knowledge on the different m-learning implementation practices elsewhere, the challenges faced, tools used and the outcome of each successful implementation.

Various tools and document formats were tested before selecting the most suitable ones for mobile learning. The tools included mobile reader applications and document conversion software.

Up to 15 mobile reader applications were tested using different types of phones running on different platforms: namely Android, BlackBerry, Symbian and Java (feature phones).

A total of five document authoring tools were sampled for testing. They were tested on compatibility with operating systems (Windows and Unix-based systems), supported file formats as well as the output quality of eBooks.

Six document formats were tested for their ability to display content on mobile devices while retaining the quality of the original document. The extent to which these document formats were tested was limited to the mobile reader applications that supported them and the type of mobile phone used.

## **4.3 Focus Group Discussions**

After students had experienced learning on mobile for a one-week period, they were engaged in a focus group discussion. The purpose of this was to get general qualitative feedback on the entire mobile learning experience.

Areas of interest:

- Students' experience while using the eBook readers; the whole process of installing the applications, downloading eBooks and reading.
- Concerns about formatting of the notes and how that affected navigation through documents, positioning of internal links and table of contents, and accessibility of the navigation links and the table of contents.

In a typical focus group discussion there were 5-10 students who were open enough to express their perceptions about mobile learning and, in some cases, suggested improvements. The discussions were recorded for more analysis that would be done later.

## 5. FINDINGS AND DISCUSSIONS

### 5.1 Questionnaire 1

The total population of students in Strathmore University was 4627 (January 2012). Of these, 531 (8.148%) completed Questionnaire 1. This questionnaire helped to ascertain the readiness of the students for mobile learning. This was achieved by analyzing aspects such as method of mobile Internet access while in the university, their perception towards mobile learning and the type of devices that students have.

**Mobile Internet access** was a key variable of concern. Statistics showed that 94 per cent of the students can access mobile Internet. This includes both broadband and Wi-Fi users. Going by the recent statics and predictions, this figure is expected to grow as Internet-enabled mobile phones become more affordable. Figure 4.1.1 (below) illustrates the findings.

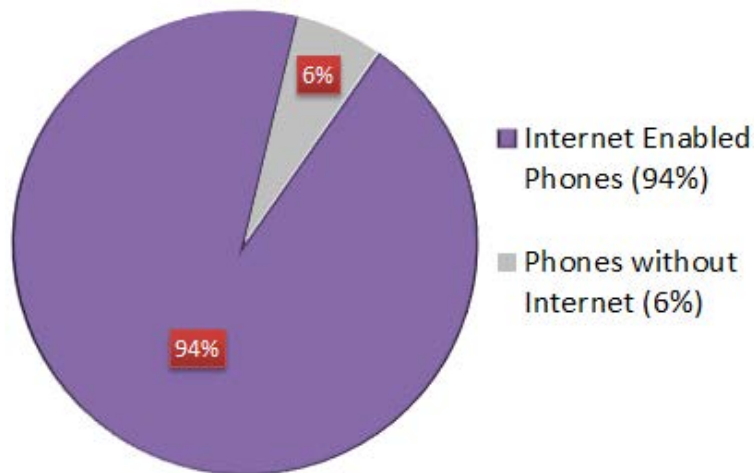


Figure 3: Mobile Internet Access

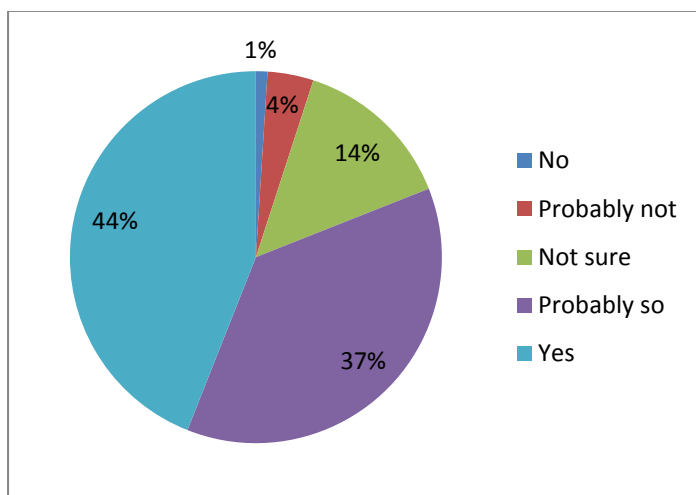
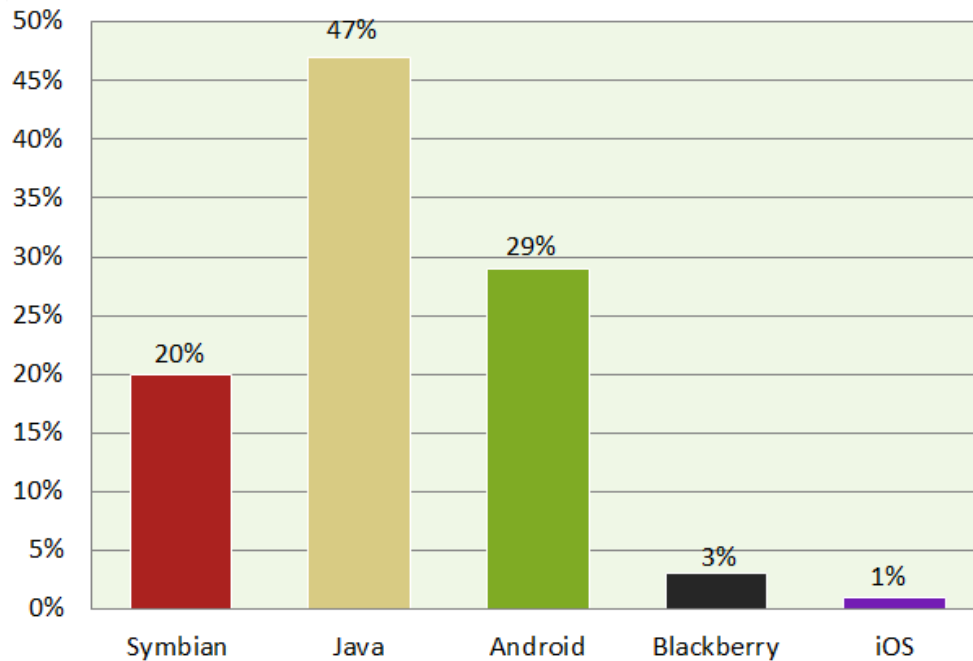


Figure 4: Student's perception of m-Learning

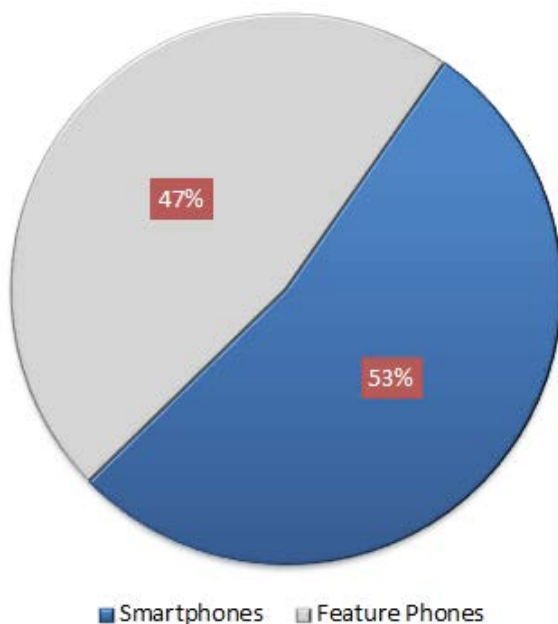
To capture the **students' perceptions** of mobile learning, we asked them whether they think mobile learning will improve their performance in class. 81% of the students gave a positive

response; 44% said yes they were sure, 37 per cent said probably so. Figure 4.1.2 (above) represents their responses.

This research also explored the different **mobile phone platforms** represented among the student population at Strathmore University. Students were asked to name their phone’s operating system (if present), the make and model. The figure below illustrates these findings.



**Figure 5: Mobile Phone Platform**



**Figure 6: Smartphones vs. Feature Phones**

Those in possession of smartphones and feature phones could be identified as the questionnaire required the students to state the makes and models of their mobile devices.

A combination of all Symbian, Android and BlackBerry smartphones totals up to be more than the number of feature phones in Strathmore University.

This indicated a high level of readiness for mobile learning within the institution.

Figure 4.1.4 (left) illustrates these findings.

## 5.2 Mobile Reader Applications

Mobile reader applications were gathered for testing. The platforms targeted were Java, Symbian, Android and BlackBerry since most students owned phones that used these platforms. The findings are shown in the below.

| Readers       | Document Formats                        | Supported Platforms   | Editing (Phone/PC)  | Pros/Cons  | Cost   |
|---------------|---|---|---|--|--|
| iSilo Reader  | iSilo, .pdb                             | Android, BlackBerry (also touch), Windows Mobile, Symbian (UIQ, UIQ3, 60 3rd, 80), WebOS, IOS | Phone: No<br>PC: Yes (iSiloX)   | <b>Pros:</b> wide variety of platforms, supports links, images, tables<br><b>Cons:</b> Symbian version issues - takes too long loading documents                                 | Android \$15.99, Symbian \$19.99, BlackBerry \$15.99, IOS 3.x \$9.99 |
| eReader       | .pdb                                    | Android, Symbian, BlackBerry, Windows Mobile, PalmOS, IOS                                     | Phone: No<br>PC: Dropbook (free Windows/MacOS), eBook Studio (not free) | <b>Pros:</b> supports hyperlinks, images, bookmarks, footnotes, online libraries/bookstores<br><b>Cons:</b> only loads eBooks from online stores                                 | Free   |
| MobiPocket    | .mobi, .doc                             | Symbian, BlackBerry, Windows Mobile, Palm OS, webOS, Psion, Kindle, iOS, Java(beta)           | Phone: No<br>PC: Yes  | <b>Pros:</b> multiple doc formats support.<br><b>Cons:</b> Some Symbian versions not supported (5800, N97, most low-end Nokia devices)   | Free   |
| Albite Reader | .epub                                   | Java, Symbian   | Phone: No<br>PC: No   | <b>Pros:</b> covers most Symbian platforms, easy to use, dictionary support, bookmarking,<br><b>Cons:</b> tables & hyperlinks not supported                                      | Free   |
| WordPlayer    | .epub                                   | Android   | Phone: No<br>PC: No   | <b>Pros:</b> free, easy to use, connects to online eBook stores, it's free<br><b>Cons:</b> only supports ePub, poor support for internal links, incredibly slow in loading pages | Free   |
| FBReader J    | epub, fb2, mobipocket (partially), .pdb | Android, Symbian (beta), Meego (beta)   | Phone: Yes (limited)<br>PC: Yes   | <b>Pros:</b> supports hyperlinks, bookmarks<br><b>Cons:</b> Symbian and Meego Versions installation difficulties.  | Free   |
| Adobe         | .pdf                                    | Symbian S60.x,  | Phone: No   | <b>Pros:</b> Rendering of text,  | \$9.99   |

|                       |                                       |                  |                                  |   |                                   |
|-----------------------|---------------------------------------|------------------|----------------------------------|---|-----------------------------------|
| Reader LE 2.5         |                                       | Android, iOS     | PC: Yes                          | tables and images is good, ease of navigation, bookmarks<br><b>Cons:</b> not free                                     |                                   |
| iReader               | .pdb, .mobi                           | Android          | Phone: NO<br>PC: No              | <b>Pros:</b> Easy to use,<br><b>Cons:</b> not free, no table/hyperlink support  | \$1.99                            |
| Aldiko                | .epub                                 | Android          | Phone: No<br>PC: No              | <b>Pros:</b> Supports Images, internal and external links,<br><b>Cons:</b> problem displaying large images.           | Free (some versions are not free) |
| Foliant (v0.7.3 beta) | .epub, .fb2 and .txt                  | Symbian, Android | Phone: No<br>PC: No              | <b>Pros:</b> Supports internal links and images<br><b>Cons:</b> heavy on low-end devices, slow on Symbian smartphones | Free                              |
| Tequila Cat           | .txt, .rtf, .pdf, .pdb/.prc and .html | Symbian          | Phone: No<br>PC: Yes (Converter) | <b>Pros:</b> light application<br><b>Cons:</b> eBook formats created don't support links                              | Free                              |
| AnyView Reader        | .txt, .html, .pdb and .udm            | Java Phones      | Phone: NO<br>PC: NO              | <b>Pros:</b> free,<br><b>Cons:</b> no links, no images, no tables   | Free                              |
| EPUB Reader           | .epub                                 | BlackBerry       | Phone: No<br>PC: No              | <b>Pros:</b> (not tested)<br><b>Cons:</b> not free  | \$1.99                            |
| Book Reader           | .epub, .txt, .mobi, fb                | BlackBerry       | Phone: No<br>PC: No              | <b>Pros:</b> Supports images and non-DRM books (not tested)<br><b>Cons:</b> not free                                  | \$0.99                            |
| Buku Reader           | .epub, .txt                           | BlackBerry       | Phone: No<br>PC: No              | <b>Pros:</b> Opens Non-DRM books.<br><b>Cons:</b> no mention of support for links, not free                           | \$2.99                            |

### 2.1.1 Discussion

There are some important features that guided the selection of suitable mobile reader applications. They include;

- Ease of installation.
- Loading speed for eBooks
- Variety of document formats supported.
- General user experience:
  - Positioning of menus
  - The ability to customize to user preferences (fonts, color, text alignment, screen orientation etc.)
- Efficiency in battery consumption.
- Support for images (zooming in/out).

To ease our understanding of how the mobile reader applications were used to deliver mobile learning, the study focused on the four most common mobile platforms: Symbian, Java, Android and BlackBerry.

### 5.2.1.1 *Android*

In Strathmore University approximately 1,334 students (29%) have Android smartphones. There is a wide variety of open source mobile reader applications that can be downloaded directly from the app stores. A number of tests were done to determine the most suitable one. Tests focused on attributes such as:

- User interface and ease of navigation.
- Additional features such as a document library
- Ability of the application to incorporate external libraries

Of all the readers evaluated, *FBReaderJ* offered the best performance and user experience, hence it was selected for Android users.

### 5.2.1.2 *Symbian & Java*

A large number of mobile document readers were tested under this category. Some of which were very specific to the device platforms, other specific to versions of phones produced. For instance, a reader meant for Nokia N93 smartphones may not work on a Nokia N97 smartphone. A number of readers that offer alternatives were identified.

### 5.2.1.3 *MobiPocket*

*MobiPocket* (<http://www.mobipocket.com/>) has many variations. Table 5.1 below shows mobile phone versions which *MobiPocket v6.2* can be installed and used. Table 4.2.2 below shows a summary of supported mobile phone makes and models.

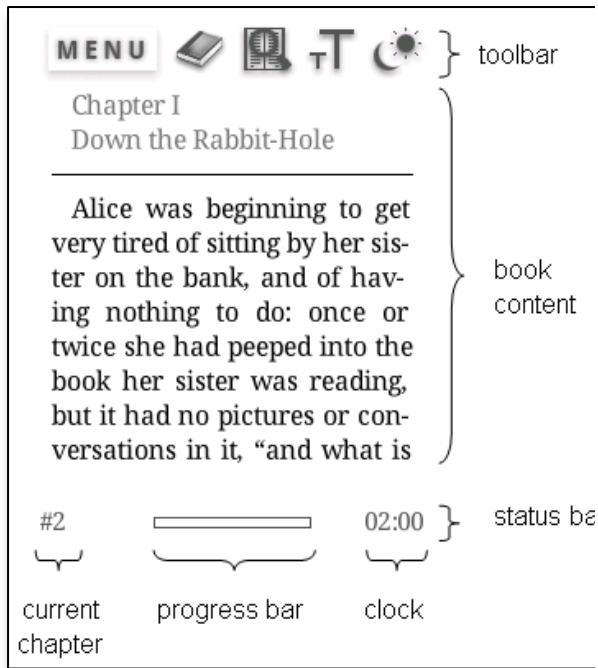
| Reader                 | Supported Makes & Models   |
|------------------------|--|
| <i>MobiPocket v6.2</i> | <p><b>Nokia</b><br/>3600/3620/3230/3250/3650/3660/5500/6260/6620/6630/6670/6680/6681/6682/6600/7650/7610/7710/E50/E60/E61/E62/E70/N71/N73/N75/N80/N91/N92/N93/N93i/N95/N70/N72/N90/N-Gage/N-Gage/9210/9290/9300/9500</p> <p>QD - <b>Siemens SX</b></p> <p><b>Sony Ericsson</b> P800/P900/P910 - Motorola A920/A925/A1000/M1000 - BenQ P30</p> <p><b>Sony Ericsson</b> M600/P990/W950</p> <p>(Mobipocket reader doesn't support the Symbian S60 5th Edition (that means the touch enabled versions e.g. Nokia 5800, N97))</p> |

**Table 3: Supported Makes and Models**

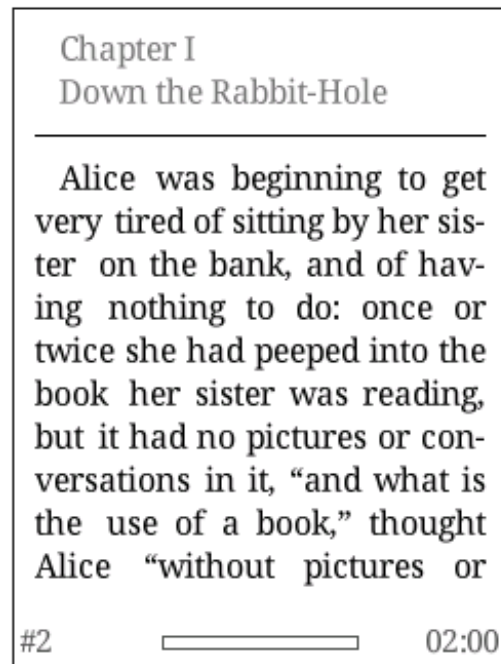
### 5.2.1.4 *Albite Reader*

Another good example is *Albite Reader* – by Svetlin Ankov (<http://albite.org/reader>).

The reader works on most Symbian and Java-based phones. It is available for both low-end and high-end phones in this category. Development of the *Albite Reader 3* is currently underway. New features of this reader are mostly user-driven. Internal navigation links (anchors), other book formats supported, more languages supported, indexing of chapters, embedded dictionaries – these are just but a few of the 43 ideas yet to be implemented. Figure 8 and 9 below show the interface of the reader.



**Figure 7: Albite Reader Layout**  
 Source: <http://albite.org/reader>



**Figure 8: Albite Reader Full Screen Movie**  
 Source: <http://albite.org/reader>

Symbian and Java devices supported by *Albite Reader* are in the table below.

| Albite Reader Version     | Supported Devices  | Memory Requirements |
|---------------------------|--|---------------------|
| Albite READER HD 2.2      | Nokia N8-00, Nokia E7-00, Nokia X6-00, Nokia C7-00, Nokia C6-00, Nokia C5-03, Nokia 5800 XpressMusic, Nokia 5531 XpressMusic, Nokia 5250, Nokia 5230 Nuron, Nokia N97  | 3000 – 10000KB      |
| Albite READER 2.2         | Samsung GT-S5230 (Star), Samsung Impression  | 1500 – 6000KB       |
| Albite READER NoTouch 2.2 | Nokia X5-01, Nokia E5-00, Nokia C5-00, Nokia N96, Nokia N95, Nokia N91, Nokia N85, Nokia N80, Nokia E72, Nokia E61, Nokia E50, Nokia 6760 slide, Nokia 6720 Classic, Nokia 6710 Navigator, Nokia 6220 Classic, Nokia 6124 Classic, Nokia 6120, Nokia 5730 XpressMusic, Nokia 5700 XpressMusic, Nokia 5630 XpressMusic, Nokia 5500 Sport ,Nokia 5320 XpressMusic, Nokia 3250, Sony Ericsson J105i | 1500 – 6000KB       |
| Albite READER Light 2.2   | Nokia 3720 Classic, Nokia 5130 XpressMusic   | 500 – 1500KB        |
| Albite READER Tiny 2.2    | (Basic java phones with 500KB or less memory)  | 500KB               |

**Table 4: Supported Java and Symbian Devices**

### 5.2.1.5 *BlackBerry*

Most BlackBerry phones come with reader applications for PDF and, in some rare cases, DOC or PPT. Mobipocket eBook Reader runs on all BlackBerry devices with a firmware 3.7 or higher. The table below summarizes the supported versions.

| Device Model           | Version   |
|------------------------|---|
| BlackBerry Curve       | BlackBerry 8300, BlackBerry 8310, BlackBerry 8320   |
| BlackBerry 8800 series | BlackBerry 8800, BlackBerry 8820, BlackBerry 8830   |
| BlackBerry Pearl       | BlackBerry 8100, BlackBerry 8110, BlackBerry 8120, BlackBerry 8130  |
| BlackBerry 8700 series | BlackBerry 8700c, BlackBerry 8700f, BlackBerry 8700g, BlackBerry 8700r, BlackBerry 8700v, BlackBerry 8703e, BlackBerry 8705g, BlackBerry 8707g, BlackBerry 8707h, BlackBerry 8707v... |
| BlackBerry 7100 series | BlackBerry 7100g, BlackBerry 7100i, BlackBerry 7100r, BlackBerry 7100t, BlackBerry 7100v, BlackBerry 7100x, BlackBerry 7105t  |
| BlackBerry 7130 series | BlackBerry 7130c, BlackBerry 7130e, BlackBerry 7130g, BlackBerry 7130v...   |
| BlackBerry 7200 series | BlackBerry 7230, BlackBerry 7250, BlackBerry 7280, BlackBerry 7290...   |
| BlackBerry 7500 series | BlackBerry 7520   |
| BlackBerry 7700 series | BlackBerry 7780   |

**Table 5: MobiPocket Reader - Supported by BlackBerry Devices**



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## APPENDIX

### APPENDIX 1: MOBILE LEARNING QUESTIONNAIRE 1



**Strathmore**  
UNIVERSITY

## MOBILE LEARNING QUESTIONNAIRE

This survey aims to identify the possibility and suitability of implementing a Mobile Learning System in Strathmore University. The system will enable students to have access to class contents anytime anywhere using their mobile phones.  
Thank you for taking time to fill in this form. Be assured that the information collected will be considered private and confidential, and used only for purposes of this research.

### SECTION 1

**Name (Optional):** \_\_\_\_\_

**Age:**  18-23  24 and above

**Gender:**  Male  Female

**Faculty/School:**

- FIT (Faculty of Information Technology)
- SMC (School of Management Commerce)
- SOA (School of Accountancy)
- SOL (School of Law)
- SHSS (School of Humanities & Social Studies)
- SFAE (School of Finance & Applied Economics)

**Course:** \_\_\_\_\_ (e.g. BBIT, BCOM, MSc IT)

**Program:**  Full-Time  Part-Time

**Year:**  1<sup>st</sup> Year  2<sup>nd</sup> Year  3<sup>rd</sup> Year  4<sup>th</sup> Year

### SECTION 2

**Q1.** What is the make and model of your mobile phone?

| MAKE          | SPECIFY MODEL (e.g. 5330, U8800, SGH480C) |
|---------------|---|
| Nokia         |   |
| Samsung       |   |
| Motorola      |   |
| Sony Ericsson |   |
| LG            |   |
| IDEOS         |   |
| Blackberry    |   |
| iPhone        |   |
| HTC           |   |
| Other: _____  |   |

**Q2.** Is your phone internet enabled?

Yes  No

**Q3.** Which mobile phone browser do you prefer to use?

- Opera Mini
- Firefox
- Default phone browser
- Other \_\_\_\_\_

**Q4.** Which operating system does your phone run on?

- Symbian
- Java
- Android
- iOS
- Blackberry
- I don't know
- Other \_\_\_\_\_

**Q5.** Which of the following mobile computing/communication activities do you regularly engage in? (Tick all that apply)

- Listen to pod casts/audio books
- Read e-books/print-based content
- View streaming movies/video clips
- Send and Receive e-mail
- Send and Receive SMS
- Transfer files via portable storage devices (USB drive)
- Play interactive games on the Internet
- Post status updates to social media sites (Facebook, Twitter, and LinkedIn)
- Mobile video conferencing (Skype)
- Browse the web
- Work collaboratively on shared documents (Google docs, Wiki, Drop box)
- Other \_\_\_\_\_

**Q6.** Where do you MOST often use your mobile phone?

- At home
- In school
- On transit/on the road
- Other (Please specify) \_\_\_\_\_

**Q7.** Given an option would you prefer accessing e-learning resources on your phone (mobile learning) or on your computer?

- Phone                       Computer

If your choice is "Phone", tick the possible reasons that guided your choice

- Anytime, anywhere access to content
- More fun because of social network focus
- Enhance interaction between and among students and instructors
- Great for just-in-time training or review of content
- More personalized learning

**Q8.** What type (format) of learning content would you prefer to view on your mobile phone?

- Slides
- Formatted text
- PDF
- Animations
- Videos Audio

**Q9.** What features would you like to see in a mobile learning system? (Please tick appropriately)

- Document reader
- Document editor
- Download/View slides (PDF & PowerPoint)
- Submit assignments & CATs
- Discussion room/forum
- Other? (Please specify) \_\_\_\_\_

**Q10.** Are you comfortable installing software on your mobile phone?

- Completely uncomfortable
- Somewhat uncomfortable
- Not sure
- Somewhat comfortable
- Completely comfortable

**Q11.** Do you think accessing course material such as slides & quizzes through your mobile phone would be beneficial to your study process?

- Don't think so
- Somewhat don't think so

- Not sure
- Somewhat think so
- Think so

Briefly explain your choice: \_\_\_\_\_

---

**Q12.** Do you think using a mobile learning application would improve your overall performance in class?

- No
- Probably not
- Not sure
- Probably
- Yes

Briefly explain your choice: \_\_\_\_\_

---

**Q13.** Would you purchase a better mobile device if you thought it would improve your performance in class?

- No
- Probably not
- Not sure
- Probably
- Yes

**Q14.** Which other device (s) do you own? (Tick all that apply)

- Laptop/ Notebook PC
- Desktop PC
- Tablet
- Other (Please specify)\_\_\_\_\_

**Q15.** How do you access internet on the device(s) in Q14 outside the University ? (Tick all that apply)

- Safaricom Modem
- Orange Modem
- Yu modem

- Airtel modem
- LAN
- Friends/Parents/Relatives work place
- Cybercafé
- Other (please specify) \_\_\_\_\_

## APPENDIX 2: MOBILE LEARNING BRIEF QUESTIONNAIRE



### MOBILE LEARNING QUESTIONNAIRE

Q1. What is the make and model of your mobile phone?

| MAKE          | SPECIFY MODEL (e.g. 5330, U8800, SGH480C) |
|---------------|---|
| Nokia         |   |
| Samsung       |   |
| Motorola      |   |
| Sony Ericsson |   |
| LG            |   |
| IDEOS         |   |
| Blackberry    |   |
| IPhone        |   |
| HTC           |   |
| Other: _____  |   |

Q2. Is your phone internet enabled?

- Yes                       No

Q3. Which mobile phone browser do you prefer to use?

- Opera Mini  
 Firefox  
 Default phone browser  
 Other \_\_\_\_\_

Q4. Which operating system does your phone run on?

- Symbian  
 Java  
 Android  
 iOS  
 Blackberry  
 I don't know  
 Other \_\_\_\_\_



## APPENDIX 3: FEEDBACK FORM



### MOBILE LEARNING FEEDBACK FORM

This survey aims to identify the possibility and suitability of implementing a Mobile Learning System in Strathmore University .

This feedback form is for those who have used materials provided by @iLabAfrica for the mobile learning survey.

Thank you for taking time to fill in this form. Be assured that the information collected will be considered private and confidential, and used only for purposes of this research.

#### **SECTION 1** LEARNERS' PERCEPTION

1. Given mobile learning materials/notes for a full semester, would you learn continuously using your mobile device?

- Yes
- No

2. What reason(s) guided your choice above?

---

---

3. With the limitations of your mobile phone (such as screen-size, memory, storage space, internet speeds), would you purchase a better device if m-learning improved your performance?

- Yes
- No

4. Briefly explain why...

---

---

5. What other types/formats of learning content would you like to use on your mobile phone? (select all that apply)

- Video tutorials
- Audio tutorials
- Quizzes for self-practice
- Short-hand notes for revision

**SECTION 2 USER EXPERIENCE.**

6. How was your experience while installing the mobile reader application on your phone?

- Very easy
- Easy
- Not complicated
- Complicated
- Very complicated

7. On average, how much time did you take to understand how the eReader application works?

- Less than 5min
- Between 5 - 10min
- Less than 15min
- More than 15min (Very Complicated)

**SECTION 3 INTERNET CONNECTIVITY.**

8. How did you connect to the Internet when downloading notes?

Wireless network in Strathmore

Safaricom Internet

Airtel internet

Yu Internet

Orange Internet

Cyber Café

Other \_\_\_\_\_

\_\_\_\_\_

9. If you tried several options trying to download the notes, which one was **FASTER**?

\_\_\_\_\_

10. How did you get the notes to your mobile phone?

Downloaded the notes on a computer first, then copied them to my phone

Downloaded directly from e-learning website to my phone

From a classmate's phone using Bluetooth

Other (briefly explain)

\_\_\_\_\_

\_\_\_\_\_

11. Briefly explain why:

\_\_\_\_\_

12. Where did you find it **MOST** appropriate to read notes on your phone?

At home

In School/University

In transit / on the road

Other \_\_\_\_\_  
\_\_\_\_\_

13. Briefly explain why:

---

*Thank you for taking time to fill this feedback form 😊*

