# Influence of Mobile Operating System Characteristics on Adoption of Mobile Devices in Education: The Case of Higher Learning Institutions in Kenya

Peter Namisiko
Department of Information Technology
Mount Kenya University, Kenya
Email: namsiko {at} gmail.com

William Sakataka
School of Post Graduate Studies
Mount Kenya University, Kenya

Sylvester Mackton Wanyama
School of Business and Economics
Mount Kenya University, Kenya

*Abstract*— **Many African countries have greatly improved their Education systems; however, enormous challenges still exist that are yet to overcome. Africa is the fastest growing mobile devices market in the world, with over 640 million subscribers. In some countries (Botswana, Gabon and Namibia), there are more subscriptions than the total population. The mobile workforce's demand for connectivity is driving change in the way Educationists in Higher Learning Institutions (HLIs) use mobile devices. On the other side, mobile devices' manufacturers are also expected to release and support robust and functional mobile device friendly applications for their customers. Research in this area has mainly focussed on application of mobile devices in mobile money transfers such as m-banking, the case in point being MPESA, ZAP and YuCash systems and e-Agriculture. The actual adoption and inclusions of mobile devices in teaching and learning in HLIs remain undetermined. This study seeks to find out the effects of Mobile Operating Systems (MOS) on actual adoption of Mobile Devices in Education in Africa. Descriptive Survey Design will be used in three local Private Universities in Kenya to collect data about students and lecturers on actual adoption of Mobile Devices in Education. It is hoped that the findings of this study serve as a basis for educational administrators and mobile devices' manufactures to develop devices that are cost effective, user friendly and convenient.**

**Keywords- Mobile devices, Mobile Operating Systems (MOS), Higher Learning Institutions (HLIs)**

## I. Introduction

Use of mobile devices in learning and teaching is becoming popular in HLIs. Even in Kenya, there is a Government policy to roll out the laptop programme in lower primary schools. While technology is not a panacea for all educational ills, today's technologies are essential tools of the teaching and learning processes in Higher Learning Institutions (HLIs). Information and communications technology (ICT) offers the potential to meet the learning needs of individual students; to promote equality of opportunity; to offer high quality learning materials; and to increase self efficacy and independence of learning amongst students of all ages. According to [1], ICT is not only an essential tool for lecturers in their daily work, but it also offers them opportunities for their own professional development. It can be used to encourage new ways of working as part of professional learning teams and it offers schools themselves the possibility of a faster route to establishing a meaningful role in the wider community, embracing learners of all ages, linking and networking to other educational establishments and bringing professionals together across a range of areas. The Mobile service industry has been identified in Africa as the fastest growing sector among all the sectors of the economy [1]. The utilisation of this sector as an ICT tool to fast track the development of teaching and learning cannot be overemphasized.

Globally, mobile device's penetration across the globe is at 85% of the world's total population. This translates to 5.98 billion mobile devices subscriptions. From this statistics, Africa has about 644 Million subscribers (about 11%) [2]. According to [3], 3G (Third Mobile Generations) and LTE (Long Term Evolution Networks deployments in Africa are quickly gaining momentum (11 million customers are predicted to be connected on these networks by 2015 in Africa). Smartphone penetration rates in Africa are now at a whopping 17 to 19 percent. The rest of mobile device users are split between either 'feature" phones or basic "dumb". [2][4].

Many African countries have greatly improved their Education systems; however, enormous challenges still exist that are yet to overcome. Africa is the fastest growing mobile devices market in the world, with over 640 million subscribers. The use of mobile devices to provide facilitate teaching becomes imperative if ICT is to meet the learning needs of individual students; promotion of equality of opportunity; provision of high quality learning materials.

The use of mobile devices as an extension of electronic learning (e-learning) has the potential to make learning even more widely available and accessible than we are used to in existing e-learning environments [5]. The role that ICT plays in the learning process is a critical success factor. It is within this context that mobile devices can contribute to the quality of education since they offer opportunities for the optimization of interaction between lecturers and learners and among learners. Furthermore, the wireless and mobile technologies within these devices also make it possible to provide learning opportunities to learners that are either without infrastructure for access (for instance, rural learners) or those learners who are continually on the move [5].

The mobile workforce's demand for connectivity is driving change in the way Educationists in Higher Learning Institutions (HLIs) use mobile devices. On the other side, mobile devices' manufacturers are also expected to release and support robust and functional mobile device friendly applications for their customers. Despite the massive opportunities that the mobile devices offer in both teaching and learning processes, adoption and inclusion of these devices in education has remained a mirage. Research in this area has mainly focussed on application of mobile devices in mobile money transfers such as m-banking, the case in point being MPESA, ZAP and YuCash systems and e-Agriculture. The actual adoption and inclusions of mobile devices in teaching and learning in HLIs remain undetermined. So what are the issues affecting the adoption and inclusion of these devices in education? The factors influencing user acceptance of a technology have been thoroughly researched and a number of theoretical frameworks have been developed in an attempt to explain the variables influencing the intention to use a specific technology. Factors such as relative advantage, compatibility, complexity, observability and trialibility, attitudes as have been found to have an influence on the adoption of new innovations and technologies [6][7][8].

In this study, we seek to determine the influence of Mobile Operating Systems (MOS) on actual adoption of Mobile Devices in Education in Africa. Specifically, the study intends to compare the adoption rates of three mobile device operating systems namely: Android Operating Systems, Windows Mobile Operating System and Apple's IOS with a view to determining which features or characteristics in these devices influence the adoption of these devices in education. It is hoped that the findings of this study serve as a basis for educational administrators and mobile devices' manufactures to develop devices that are cost effective, user friendly and convenient in Africa since the situation of Kenya reflects many countries in parts of the Africa.

## II. LITERATURE REVIEW

### *A. Theoretical Framework*

A theory that explains technology adoption will be important in this study. The factors influencing user acceptance of a technology have been thoroughly researched and a number of theoretical frameworks have been developed in an attempt to explain the variables influencing the intention to use a specific technology. The theoretical framework adopted for this study was a combination of Unified Theory of Acceptance and Use of Technology (UTAUT) and Network Effect Theory (NET), from which appropriate constructs will be made as possible determinants of Mobile Operating Characteristics on adoption of mobile devices in education. These frameworks offer various variables to a complete framework for influencers of Mobile Operating System Characteristics on Adoption of Mobile Devices in Education. Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT theory was formulated by Venkatesh and others in "User acceptance of information technology: Toward a unified view". The theory aims to explain user intentions to use an information system and subsequent usage behaviour. The theory holds that four key constructs: Performance Expectancy, Effort expectancy, Social Influence and Facilitating conditions; the first three being direct determinants of usage intention and behaviour, and the fourth a direct determinant of use behaviour [9]. Gender, age, experience, and voluntariness of use are posited to moderate the impact of the four key constructs on usage intention and behaviour. This theory has widely been used in various studies. Mobile Operating systems are critical to an adoption of mobile devices. A Smartphone without good mobile operating systems running on it is barely useful to customers. The characteristics of the mobile operating systems become critical to the adoption of the mobile device. In this study, the mobile operating characteristics which form the performance expectancy and effort expectancy of the UTAUT will include: Speed of Use, Power provided to the user, Applications available for the mobile operating system and Multi-tasking features provided by the MOS.

**Network Effect Theory (NET)**

Network Effect Theory was proposed by Katz and Shapiro. According to this theory, the utility that a given user derives from a good or a service (Network Effect) depends upon the number of other users who are in the same network. A product riding a positive network effect will likely to be a success, because as its network becomes more valuable and more people join, network effect can create a bandwagon effect in a positive feedback loop.

Suppose there are n firms in the market [10]. When choosing a product provided by firm i (i = 1,…,n), consumers consider both the basic value of the product r, as well as this consumer's prediction of the size of the network with which firm i is associated, let it be yie. Hence, the utility of a firm i's consumer xi is determined by

$$U(xi) = r + v(yie) - pi \qquad (1)$$

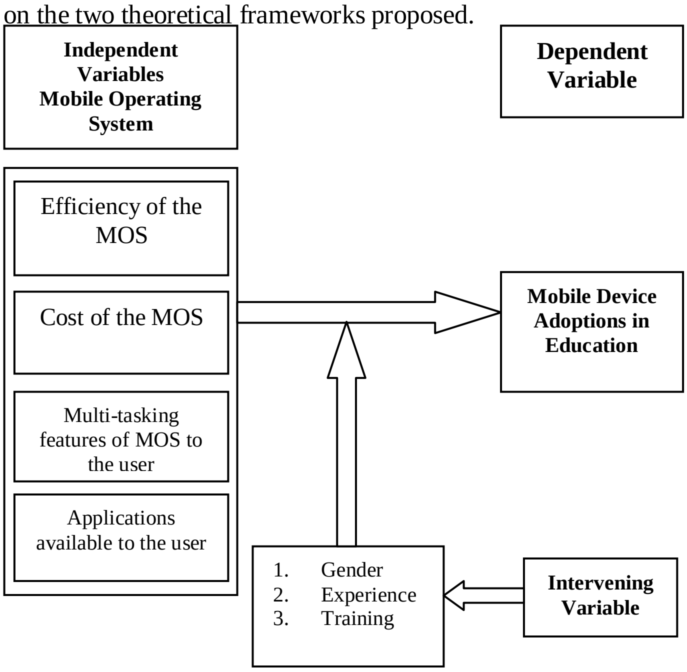
In the formula above, pi is the product price from firm i, and the externality function v(y) is the value the consumer attaches to the consumption externality when the number of subscribers is y. In Katz and Shapiro's model, the externality function is taken to be twice continuously differentiable, with $v' > 0$, $v'' < 0$, and $\lim v'(y) = 0$ as y tends to infinity [10].

MOS is a software platform aimed at a large scale of users that include educationists, so we can apply network effect on it. During adoptions of MOS, consumers buy the mobile device and MOS as a whole, so the actual price of the OS is invisible to Consumers. Consumers can only perceive the basic usability of an MOS (e.g. menu, functions), and passively accept the size of a MOS's network since the MOS are chosen by device makers. In fact, device makers play the roles of agents for consumers when selecting MOS. They will choose an OS with good basic functions r so that consumers would accept it. They will consider the scale of an OS's network v(y) so that their consumers would benefit from the externality. What's more, the price of an OS has a direct impact on device makers' decisions. They tend to choose the OS with a better price pi so that their devices can get a price advantage.

The type of applications the MOS provide is another important fact considering the network effect. A MOS's application software can accelerate its network effect. The improvement of software qualities can make an OS more usable, thus increase the basic value r of the MOS. For another thing, with more applications running on a certain OS, it becomes more attractive to consumers, which increase the size of its user network, so the network value v(y) for consumers goes higher. With two factors increase in (1), consumers gain more utilities, so they tend to choose an MOS with better software usability and wider software variety. In this study, the kind of applications used in Android Operating Systems, Windows Mobile Operating Systems and IOS will be investigated with a view to understanding whether they have an influence on adoption of mobile devices in education.

### *B. Conceptual Framework*

The following conceptual framework can be derived based on the two theoretical frameworks proposed.




### *C. Review of Related Literature*

**Mobile Operating Systems**

An Operating System (OS) is the most critical software element on any running processor-based device. It manages the hardware and software resources within a device and performs and manages basic tasks such as the recognition of input from the device keyboard and generation of output to the device's screen. It also ensures that different programs running at the same time do not interfere with each other. It is responsible for the management of memory and for communication within the device [11]. A Mobile Operating System is an OS that is specifically designed to run on mobile devices such as mobile phones, smart phones, PDAs, tablet computers and other handheld devices. The MOS is the software platform on top of which other programs, called application programs, can run on mobile devices [12]. MOS has applications that assist users to make calls, text messages, taking photos, and so on. The original MOS's were fairly simple, since the capabilities of the phones they supported were limited. Modern mobile devices have added many of the features of a full-fledged computer: high speed CPUs and GPUs, large storage space, multitasking, high resolution screens and cameras, multipurpose communication hardware, and so on. MOS's have had to grow in sophistication to support these features. Examples of MOS include: Android Operating Systems, Windows Mobile Operating Systems, Apples' IOS, Blackberry, Nokia's Symbian Operating System, and Bada Operating System. The application of mobile devices in education requires the MOS that supports smart phones capability. Some MOS such as Symbian OS have diminished in value and are facing extinction. The figure below illustrates the market share that each MOS occupy as at end of the December 2013.

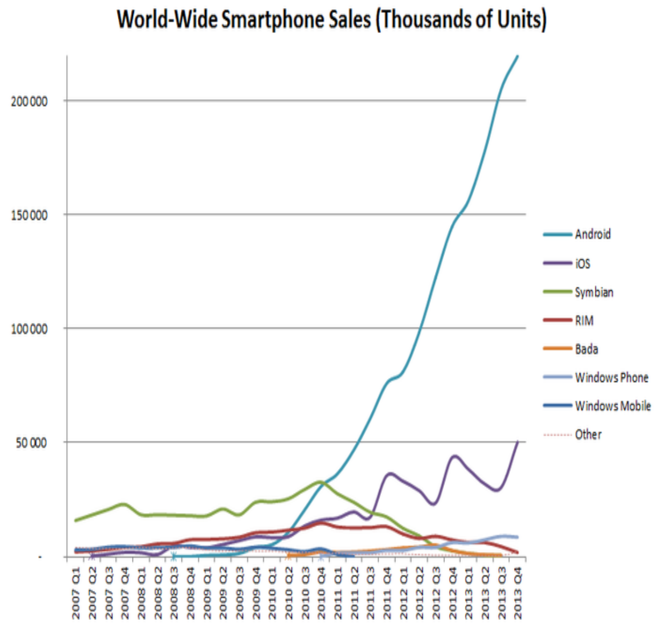



Figure 1: Worldwide Smartphone sales as December 2013
Source: [13]

**Android Operating System**

Google unveiled the Android distribution in November 2007. Most of the Android core is released under the open-source Apache License. Android uses a Linux kernel with higher-level APIs written in C. Applications are normally programmed in Java and run with the Dalvik virtual machine (DVM) using just-in-time compilation to translate Java byte code into Dalvik dex-code. Android Inc. was initially founded by Andy Rubin, Rich Miner, Nick Sears, and Chris White in October 2003 [14]. Although the core OS is open-source, other parts are controlled differently. The Open Handset Alliance develops the GPL-licensed parts of Android. Device manufacturers cannot use the Android trademark unless Google certifies their device against the Compatibility Definition Document (CDD). Applications like the Android Market, Google Maps, and Google Docs are not open-source, and are only licensed to devices that pass the CDD.

Android's architecture is split into a Linux kernel with low-level hardware drivers and power management, a set of service libraries namely: OpenGL ES, SGL, SSL, libc, WebKit, and SQLite which is the Android core runtime libraries and the DVM, an Application Framework of application level APIs, and the applications themselves. Currently, the majority of devices run some variant of Android versions that include 4.1, 4.2, 4.3 or 4.4 (Jelly Bean). According to [15], Android OS has the potential to be a pivotal in the mobile space because of application development because of ease of development of the applications that suit various needs of the mobile device users.

**Windows Phone Operating System**

Windows Phone is a mobile OS developed by Microsoft as a replacement for their Windows Mobile platform. It was launched in 2010 under the name Windows Phone 7. Various hardware manufacturers including HTC, Samsung, LG, and Nokia are developing Windows Phone devices. In February 2011 Nokia and Microsoft announced that Windows Phone 7 would be the primary OS for all future Nokia smart phones. It received a major upgrade (7.5 Mango) in February 2011, adding features that had been missing in the original release. The second generation Windows Phone 8 was released in October 2012. Windows Phone uses technologies and tools, which are also, used in the station based application development, like the development environment Visual Studio and the Frameworks Silverlight, XNA and .NET Compact [12][16].

**Apples' iOS**

Apples iOS is a mobile operating system developed by Apple Inc. and distributed exclusively for Apple hardware. It is the operating system that powers iPhone, iPad, iPod Touch, and Apple TV. It was originally unveiled in 2007 for use in iPhones [12]. However, it has been extended to support other Apple devices such as the iPod Touch (September 2007), iPad (January 2010), iPad Mini (November 2012) and second-generation Apple TV onward (September 2010). As of October 2013, Apple's App Store contained more than 1 million iOS applications, 500,000 of which were optimized for iPad. These applications have collectively been downloaded more than 60 billion times. It had a 21% share of the Smartphone mobile operating system units shipped in the fourth quarter of 2012, behind Google's Android. By the middle of 2012, there were 410 million devices activated [13].

The user interface of iOS is based on the concept of direct manipulation and using multi-touch gestures. Interface control elements consist of sliders, switches, and buttons. Interaction with the OS includes gestures such as swipe, tap, pinch, and reverse pinch, all of which have specific definitions within the context of the iOS operating system and its multi touch interface. Internal accelerometers are used by some applications to respond to shaking the device. Apples' iOS shares with OS X some frameworks such as Core Foundation and Foundation; however, its UI toolkit is Cocoa Touch rather than OS X's Cocoa, so that it provides the User Interface Kit framework rather than the AppKit framework. It is therefore not compatible with OS X for applications. Also while iOS also shares the Darwin foundation with OS X, Unix-like shell access is not available for users and restricted for apps, making iOS not fully Unix-compatible either [12][17].

**Blackberry OS**

Blackberry OS is the proprietary mobile operating system developed by the Canadian company Research in Motion and is used for Blackberry devices only. Instead of all the other regarded mobile operating systems, it is mainly developed for business usage. Analysts predict a decreasing relevance in the future [18]. It uses different trust roles for assignments and applications have full access to the complete device and data. It is also requires to sign an application via Certificate Authorities (CA) or generated (self signed) certificate to run code on the device [19]. This operating system provides multitasking and supports specialized input devices that have been adopted by BlackBerry Ltd. for use in its handhelds, particularly the track wheel, trackball, and most recently, the track pad and touch screen.

**Mobile Operating Characteristics**

**Efficiency of the MOS**

Although, mobile devices may have limited resources compared to today's desktop computers, they still require enough computing resources such as speed, memory capacity to operate at optimum. Therefore, a MOS that provided effective memory management is essential in determining the performance of the mobile device. According to [20], regular updating of the MOS may be the major contributing factor to the degradation of speed on most Android mobile devices. The argument put forward is that as developers gain access to faster smart phone hardware, games and other applications may be optimized for this faster hardware and perform worse on older devices which seems to happen on every platform.

Mobile users tend to get discouraged as result of slow mobile devices. The adoption of such devices become challenging in future due to the experiences of resources consumption by the mobile devices.

**The cost of the MOS**

The cost of acquiring, managing, and maintaining a MOS has been identified as the major contributor to cost of the mobile device. The price of the most of the mobile devices is tied to the MOS installed in it. If the cost of the MOS is cheaper, manufactures are likely to develop low cost mobile devices, but if the cost of the MOS is higher then manufacturers are likely to develop high cost devices [6]. This implies that those mobile devices that use open source MOS tend to be cheaper compared to proprietary and commercial MOS.

**Multi-tasking features of MOS to the user**

The ability of a MOS to multi task is a factor that may influence more users to either adopt or not adopt MOS. For instance, more users are likely to adopt Windows phone OS devices due to multitasking features it provides compared to iOS and Android OS [12]. In Windows phone, if a user wishes to see his/her open apps, he/she just need to press and hold the back button to view a bunch of thumbnails in a row. Tapping on one of those thumbnails resumes the app almost instantaneously. For most users this process is faster compared to those devices who's MOS do not offer. Older versions of Android OS and iOS did not provide these features thereby making it very difficult for consumers to use.

**Applications available in MOS to the user**

The numbers of applications provided by a MOS are likely to influence user on whether to adopt that device or not [6]. Android OS which is the most popular smart phone OS, has succeeded in convincing users about its usage due to millions of applications that are available on Google Play. These applications, most of which are free to access have made it outnumber other MOS such as iOS and Windows phone despite that iOS and Windows phone have the Appstore and Windows Market respectively where users can download and use applications. With multiple device manufacturers competing on price, quality, features and other positions, Android devices offer a flexibility that iOS and Windows phone cannot match [7]. On the other hand, Windows phone OS reflects Microsoft's philosophy on enabling powerful business applications that reward a steep learning curve with tremendous competitive advantage. This has led to the least intuitive touch screen platform, the social integration is the most uneven, and the apps and consumer content are the sparsest [2][21].

## III. METHODOLOGY

This study employed Quantitative study design approach in which data was collected from both lecturers and students at 3 Local University Campuses in Kitale town. Online Questionnaires were submitted to a total of 500 participants which included Lecturers and students as shown by the table below:

Table 1: Sampling Criteria and Response rate

| Category of participant | Number | Responses Generated | % Response Rate |
|---|---|---|---|
| Students | 400 | 224 | 56 |
| Lecturers | 100 | 57 | 57 |
| TOTAL | 500 | 281 | 56.2 |

The initial and follow up mailing generated 281 usable responses, resulting in a response rate of 56.2%. This response rate from an unsolicited mailed questionnaire suggested that respondents found the topic interesting and relevant. As shown in table 2, the subjects were nearly evenly men and women, with only slightly more men (51.6%) responding than women (48.4%).

Table 2: Descriptive statistics of measured items

| Measured items | Frequency | % Response Rate |
|---|---|---|
| Gender | | |
| Male | 145 | 51.6 |
| Female | 136 | 48.4 |
| TOTAL | 281 | |

As illustrated in table 3, 71 respondents (25.3%) had never used Mobile Device in Education while 73 respondents (26.0%) had a one year experience with use of Mobile Devices in Education, whereas 147 (48.7%) had experiences of 2 years and above with use of Mobile Devices in education.

Table 3: Descriptive statistics of measured items

| Measured items | Frequency | % Response Rate |
|---|---|---|
| Experience with use of Mobile Devices in Education | | |
| 0 Years | 71 | 25.3 |
| 1 Year | 73 | 26.0 |
| 2 Years | 58 | 20.6 |
| 3 Years | 58 | 20.6 |
| > 4 Years | 21 | 7.5 |
| TOTAL | 281 | 100 |

This study sought to determine the influence of Mobile Operating Systems (MOS) on actual adoption of Mobile Devices in Education in Africa. Based on the Conceptual Framework the following variables were identified:

a. Efficiency of the MOS
b. Cost of the MOS
c. Applications available to the user from MOS
d. Multitasking features of the MOS

This study employed both descriptive and inferential statistics to analyse the data. Descriptive statistics used included use of histograms, frequency tables and pie charts to represent data. This was useful in comparing groups that differed in size. On the other hand, inferential statistics was used to verify the relationship between Mobile Device adoptions with respect to MOS characteristics that were identified in the conceptual framework. This included Efficiency of the MOS, Cost of the MOS, Applications available to the user from MOS and Multitasking features of the MOS. A number of hypotheses concerning the correlations of some of the survey's variables were tested. This included:

**H1:** Efficiency of the MOS has significant influence on the adoption of Mobile Devices in Education.

**H1a:** Efficiency of the MOS has no significant influence on the adoption of Mobile Devices in Education.

**H2:** The cost of the MOS has significant influence on the adoption of Mobile Devices in Education.

**H2a:** The cost of the MOS has no significant influence on the adoption of Mobile Devices in Education.

**H3:** Applications available to the user from MOS has significant influence on the adoption of Mobile Devices in Education.

**H3a:** Applications available to the user from MOS has no significant influence on the adoption of Mobile Devices in Education.

**H4:** Multitasking features of the MOS has significant influence on the adoption of Mobile Devices in Education.

**H4a:** Multitasking features of the MOS has no significant influence on the adoption of Mobile Devices in Education

A regression model was used to establish the level of correlation between Mobile adoption and each the independent variables that included Efficiency of the MOS, Cost of the MOS, Applications available to the user from MOS and Multitasking features of the MOS.

### *A. Research Findings*

This study sought to determine the main challenges facing deployment and adoption of in Higher learning institutions in Kenya. The table below shows the descriptive statistics.

Table 4: Descriptive statistics of variables among variables (n=281)

| Variable | Yes (%) | No (%) | Not Sure (%) | TOTAL |
|---|---|---|---|---|
| Efficiency of the MOS | 60.4 | 34.0 | 5.6 | 100 |
| Cost of the MOS | 70.2 | 22.8 | 7.0 | 100 |
| Applications available to the user from MOS | 56.2 | 21.8 | 22 | 100 |
| Multitasking features of the MOS | 46.4 | 42.6 | 11.0 | 100 |

From the results, the following can be concluded:

70.2% of the respondents cited the cost of the MOS as one of the major factors that influence the adoption of the mobile devices in education. A majority of the respondents cited the price of the mobile devices as a hindrance factor to the actual adoption and use of the device in education. Since the price of the most of the mobile devices is tied to the MOS installed in it, then it implies that those mobile devices that used open source MOS tend to be cheaper compared to proprietary and commercial MOS. In fact, majority of the respondents cited Android based mobile devices as the appropriate mobile device MOS to use in education due the cost factor. The cost of the MOS was closely followed by efficiency of the MOS at 60.4%. These findings corroborate with the finding of [20] who found that users experience with degradation of speed and memory management of the MOS may be a limiting factor on the adoption of the mobile devices in education. Most respondents felt that the adoption of such devices become challenging in future due to the experiences of resources consumption by the mobile devices. 56.2% of the respondents cited the number of applications as a motivational factor to adoption of mobile phone devices in education. Most respondents felt that Android OS which is the most popular smart phone OS, has numerous applications, most of which are free to access which has made it outnumber other MOS such as iOS and Windows phone despite that iOS and Windows phone have the Appstore and Windows Market respectively where users can download and use applications. Only 46.4% of the respondents cited multitasking features of the MOS as a factor of adoption of the MOS in education.

### *B. Linear Regression Analysis*

Linear regression analysis was conducted to test the hypotheses. Four variables were applied as independent variables, while Mobile Device Adoption the dependent variable. Table 5-8 summarises the results of regression analysis.

Table 5: Efficiency of the MOS and the adoption of Mobile Devices in Education

| Variable | **β** | Standard Error of β | P | $R^2$ |
|---|---|---|---|---|
| Efficiency of the MOS | 0.652 | 0.453 | 0.003 | 0.678 |

Dependent variable: Adoption of Mobile Devices in Education

As shown in Table 5, the efficiency of the MOS had a significant effect on adoption of mobile devices in education. The relationship is significant at level P =0.003 while R2 (0.678) which is the coefficient of the regression shows strong relationship between the variables. Therefore, H1 was accepted.

Table 6: Cost of MOS and the adoption of Mobile Devices in Education

| Variable | **B** | Standard Error of β | P | $R^2$ |
|---|---|---|---|---|
| The cost of MOS | 0.345 | 0.561 | 0.001 | 0.879 |

Dependent variable: Adoption of Mobile Devices in Education

As shown in Table 6, the cost of the MOS had a significant effect on adoption of mobile devices in education. The relationship is significant at level P =0.001 while R2 (0.879) which is the coefficient of the regression shows strong a very strong relationship between the variables. Therefore, H2 was accepted.

Table 7: Applications available to the user from MOS the adoption of Mobile Devices in Education

| Variable | **β** | Standard Error of β | P | $R^2$ |
|---|---|---|---|---|
| Applications available to the user from MOS | 0.651 | 0.569 | 0.002 | 0.513 |
| Dependent variable: Adoption of Mobile Devices in Education | | | | |

As shown in Table 7, Applications available to the user from MOS had a significant effect on adoption of mobile devices in education. The relationship is significant at level P =0.002 while R2 (0.513) which is the coefficient of the regression shows strong relationship between the variables. Therefore, H3 was accepted.

Table 8: Multitasking features of the MOS and the adoption of Mobile Devices in Education

| Variable | **B** | Standard Error of β | P | $R^2$ |
|---|---|---|---|---|
| Multitasking features of the MOS | 0.356 | 0.210 | 0.001 | 0.215 |
| Dependent variable: Adoption of Mobile Devices in Education | | | | |

As shown in Table 8, Multitasking features of the MOS had a minimal significant effect on adoption of mobile devices in education. The relationship is significant at level P =0.001 while R2 (0.215) which is the coefficient of the regression shows a weak relationship between the variables. Therefore, H4 was rejected.

Therefore among 4 independent variables, 3 were considered to have critical relationships with adoption of mobile device in education with p-values less than 0.05. These factors were Efficiency of the MOS, Cost of the MOS and Applications available to the user from MOS. Only Hypothesis 4 was not supported. These is summarised in the table below:

Table 9: Summary of Hypothesis Results (Regression Testing for n=281)

| Hypothesis | Relationship | Results $R^2$ | P |
|---|---|---|---|
| H1 | Efficiency of the MOS has significant influence on the adoption of Mobile Devices in Education | 0.678 | 0.003 |
| H2 | The cost of the MOS has significant influence on the adoption of Mobile Devices in Education | 0.879 | 0.001 |
| H3 | Applications available to the user from MOS has significant influence on the adoption of Mobile Devices in Education | 0.513 | 0.002 |
| H4 | Multitasking features of the MOS has significant influence on the adoption of Mobile Devices in Education | 0.215 | 0.001 |

This can further be illustrated in the table below

Table 10: A summary of Hypothesis Results

| Hypothesis | Independent Variable | Whether Significant or not |
|---|---|---|
| H1 | Efficiency of the MOS | Yes |
| H2 | The cost of the MOS | Yes |
| H3 | Applications available to the user from MOS | Yes |
| H4 | Multitasking features of the MOS | No |

## IV. CONCULUSIONS AND FUTURE WORK

The major purpose of this study was to investigate the influence of mobile operating systems characteristics on the adoption of mobile devices in education. The literature review revealed the main characteristics of the mobile operating system characteristics as efficiency of the MOS, the cost of the MOS, the applications available to the user from the MOS and the multitasking features of the MOS. A quantitative study design approach used in which data was collected from both lecturers and students at 3 Local University Campuses in Kitale town in order to investigate the influence of mobile operating systems characteristics on the adoption of mobile devices in education. This study identified the following as the major determinants of adoption of mobile devices in education in Kenya: Efficiency of the MOS, the cost of the MOS and applications available to the user from MOS. Multitasking features of the MOS was found to have minimal significance on the adoption of the mobile device in education. The use of mobile devices to provide facilitate teaching becomes imperative if ICT is to meet the learning needs of individual students; promotion of equality of opportunity; provision of high quality learning materials. The use of these devices as an extension of electronic learning (e-learning) has the potential to make learning even more widely available and accessible than we are used to in existing e-learning environments. We recommend that mobile devices' manufacturers should release and support robust and functional mobile device friendly applications for their customers if mobile devices are to be applicable in learning.

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