

# Smartphone Usage and Self-Directed Learning Activities at Mount Kenya University, Kigali, Rwanda

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**Abstract:** The purpose of this study was to assess the effects of smartphone usage on self-directed learning activities by considering the case of Mount Kenya University Kigali, Rwanda. The targeted population was 1,984 students of six schools of Mount Kenya University, Kigali and 180 lecturers, from which a sample of 95 students and 64 lecturers was obtained using simple random sampling technique by applying Slovin's formula. Data was collected using questionnaires and interview guide. The analysis and interpretation of quantitative data was done using statistics such as frequencies, percentages, weighted means, standard deviations and Multiple Regression Analysis. This was achieved using Statistical Package for the Social Sciences version 20.0 (SPSS V.20.0) and Microsoft Excel 2013 software as the tools for analysis. Qualitative data was interpreted using content analysis. The research findings was presented using graphs and frequency tables. The analysis of the study indicated that 89 (93.70%) of the respondents students owns smartphones and 87 (91.60 %) of them participate in self-directed learning activities such as 85 (89.50%) of the respondent participating in knowledge sharing and collaborative learning activities and 71 (74.70%) of the respondents confirmed to participating in self-guided reading and researching activities. From the Multiple regression analysis, it was found that the correlation coefficient  $r=0.591$ , signifying a moderately strong, positive correlation between the usage of smartphones and self-directed learning activities. Recommendations included, conducting awareness campaign on potential benefits of smartphone in education, promoting self-directed learning at higher learning institution and breaking barriers that compromise information access such internet access facility.

**Keywords:** Smartphone, Mobile Learning, Self-directed learning.

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## 1. INTRODUCTION

Countries across the globe are embracing a vision for development of knowledge societies, adopting policies and strategies to encourage this development. Education is of vital importance in the knowledge society, as a source of basic skills, as a foundation for development of new knowledge and innovation, and as an engine for socio-economic development. Education is therefore a critical requirement in creating knowledge societies that can stimulate development, economic growth, and prosperity. It is not only the means by which individuals become skilled participants in society and the economy, but is also a key driver expanding ICT usage (Mansell & Tremblay, 2013).

In 21st Century learning, students use learning technologies to apply knowledge to new situations, analyze information, collaborate, solve problems, and make decisions. Utilizing emerging technologies to provide expanded learning opportunities is critical to the success of future generations. According to Buck, McInnis and Randolph (2013), mobile phone technology allows the 21st Century student to engage in a learning environment while being mobile. Educational applications (i.e. APPs) assist students in accessing interfaces to virtual classrooms, researching specific subject matter, studying flash card notes, and much more. This method of learning appeals to the various learning styles of students, and it allows students to have autonomy and ownership in their learning process.

According to Chen and Denoyelles (2013), mobile technologies are playing an increasingly important role in college students' academic lives. Devices such as smartphones, tablets, and e-book readers connect users to the world instantly, amplifying access to information and enabling interactivity with others. Applications that run on these devices let users not only consume but also discover and produce content. As such, they continue to transform how college students learn, as well as influence their learning preferences, both within and outside the classroom. Students of Mount Kenya University Kigali, Rwanda own also mobile phones and some of them are smartphones; they use them a lot in their daily campus life. Apart from making calls they also use their smartphones for internet browsing, sharing information including learning materials and others by using different smartphone Apps and features.

### **1.1 Statement of the problem:**

Due to the fast growth in information and communication technologies (ICT) and advances in electronic learning technologies, mobile technologies has created a challenge for higher education institutions who want to provide students with high quality and sustainable technology-rich environments. Smart mobile technologies, such as tablet computers and smartphones, offer advanced computing abilities as well as access to internet-based resources without the constraints of time or place. Education institutions are also often hampered by a conservative organizational culture and entrenched processes which impact on their ability to provide wide-scale support for the use of innovative technologies (Maringai, Skourlas & Belsis, 2013).

Particularly in Eastern Africa, there has been an incredible growth and penetration of mobile technologies and mobile services. Despite the penetration of mobile devices in higher education, most of eLearning technologies implemented are based on desktop computers. Therefore, it is becoming increasingly difficult to ignore the importance of mobile learning to enhance education and its capability to develop self-regulated learning competences in higher education, in East Africa. Therefore is a need to determine factors that contribute to mobile learning in education in order to facilitate adoption and usage of mobile learning (Mtebe & Raisamo, 2014). Furthermore, Rwanda as a member of Eastern Africa, has implemented numerous ICT initiatives in education, to create educational opportunities by providing each child with a rugged, low-cost, low-power, One Laptop per a Child Programme with content and software designed for collaborative, joyful, self-empowered learning (Rubagiza & Sutherland, 2011). Rwanda like any other Eastern African country, mobile learning technology has not been adopted yet in education system. Therefore there is a need to examine the influence of smartphones in learning at higher learning institutions.

It was observed that at Mount Kenya University Kigali, Rwanda, students make use of Facebook and WhatsApp both in as well as off campus. It is not known exactly whether students actually make use of educational applications at university level for Self-directed learning. It is also not known how lecturers interact with students via smartphone for academic purposes (Prof. R. Ongus, Personal Communication, July 17, 2015). Studies, particularly published ones on a similar topic, in Rwanda are scarce. Therefore the research sought to assess how smartphone usage affects self-directed learning activities by considering the case of Mount Kenya University Kigali, Rwanda.

### **1.2 General Objective:**

The main objective was to assess the effect of smartphone usage on self-directed learning activities at Mount Kenya University Kigali, Rwanda.

#### **1.2.1 Specific Objectives:**

The specific objectives of the study were:

1. To establish how smartphones are used by students and lecturers of Mount Kenya University Kigali, Rwanda.
2. To assess how self-directed learning activities are carried out by students of Mount Kenya University Kigali, Rwanda.
3. To analyze the correlation between smartphones usage and self-directed learning activities at Mount Kenya University Kigali, Rwanda

### **1.3 Significance of the study:**

This study would help Ministry of Education to identify the potential opportunities that smartphones can play as learning tools and to be able to strengthen the usage of smartphones in education system. Higher learning institutions Mount Kenya University Kigali included would also benefit from this study by being aware of the effect of smartphones on self-directed learning activities so that they can promote it and improve quality of education. It would also help students and lecturers in knowing how smartphones can be more useful in learning and how it can be used to improve learning.

The study would also assist Ministry of Youth and ICT to promote usage of ICT in Youth in Rwanda using smartphones for easy access to information and also to breach digital divide. Some investors in educational software such as Microsoft, IBM, Apple and others would also benefit by proposing different solutions products that can assist to improve usage of ICT in education. In addition the output from this study will be used to produce a publication.

#### **1.4 Limitation of the study:**

The study considered only the individuals who possessed smartphones within Mount Kenya University (MKU), Kigali. Due to challenges of administering data collection instruments the study excluded the school based and virtual students, since they were difficult section of students to follow up effectively.

## **2. LITERATURE REVIEW**

### **2.1 Theoretical Review:**

The theoretical literature contains conceptual description of the key terms and theories related to them.

#### **2.1.1 Learning Theory:**

Over the past century, educational psychologists and researchers have suggested many theories to explain how individuals acquire, organize and deploy skills and knowledge. Ertmer and Newby (1993) grouped learning theories into three basic categories: Behaviorism, Cognitivism and Constructivism theories.

According to Ertmer and Newby (1993), Behaviourism is a worldview that assumes a learner is essentially passive, responding to environmental stimuli. The learner starts off as a clean slate and behavior is shaped through positive reinforcement or negative reinforcement. Cognitivism focuses on the inner mental activities – opening the “black box” of the human mind is valuable and necessary for understanding how people learn. Mental processes such as thinking, memory, knowing, and problem-solving need to be explored. Knowledge can be seen as schema or symbolic mental constructions. Learning is defined as change in a learner’s schemata. Constructivism states that learning is an active, contextualized process of constructing knowledge rather than acquiring it. Knowledge is constructed based on personal experiences and hypotheses of the environment. Learners continuously test these hypotheses through social negotiation. Each person has a different interpretation and construction of knowledge process. The learner is not a blank slate but brings past experiences and cultural factors to a situation.

#### **2.1.2 e-Learning theory:**

E-learning theory consists of cognitive science principles that describe how electronic educational technology can be used and designed to promote effective learning. Theoretical approaches guiding these efforts group at the collaborative, constructivist, cognitivist, end of the spectrum; encouraging active participation and contribution by learners and carrying principles of adult learning, informal learning and expert learning to e-learners of all ages and stages (Keskin and Metcalf, 2011).

#### **2.1.3 Mobile Learning theory:**

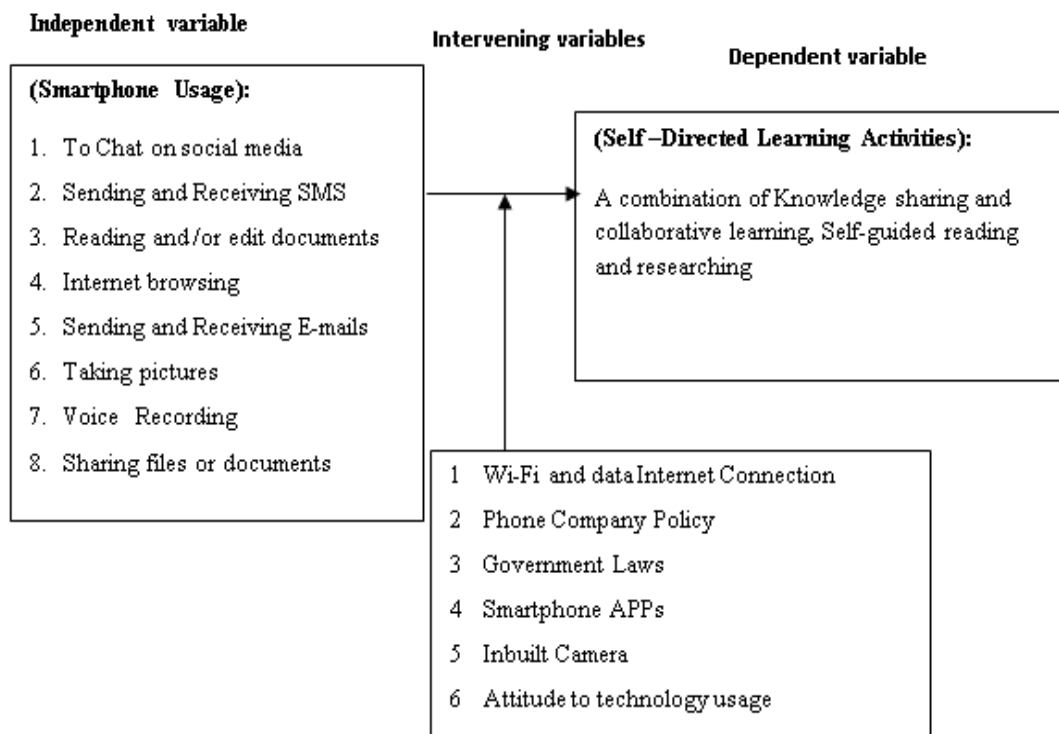
According Keskin and Metcalf (2011), mobile learning (m-learning) is defined differently by different people. Early perspectives of m-learning were focused on technology, and defined as the delivery of training by means of mobile devices such as mobile phones, PDAs and digital audio players, as well as digital cameras and voice recorders, pen scanners, etc.

Some researchers characterize mobile learning as an extension of e-learning. For instance, Kadirire (2009) defines m-learning as a form of e-Learning, which can take place anytime, anywhere with the help of a mobile communication device such as a mobile phone, a personal digital assistant (PDA), iPod or any such small portable device. But new mobile learning perspectives accept m-learning as a paradigm change. One of these perspective is the learner-centred perspective. It asserts that m-learning is any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning opportunities offered by mobile technologies (O’ Malley et al, 2005).

The other perspective focuses on individualism. According to this perspective, m-learning is defined as any activity that allows individuals to be more productive when consuming, interacting with, or creating information, mediating through a compact digital portable device that the individual carries on a regular pocket or purse (Wexler, Brown, Metcalf, Rogers & Wagner, 2008).

## 2.2 Conceptual Framework:

The researcher presented the conceptual frame worker showing the relationship between the study variables and the factors from which the situation can affect the relationship between the study variables.



## 2.3 Empirical Literature:

The empirical review discusses the previous studies. It looks at systematic identification, location, and analysis of documents containing information related to a research problem under investigation.

### 2.3.1 Smart Phones Changing College Student Lives:

According to Cochrane and Bateman (2009)'s study on transforming pedagogy using mobile Web 2.0 at Sheffield Hallam University in United Kingdom. The study showed that smartphones provide an ubiquitous connection to mobile Web 2.0 social software and the ability to view, create, edit, upload, and share user generated Web 2.0 content. In their study they realized that smartphones were also used as a communication tool between students and with teaching staff for immediate feedback via instant messaging, email and RSS subscriptions.

The study done by Den, Rowe, Boyd and Lloyd (2012) on use of mobile Web 2.0 technology for collaborative learning at Southern Cross University in Australia shown that Wikis, blogs and other web2.0 tool are used by students for collaborative learning. Enable students to work at the conceptual level of understanding on authentic projects where they can solve problems, discover relationships, discern patterns, and develop a deep understanding of content; and collaboratively build knowledge of students mediated by user-generated (either student or teacher) design; allow students and teachers opportunities for reflection; and, ultimately, cultivate communities of practice.

Research done by Mokoena (2012) at University of Zululand in South Africa to assess the impact of mobile phones on students learning. The study revealed that smartphones users are higher than the regular cellular phone users where 56.88% of Students own a smartphone and 43.12% own a regular phone. Students regarded the smartphones as a useful tool for their learning. Even the regular cellular phone users regarded the smartphones capabilities as useful functions for students learning.

### 2.3.2 Impact of Smartphone Technology in Education:

The study done by Kumar (2011), on the impact of the Evolution of Smart Phones in Education Technology and its Application in Technical and Professional Studies on Indian Perspective revealed that the use of Internet has become a part of life of every student. These days, use of mobile phones for internet purposes has become a habit with all students.

In recent times, smart phones have gained remarkable popularity in consumer markets across India. India today serves as a lucrative market for all mobile phone manufacturers across the world apart from the big players like Nokia, Apple, RIM, HTC, Samsung, LG, Motorola and Sony Ericsson.

Kumar (2011) concluded that, the difference between traditional universities and distance education institutions has disappeared. The need for lifelong learning and rapid developments in ICT have led many traditional universities to become involved with online delivery, and the commercial potential has attracted many new technology-oriented private as well as public providers. Mobile learning may be used to access the educational opportunities to different segments of the society where distance or other obstacles present a barrier to accessing formal learning centers and to enhance the quality of learning and continued professional development.

### **2.3.3 Smartphone Usage for Learning in Higher Learning Institution:**

The study conducted by Woodcock, Middleton & Northcliffe (2012) investigated on the Student's interest in the use of personal technology to enhance their learning by considering smartphone learner. The study revealed that the capacity of a smartphone to access, manipulate, produce, store or share content almost as soon as it is created, wherever it is created, provides the rationale for why education needs to explore the technology. This versatility promises to change the nature of educational content and communication and therefore the nature of learning itself.

There is evidence of growing interest in the use of smartphones in higher education leading to new pedagogical practices. Cochrane and Bateman (2010) reflected on three years of action research into the pedagogical affordances of smartphones; correlate the user-centered and social value of Web 2.0 technologies to education with the smartphone's capacity to facilitate student-centered social constructivist pedagogies, which McLoughlin and Lee (2008) refer to as "Pedagogy 2.0".

The study conducted by Utulu (2012) on usage of mobile phones for project based learning by undergraduate students in Nigeria; the study revealed that mobiles phones were used by students for communicating with lecturer in charge of the course, collect data ,sending emails to lecturers, access Online Public Access Catalogue and share knowledge. Furthermore the study done by Mtepa, Msungu, Senare, & Bernard (2012) on usage of Mobile Phones for Teaching and Learning Purposes in Higher Learning Institutions at Sokoine University of Agriculture in Tanzania on a total sample size of 30 teaching staff and students.

The Study proved that 70% teachers own and use smartphones where 84% of them access internet services through their phones, 68% use Multimedia Services while 64% mentioned to use some Web 2.0 applications and 76% mentioned download scholarly materials through their mobile phones. Others, 54% mentioned use smart phone learning applications to support the teaching learning process. Among those who accessed internet services, 63% mentioned read scholarly articles through their mobile phones, 37% use some mobile web based applications for data collection while 58% reported to use their mobile phones for accessing and reading online text books.

Majority (84%) of those who used internet services accessed online dictionaries while 11% and 42% search library catalogues and share information resources to others through their mobile phones respectively. Also among those who used mobile web based services to share information resources, 73% mentioned to access e-mails, others (30%) mentioned to use social network software while some (36%) used Google drive for the same purpose. Generally the study found that mobile phones are used for teaching and learning purposes among both teaching staff and students at Sokoine University (Mtepa, Msungu, Senare, & Bernard, 2012).

### **2.4 Critical Review and Research Gap Identification:**

The study made critical review of existing literature and identified the gap that needs to be filled by the research.

#### **2.4.1 Critical Review:**

Cochrane and Bateman (2009)'s study emphasized on usage of smartphone to support mobile Web2.0 social constructivism learning model. Their study demonstrated that mobile learning technologies provide the ability to engage in learning conversations between students and lecturers, between student peers, students and subject experts, and students and reliable environments within any context. It is the potential for mobile learning to bridge pedagogically designed learning contexts, facilitate learner generated contexts, and content (both personal and collaborative), while providing personalization and ubiquitous social connectedness, that sets it apart from more traditional learning environments.

Den, Rowe, Boyd and Lloyd (2012)'s study also supported the theory of social constructivism learning using Web 2.0 technologies. In their study they found that Web 2.0 technology has been used for distance education in Australian higher education. In both courses wikis, blogs and other Web 2.0 technologies were used to facilitate collaborative learning. They concluded that there is a clear need to develop and integrate Web 2.0 to support and encourage interaction both between teachers and students, and amongst the students themselves.

Kumar (2011)'s study supported the lifelong learning theory. According to him the need for lifelong learning and rapid development of in ICT has led many universities to become involved in online learning delivery. He also emphasized that the growing demand of smart phone and high speed mobile browsing is ready to change the basics of higher education delivery system and the smart phones could be one way to engage and motivate student learning. The study also looked at the growth of smartphone owners in India, high speed internet and how this has promoted mobile learning to remove barriers of accessing educational opportunities in different segment of India's society.

Woodcock, Middleton & Northcliffe (2012)'s study looked at the usage of smartphone for learning in aspect different than social constructivism learning model. They emphasized the usage of smartphone in social cognitivist learning model where smartphones are used by student in order to acquire knowledge by observing, hearing, following teacher or others through use of internet connectivity or recorded learning content. Their study revealed that students use different smartphone services and application including SMS, MMS, voice recorder, Email, Note Pad.

In his study Utulu (2012), he supported collaborative learning and lifelong learning skills, technology use skills, knowledge sharing skills and social networking skills for students in Nigeria universities .The study revealed the fact that mobile phones can be taken to any location and still receiving internet signals makes them unique and preferable device for the students involved in project based learning for knowledge sharing and collaboration with others.

Mtega, Msungu and Sanare (2012)'s study followed social constructivism learning model. The study showed that social network tools such as Web 2.0 technology are being used by students and lecturers to create upload, download and share academic resources through their smart phones while others recorded and stored files in their phones.

#### **2.4.2 Research Gap Identification:**

Cochrane and Bateman (2009)'s study focused on usage of mobile Web 2.0 technology to transform pedagogy and engage learners using smartphones and in addition Den, Rowe, Boyd and Lloyd (2012) also conducted a study on usage of Web 2.0 technology to facilitate collaborative learning in distance learning. This led to creation of knowledge gap as to find out how mobile Web 2.0 technology can enhance self –directed learning on smartphone. Kumar (2011)'s study was focusing on evolution of smartphone in education and its impact to professional studies in India. This led to creation of a knowledge gap as no similar study has been carried out to find out how evolution of smartphones has affected learning at higher learning institutions in Rwanda, precisely at Mount Kenya University, Kigali Campus.

Similarly Woodcock, Middleton & Northcliffe (2012) investigated on the interest of student in use of personal technology to enhance their learning, a case study of smartphone learner, the study looked at learning in general view but there is a need to know how the usage of smartphone in self-directed learning has motivated students. Utulu's study (2012), on usage of mobile phone for project based learning by undergraduate students of Nigerian private universities. Utulu's intention was to identify how usage of Information Communication Technology (ICT) could assist graduates to become flexible and life-long learners and how project based learning model can be used to support collaborative learning , lifelong learning skills, technology use skills, knowledge sharing skills and social networking skills for students in Nigeria universities. This led to creation of a knowledge gap on how can smartphone as advanced ICT tool can be used to support collaborative learning and knowledge sharing among students at higher learning institutions in Rwanda.

The Mtega, Msungu and Sanare (2012)'s study, focused on how mobile phones have been used for teaching and learning purposes in higher learning institutions in Tanzania and discovered that the mobile phones were used for teaching and learning purposes among both teaching staff and students .The fact that Rwanda and Tanzania are the neighboring countries led to creation of a knowledge gap to find out how progress in mobile technology has affected learning activities in higher learning institutions of Rwanda as well , this research will identify the effect of smartphone usage at higher learning institution in Rwanda.

### 3. RESEARCH METHODOLOGY

#### 3.1 Research Design:

The study used case study research design. According Baxter and Jack (2008) case study design is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources. This ensures that the issue is not explored through one lens, but rather a variety of lenses which allows for multiple faces of the phenomenon to be revealed and understood. It was used in order to provide a comprehensive understanding of the issue and strengthen what is already known. Mount Kenya University, Kigali Campus is selected to be a case study.

#### 3.2 Target Population:

A population of 2026 students of six schools and 180 lecturers of MKU Kigali, Rwanda, this was the target population from which a sample was taken as respondents in this study (Prof. R. Ongus, Personal Communication, July 17, 2015).

#### 3.3 The Sample Design:

Due to the fact that the population is big, the researcher carried out sampling so that the population can be reduced to a controllable size in order to collect effectively the respondent's views and facility accomplishment of the study.

##### 3.3.1 Sample Size:

As it is not possible to study the entire population, a small sample is taken using Slovin's formula (1960). Which is a statistical formula used to obtain a sample.

Slovin's formula:

$$n = \frac{N}{1 + N * e^2}$$

n= Number of Samples

N=Total population

e =Margin error, is a statistic expressing the amount of random sampling error in a survey's results.

For our case we shall use:

Students (N) =2026, margin error (e) =0.1

$$n = \frac{2026}{1+(2026)(0.1)^2} = \frac{2026}{1+(2026)(0.01)} \text{ i.e. } n = \frac{2026}{1+20.26}$$

$$n = \frac{2026}{21.26} = 95 \text{ Students}$$

Lecturers (N) =180

$$n = \frac{180}{1+(180)(0.1)^2} = \frac{180}{1+(180)(0.01)} \text{ i.e. } n = \frac{180}{2.8}$$

n=64

The sample size of the study was 95 students and 64 lecturers respondents selected from the total population.

##### 3.3.2. Sampling Technique:

A process used in statistical analysis in which a predetermined number of observations was taken from a larger population (Shah & Corley, 2006). The methodology used to sample from a larger population was depended on the type of analysis being performed. For this study, a sample of respondents was selected using simple random sampling.

**Table 3.1 Total population, sample size and sampling techniques**

Category	Population	Sample size	Sampling technique
Lecturers	180	64	Simple random sampling
Students	2,026	95	Simple random sampling

### 3.4 Data Collection Methods:

The data collection instruments used in this study was questionnaires and they were distributed to the respondents (Mount Kenya University, Kigali Campus students) and collected upon completion. Questionnaire was preferred because it was used to collect data from many respondents within the shortest time possible compared to other data collection methods. Closed ended questions are formulated according to the objectives of the research, where respondents were required to choose the answer from a list. The instrument helped to obtain main data that essentially gave reliable data in relation to usage of smartphone for self-directed learning activities. The interview guide to the lecturers of MKU, Kigali Campus was also used.

#### 3.4.1 Data Collection Instruments:

Firstly ninety five well-structured questionnaires were distributed to the Mount Kenya University (MKU), Kigali Campus Students who participate in different self-directed learning activities and use smartphones in their daily campus life. Secondary interview schedules were conducted targeting the sixty four MKU, Kigali Campus lecturers. They were selected because they are involved in learning activities by teaching, coaching or facilitating student in acquiring new knowledge and they are more familiar with self-directed learning activities. Thus, their responses were constructive and reliable for this study.

#### 3.4.2 Administration of Data Collected Instruments:

The study was personally administered for all process of collecting data.

#### 3.4.3 Reliability and Validity:

In order to test adequacy, correctness and the clearness of the research instruments a preliminary study was conducted and the validity of the instrument was measured by Computing Validity Coefficient (CVI). The results of the pilot study were used to improve the research instruments and make them more clearly to the targeted respondents. The objective of this pre-test was to see variations if the manner of formulating questionnaire brought out similar responses (construct validity). Also this procedure ensured that the whole questionnaire was understood and measured validly.

##### a) Pilot Study:

A pilot study, pilot project or pilot experiment is a small scale preliminary study conducted in order to evaluate feasibility, time, cost, adverse events, and effect size in an attempt to predict an appropriate sample size and improve upon the study design prior to performance of a full-scale research project.

In order to verify reliability and validity of instruments a pilot study was carried out using Cronbach's alpha Test on 8 respondents from population with similar characteristics as the population to be studied. After the pilot study, the data collection instruments was adjusted to remove ambiguous and poorly constructed on inefficient questions.

**Table 3.2 Cronbach's Alpha Test**

	Cronbach's alpha value	No items
Smartphone usage	0.90	9
Self-guided reading and researching	0.76	6
knowledge sharing and social collaborative learning	0.85	5

As shown shows in Table 3.2, the Cronbach's Alpha of all sections was found to be acceptable. It was assumed that all sections were valid and reliable because the Cronbach's Alpha was greater than 0.5. After the pre-test, modifications were made to the questionnaire in order to enhance its simplicity and clarity before producing the actual questionnaire. The data collected, remarks and suggestions were analyzed and gaps between the preliminary questionnaire and the required data were identified.

In this research the validity of the instrument was measured by Computing Validity Coefficient (CVI). The instrument was valid because  $CVI=R/IR = 95/95=1$  where: R stands for the retrieved questionnaires and IR for the total questionnaires. The instrument considered to be valid when its maximum content index is at least 0.772 (Amin, 2005).



### 3.5 Data Analysis Procedure:

Data analysis is a process of inspecting, cleaning, transforming, and modeling data with the goal of discovering useful information, suggesting conclusions, and supporting decision-making.

#### 3.5.1 Tools of data analysis:

Statistical Package for the Social Science (SPSS) version 20 and Microsoft Excel 2013 were used as tools for analyzing data that was collected in this study.

#### 3.5.2 Methods of Data Analysis:

The collected data was assembled and checked for corrections (i.e. data cleaning), coding and data entry into SPSS. Analysis techniques was run to SPSS outputs. Methods of quantitative analysis included: Frequencies, percentages, weighted mean and standard deviation. Interview guide was analyzed qualitatively using content analysis with help of Microsoft Excel 2013.

Correlation between two variables was analyzed using multiple regression analysis. The analysis applied multiple linear regression attempts to model the relationship between two variables and a response variable by fitting a linear equation to observed data. Every value of the independent variable  $x$  was associated to a value of the dependent variable  $y$ .

The population regression line for  $p$  explanatory variables  $x_1, x_2, \dots, x_p$  will be defined as  $\mu_y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p$ . The observed values for  $y$  vary about their means  $\mu_y$  and are assumed to have the same standard deviation  $\sigma$ . The fitted values  $b_0, b_1, \dots, b_p$  estimate the parameters  $\beta_0, \beta_1, \dots, \beta_p$  of the population regression line.

### 3.6 Ethical Considerations:

Verbal consent was sought from each respondent to enable him/her to participate in the study. Information obtained from respondents was treated with highest confidentiality. Respondents were given prior assurance that information obtained from them would be used for academic purposes only.

## 4. RESEARCH FINDINGS AND DISCUSSION

### 4.1 Presentation of Findings:

Questionnaires were distributed randomly to Mount Kenya University (MKU) Kigali, Rwanda students. During questionnaire examination process, data were obtained on general usage of smartphone. Data were also obtained on usage of smartphone for self-directed learning activities. Furthermore the interview was conducted on Mount Kenya University Kigali, Rwanda lecturers. Interview collected the views of lecturers on the role of self-directed learning as well as usage of smartphone in education.

### 4.2 Findings from Questionnaire:

The questionnaire was organized in four sections: demographic information, general usage of smartphone and questions on usage of smartphone for knowledge sharing, collaborative learning as part of self-directed learning activities.

#### 4.2.1 Demographic Characteristics of Respondents (Students):

General information studied in the survey included gender, age, program of study and mode of study of respondents. These demographic characteristics was important because they facilitated us to study the characteristics of individual population independently.

##### i) Distribution of Students by gender

The gender distribution of the respondents was assessed and the findings showed:

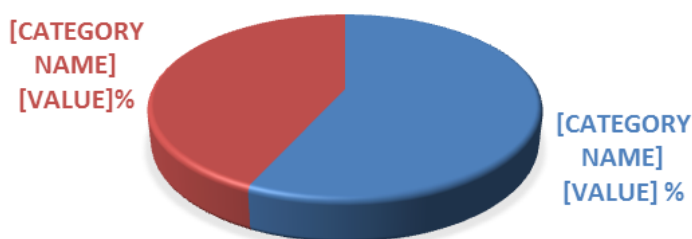


Figure 4.1 Gender distribution of respondents

According to Figure 4.1, the gender distribution of respondents was 54 (56.84%) female and 41 (43.16 %) male.

ii) Age distribution

The age distribution of the respondents was also evaluated and the findings were shown as;

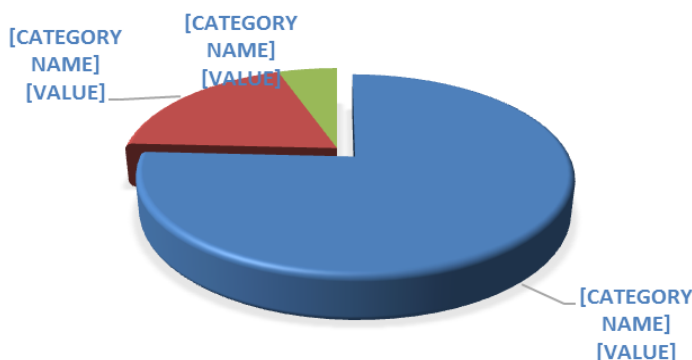


Figure 4.2 Age distribution of respondents

Figure 4.2 indicates the distribution of respondents considered based on their age where the majority of respondents 72 (75.79 %) were between 18 and 25 of age, 18 (18.94%) were between 26 and 35 of age and 5(5.27 %) were between 36 and above of age.

iii) Program of study:

The program of study of the respondents was evaluated and the findings showed:

Table 4.1 Program of Study

	Program	Frequency	Percent
Questionnaire	Bachelor	89	93.68
	Masters	6	6.32
	Total	95	100.00

Table 4.1 shows the program of study of the respondents where majority 89 (93.68%) of respondents were bachelor’s students and 6 (6.32%) were master’s students.

iv) Mode of study:

The mode of study of the respondents was considered.

Table 4.2 Mode of Study

	Mode	Frequency	Percent
Questionnaire	Regular	69	72.63
	Evening	26	27.37
	Total	95	100.00

Table 4.2 illustrates that most of the respondents were regular students which represents 69 (72.63%) of respondents and 6 (27.37%) were evening students.

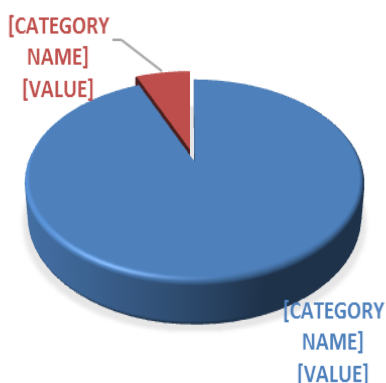
In demographic point of view, the majority of the respondents who participated in the study were female, regular students, who were doing bachelors program and age between 18-25. This is due to the fact that majority of the students in private higher learning institutions female were higher than male (Rwanda Ministry of education ,2015) and the fact that the education system of Rwanda allow majority of students in higher learning institutions to be of age between 18-25 (Rwanda Ministry of education ,2015). Due to availability of the students and class hours, regular students contributed much to the study than others.

**4.2.2 General Usage of Smartphone:**

Generally, different activities that students conducted on their smartphones were investigated. This helped to understand the conditions from which students used their smartphones generally.

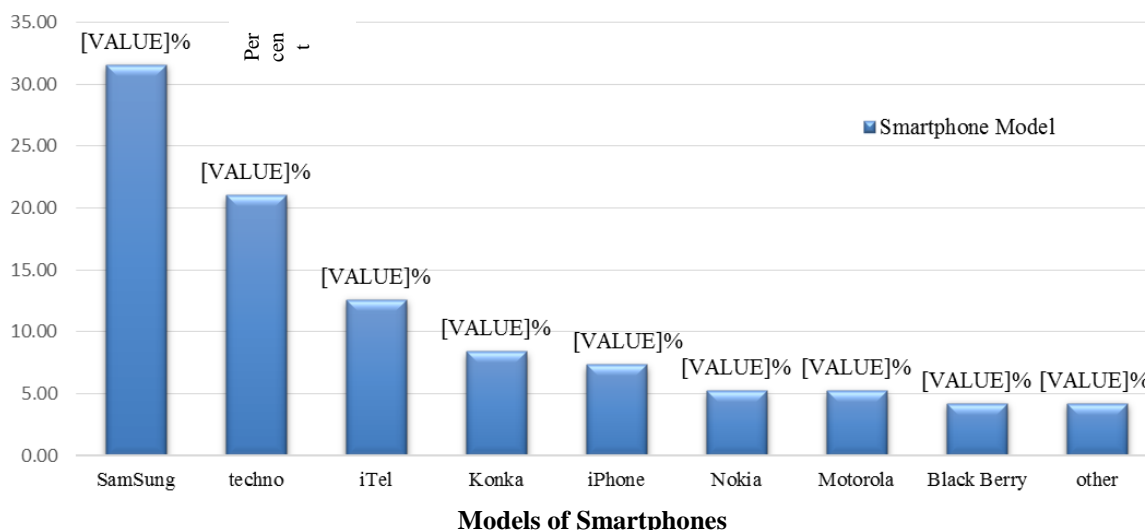
**i) Smartphone ownership and preferred Model:**

The study evaluated the figure of smartphone owners and the preferred model of the smartphone for the respondents.



**Figure 4.3 Smartphone owner**

Figure 4.3 shows that 89 (93.68%) of the respondents owned the smartphones and 6(6.32%) of the respondents did not own the smartphones.

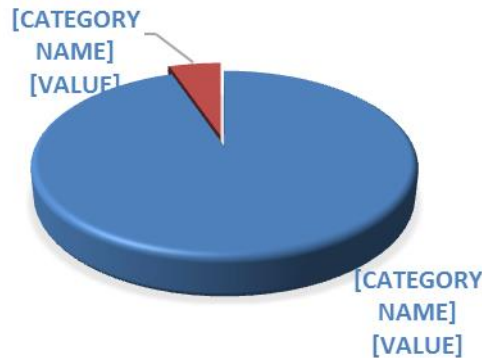


**Figure 4.4 Smartphone Model**

Figure 4.4 shows that the most preferred model of smartphone for respondent students were: Samsung 30 (31.57%), Techno 20 (21.05%), iTel 12 (12.63%), Konka 8 (8.42%), iPhone 7 (7.37%), Nokia 5(5.26%), Motorola 5(5.26%), Black Berry 4(4.21%) and others 4(4.21%). Reason behind the choice of these model were; affordability and availability of free Smartphone Applications.

**ii) Internet Access on Smartphone:**

The study assessed the availability of the Internet on the respondents’ smartphones;



**Figure 4.5 Access of internet on smartphone**

Figure 4.5 shows that apart from making calls, 90 (94.74%) of the respondents accessed the Internet on their smartphones and only 5(5.26%) did not access Internet on their smartphones.

**Table 4.3 Internet access time arrange**

		Frequency	Percent
Questionnaire	Several times in a day	55	57.89
	3-5 days in a week	17	17.89
	About once in a day	14	14.74
	1-2 days in a week	6	6.32
	Never	2	2.11
	Every few weeks	1	1.05
	Total	95	100.00

Table 4.3 shows that 55 (57.89%) of the respondents accessed the Internet several times in day, 17(17.89%) about three to five days in week, 14(14.74%) about once in a week, 6(6.32%) about 1-2 days in a week, 1(1.05%) about every few weeks and only 2(2.11%) of the respondents did never access Internet on smartphones.

**Table 4.4 Other use of smartphone**

	N	YES	NO
Chatting with friends on social media	95	73 (76.84%)	22 (23.16)
Send and receive SMS	95	69 (72.63%)	26 (27.34%)
Internet browsing	95	68 (71.58%)	27 (28.42%)
Reading and /or edit documents	95	55 (57.90%)	40 (42.10%)
Sharing files or Documents	95	85 (89.47%)	10 (10.53%)
e-mail	95	34 (35.79%)	61 (64.21%)
Taking picture	95	53 (55.79%)	43 (44.21%)
Voice recording	95	42 (44.21%)	53 (55.79%)
Others		6 (6.31%)	89 (93.69%)

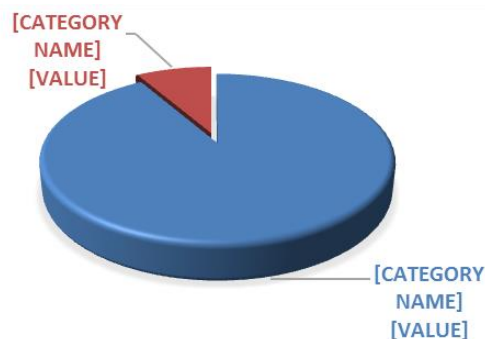
Table 4.4 confirmed that 73 (76.84%) of students used smartphones to chat with friends and colleagues using social media Apps, 69 (72.63%) used their smartphones in sending and receiving SMS, 68(71.58%) used smartphones for internet browsing ,55(57.90%) used smartphones to read and edit documents, 53(55.79%) use smartphone to take

picture, 42(44.21%) used smartphones in voice recording, 34(35.79%) used smartphones for reading and sending emails and 6 (6.31%) used smartphones for other activities including games, watching video, downloading APPs and so on.

In general, the study found that the majority of the respondents owned smartphones and Samsung and techno smartphones are mostly preferred smartphone models. The study also found that the smartphones were mostly used for accessing internet on daily basis in order to be able to use social media applications which allows chatting, sharing of files among friends and colleagues, or browsing internet for information searching. In comparison with other Calandro, Stock and Gillwald (2012) found that in Rwanda among Internet users in 2012, 71% of them access Internet through their mobilephone. It also found that 57% of the Internet users in Rwanda access it daily.

**4.2.3 Usage of Smartphone in Self-directed Learning Activities:**

According to Hiemstra (1994), self-directed learning involves various activities and resources such as self-guided reading, participation in study groups, electronic dialogues and reflective writing activities. In referring to Hiemstra (1994) the study looked at the usage of smartphones in electronic dialogue (interaction) for knowledge sharing and collaborative learning. The study also considered the usage of smartphones in self-guided reading, researching, group learning and collaborative learning.



**Figure 4.6 Participation in Self-directed learning activities**

Figure 4.6 indicates that 87 (91.58%) of the respondents participated in different self-directed learning activities and only 8(8.42%) of the respondents did not participate in any self-directed learning activities.

**Table 4.5 Usage of smartphone in learning activities**

Activities	N	Agree	Neutral	Disagree	Mean	Std
		3	2	1		
To read class notes	95	55 (57.89%)	17 (17.89%)	23 (24.21%)	2.33	0.84
To read books	95	41 (43.15%)	17 (17.89%)	37 (38.94%)	2.04	0.90
To share document with classmates	95	83 (87.36 %)	5 (5.26%)	7 (7.36%)	2.79	0.55
To register course online	95	43 (45.26%)	26 (27.36%)	26 (27.26 %)	2.17	0.83
To check marks online	95	60 (63.15 %)	15 (15.78%)	20 (21.05%)	2.42	0.81
To do research on internet	95	81 (85.26%)	9 (9.47%)	5 (5.26%)	2.79	0.51
To consult online libraries	95	23 (24.21%)	31 (32.63%)	41 (43.15%)	1.81	0.80
To communicate with lecturers	95	54 (56.84%)	18 (18.94%)	23 (24.21%)	2.32	0.84

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

(SD >0.5 or high -Respondents responses dispersed on the responses)

Table 4.5 shows different learning activities that students participated in. The respondents views on usage of smartphones to read class notes lied between agree and neutral, with a corresponding weighted average of 2.33. However the standard deviation of 0.84 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usage of smartphones to read books lied between agree and neutral, with a corresponding weighted average of 2.04. However the standard deviation of 0.90 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of smartphones to share documents among students, were between agree and neutral, with a corresponding weighted average of 2.79. However the standard deviation of 0.55 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usage of smartphones to register course online lied between agree and neutral, with a corresponding weighted average of 2.17. However the standard deviation of 0.83 indicated that respondents were fairly dispersed on their responses.

In addition, the respondents' opinion on usage of smartphone to check marks online lied between agree and neutral, with a corresponding weighted average of 2.42. However the standard deviation of 0.81 indicated that respondents were fairly dispersed on their responses.

Furthermore, the respondents' view on usage of smartphones for doing research on the Internet, were between agree and neutral, with a corresponding weighted average of 2.42. Nevertheless the standard deviation of 0.51 indicated that respondents were fairly dispersed on their responses.

The respondents' view on usage of smartphones to consult online libraries lied between neutral and disagree, with a corresponding weighted average of 2.17. However the standard deviation of 0.80 indicated that respondents were fairly dispersed on their responses.

Additionally, the respondents' opinions on usage of smartphones to communicate with lecturers lied between agree and neutral, with a corresponding weighted average of 2.32. Nevertheless the standard deviation of 0.84 indicated that respondents were fairly dispersed on their responses.

**Table 4.6 Category of shared documents**

Shared documents	N	Yes	No
Class assignments	95	58 (61.05%)	37 (38.95%)
Class notes	95	65 (68.42%)	30 (31.58%)
Web links	95	41 (43.16%)	54 (56.84%)
e-books	95	28 (29.48%)	67 (70.52%)
Explanation notes	95	27 (28.42%)	68 (71.58%)
Others (including time table)	95	6 (6.32%)	89 (93.68%)

Table 4.6 shows that 65(68.42%) of the respondents shared class notes through their smartphones. Also 58(61.05%) of respondents shared class assignments using their smartphones, and others including web links 41(43.16 %), e-books 28 (29.48%), explanation notes 27 (28.42%) and 6(6.32%) among others.

**Table 4.7 Smartphone Applications used in Information sharing**

	Always (5)	Very Frequently (4)	Occasionally (3)	Rarely (2)	Never (1)	Mean	Std
email	33 (34.73%)	14 (14.73%)	19 (20.00%)	4 (4.21%)	25 (26.31%)	3.27	1.60
Bluetooth	17 (17.89%)	11 (11.57%)	23 (24.21%)	11 (11.57%)	33 (34.73%)	2.66	1.49
WhatsApp	55 (57.89%)	24 (25.26%)	6 (6.31%)	0 (0.00%)	10 (10.52%)	4.20	1.25
Facebook	18 (18.94%)	16 (16.84)	5 (5.26%)	8 (8.42%)	48 (50.52%)	2.45	1.66
Twitter	2 (2.10%)	0 (0.00%)	8 (8.42%)	6 (6.31%)	79 (83.15%)	1.31	0.80
Google Drive	6	3	4	8	74	1.51	1.13

	(6.31%)	(3.15%)	(4.21%)	(8.42%)	(77.89%)		
Drop Box	2 (2.10%)	0 (0.00%)	6 (6.31%)	8 (8.42%)	79 (83.15%)	1.29	0.77
Skype	6 (6.31%)	6 (6.31%)	0 (0.00%)	2 (2.10%)	81 (85.26%)	1.46	1.18

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),

(SD >0.5 or high -Respondents responses dispersed on the responses)

Table 4.7 shows different smartphone applications (APPS) that were used to share information among the students. The respondents' views on usage of e-mail application of smartphone to share information, were between very frequently and occasionally, with a corresponding weighted average of 3.27. However the standard deviation of 1.60 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usage of Bluetooth application of smartphone to share information among students lied between occasionally and rarely, with a corresponding weighted average of 2.66. However the standard deviation of 1.49 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of WhatsApp application to share information among students lied between always and very frequently, with a corresponding weighted average of 4.20. However the standard deviation of 1.25 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of Facebook application to share information among students lied between occasionally and rarely, with a corresponding weighted average of 2.45. However the standard deviation of 1.66 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of Twitter application to share information among students lied between rarely and never, with a corresponding weighted average of 1.31. However the standard deviation of 0.80 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of Google driver application to share information among students lied between rarely and never, with a corresponding weighted average of 1.51. However the standard deviation of 1.13 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of Drop Box application to share information among students lied between rarely and never, with a corresponding weighted average of 1.29. However the standard deviation of 0.77 indicated that respondents were fairly dispersed on their responses.

The respondents' opinions on usage of Skype application to share information among students lied between rarely and never, with a corresponding weighted average of 1.46. However the standard deviation of 1.18 indicated that respondents were fairly dispersed on their responses.

**a) Participation of student in group learning activities:**

The study identified different group learning activities that students were participating in.

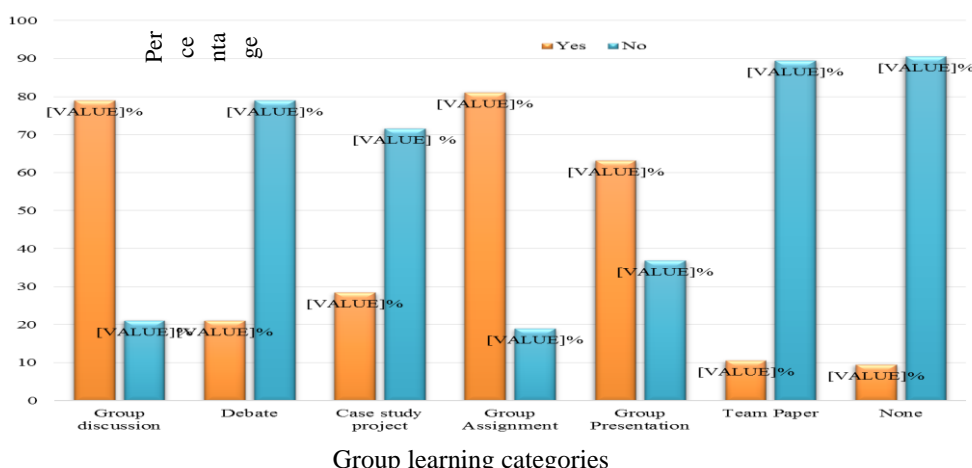


Figure 4.7 Student participation in group learning activities

Figure 4.7 indicates that 86 (90.52%) of the respondents participated in one or different type of group learning activities. In addition, 75 (78.94%) of respondents participated in group discussion activities, 77(81.05%) in group assignment in class and 60 (63.15%) in group presentations in class. Also, 27 (28.42%) of the respondents participated in case study projects and 20 (21.05%) of the respondents participated in debates. The study showed that only 9 (9.47%) of respondents did not participate in any group learning activities at all.

**Table 4.8 Usage of Smartphone in group study**

Activities	N	Agree 3	Neutral 2	Disagree 1	Mean	Std
Help to communicate with my group members	95	79 (83.16%)	8 (8.42 %)	8 (8.42 %)	2.74	0.60
Help to do the research on the topic to be discussed in group	95	64 (67.37%)	21 (21.11%)	10 (10.53%)	2.56	0.67
Allows to share documents and links to team members	95	51 (53.68%)	34 (35.79%)	10 (10.53%)	2.43	0.67

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),  
(SD >0.5 or high -Respondents responses dispersed on the responses)

The study assessed the usage of smartphones in group learning activity. Table 4.8 shows the respondents views on usage of smartphone in group learning action. The respondents' opinions on usage of smartphones to help students communicate among the group members lied between agree and neutral, with a corresponding weighted average of 2.74. However the standard deviation of 0.60 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usage of smartphones to help in doing research on the topic to be discussed in group, were between agree and neutral, with a corresponding weighted average of 2.56. However the standard deviation of 0.67 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usage of smartphones to share documents and links among the team members, were between agree and neutral, with a corresponding weighted average of 2.43. However the standard deviation of 0.67 indicated that respondents were fairly dispersed on their responses.

**Table 4.9 Usefulness of Smartphone for Self-directed Learning Activities**

Activities:	N	Useful 3	Some impact 2	Not useful 1	Mean	Std
Use of smartphone allow...						
Internet connectivity anywhere and at any time	95	74 (77.89%)	15 (15.79%)	6 (6.32 %)	2.71	0.57
Share knowledge, to follow and collaborate with others	95	71 (74.74%)	23 (24.21%)	1 (1.05%)	2.73	0.46
Access digital course references	95	56 (58.95%)	26 (27.37%)	13 (13.68%)	2.45	0.72
Do research on class related work.	95	81 (85.26%)	10 (10.53%)	4 (4.21%)	2.81	0.49
To read learning information anytime and everywhere	95	77 (81.05%)	14 (14.74%)	4 (4.21%)	2.76	0.51
To watch video learning materials (e.g. tutorials)	95	41 (43.16%)	40 (42.11%)	14 (14.74%)	2.28	0.70

(SD<0.5 or close to zero -Respondents responses crowded around the weighted mean),  
(SD >0.5 or high -Respondents responses dispersed on the responses)

The study also evaluated the usefulness of smartphone on self-directed learning activities. Table 4.9 indicate that different self-directed learning activities from which smartphones were useful to use. The respondents' opinions on usefulness of smartphone to access the Internet connection anywhere and at any time lied between useful and some impact, with a corresponding weighted average of 2.71. However the standard deviation of 0.57 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usefulness of smartphone to share knowledge, to follow and collaborate with others lied between useful and some impact, with a corresponding weighted average of 2.73. However the standard deviation of 0.43 indicated that respondents were fairly crowded around the weighted mean.



The respondents' views on usefulness of smartphone to access electronic course references lied between useful and some impact, with a corresponding weighted average of 2.45. However the standard deviation of 0.72 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usefulness of smartphone to do research on class related work lied between useful and some impact, with a corresponding weighted average of 2.81. However the standard deviation of 0.49 indicated that respondents were fairly crowded around the weighted mean.

The respondents' views on usefulness of smartphone to read learning information anytime and everywhere, were between useful and some impact, with a corresponding weighted average of 2.76. However the standard deviation of 0.51 indicated that respondents were fairly dispersed on their responses.

The respondents' views on usefulness of smartphone to watch video learning materials, were between useful and some impact, with a corresponding weighted average of 2.28. However the standard deviation of 0.70 indicated that respondents were fairly dispersed on their responses.

**b) Self-guided reading and researching:**

The study evaluated the ways students were using in order to access learning materials and do research.

**Table 4.10 Usage ways for self-reading and researching**

	N	YES	NO
Check on google search	95	71 (74.74%)	25 (25.26%)
Check on YouTube	95	21 (22.11%)	74 (77.89%)
Check on different website	95	51 (53.68%)	44 (46.32%)
Check in books from library	95	26 (27.37%)	69 (72.63%)
Ask friends on chat	95	43 (45.26%)	52 (54.74%)
Ask teacher on chat	95	17 (17.89%)	78 (82.11)
I post question on social media and get answer	95	20 (21.05%)	75 (78.95%)
Others....	95	2 (2.11%)	93 (97.89%)

Table 4.10 shows the different ways students used in order to acquire new knowledge or understand more their subject by themselves. The study indicates that 71(74.74%) of the respondents used Google to search for learning information, 51(53.68%) of the respondents consulted different websites in order to acquire knowledge and 43(45.26%) of the respondents consult friends and classmates.

In addition, Table 4.10 shows that 26 (27.37%) of the respondents used the campus library in order to read and acquire knowledge, 21 (22.11%) of the respondents consulted YouTube website and watched tutorial videos in order to learning more and acquire knowledge. Also, 20 (21.10 %) of the respondents used social network tools to get help from different people on social media.

**Table 4.11 Access to electronic/Digital course references**

	N	YES	NO
No reference	95	21 (22.11%)	74 (77.89%)
web link reference	95	57 (60.00%)	38 (40.00%)
e-books reference	95	42 (44.21%)	53 (55.79%)
Online video reference	95	12 (12.63%)	83 (87.37%)

In addition, the study tried to find out if students were given course references by their lecturers in order for them to read by themselves and acquire more knowledge. Table 4.11 shows that 74(77.89%) of the respondents confirmed to have been given electronic course reference materials by lecturers to read by themselves. Also, 57(60.00%) among the respondents got web links references from their lecturers, 42(44.21%) of the respondents got course e-book references from their lecturers, 12(12.9%) of the respondents got course online video references from their lecturers. Only 21(22.6%) of the respondents did not get any electronic course reference from their lecturers.

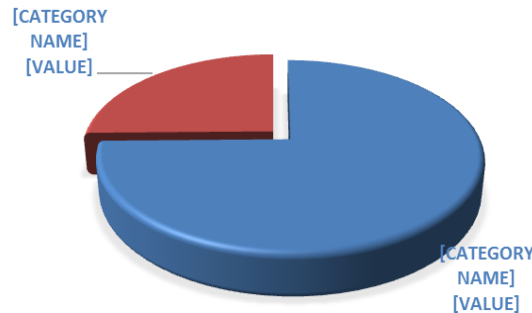


Figure 4.8 Access electronic course reference on smartphone

Above all, Figure 4.8 indicates that 71 (74.74%) of the respondents confirmed having used their smartphones in accessing and reading different electronic course references given by their lecturers for self-reading and researching in order to improve their skills (See Table 4.11).

Song, Wong and Looi (2012) revealed that utilizing smartphones as part of the curriculum met the individual learning needs of students which included improving anytime and anywhere communication and collaboration. They also found that students felt empowered with self-sufficiency, developed and followed their own learning paths which allowed more room for creativity, collaboration and problem-solving. Zhang, Song and Burston (2011) also confirmed that mobile phone technologies have the potential to increase learners' efficiency in self-regulated learning environments

In general, the study found that majority of the respondents were using smartphones in several learning activities which could lead them to become self-directed and long life learners. Among those activities, it was found that respondents were much involved in group learning activities mainly group discussion and group assignments activities, they used their smartphones in knowledge sharing and collaborative learning activities, self-guided reading and researching activities.

#### 4.2.4 Determination of Smartphone usage influence on Self-directed Learning Activities:

Multiple regression was used to predict the value of a variable based on the value of two or more other variables. The variable which was to be projected was called the dependent variable. The variables used to predict the value of the dependent variable were called the independent variables. Multiple linear regression tried to model the relationship between several explanatory variables and a response variable by fitting a linear equation to observed data. These results were achieved by the use of a multiple regression model. The multiple regression model was used to test how usage of smartphones affect self-directed learning activities at Mount Kenya University, Kigali campus. The statistical significance was verified by the Coefficient ( $\beta$ ), t-statistics, significance. In additional, statistically significant relationship between the dependent variable and independent variable from the model was accepted at 5% significance level.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + e$$

The dependent variable (Y): Self-directed learning activities

- i) The unknown parameters,  $\alpha$  (Alpha) represented a constant or intercept and  $\beta$  (Beta) denoted as  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$  represented a Beta coefficient.
- ii) The independent variables  $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8$  represented usage of smartphone to share documents, to send and receive SMS, to browse on Internet, to chat on social media, to send and receive e-mail, to record voice, to read and/or edit documents, to take pictures.
- iii) SPSS – Compute Variable option was used to compute the dependent variable (Self-directed Learning Activities) from the two constructs of the variable (i.e. Self-guided reading and researching, knowledge sharing and collaborative learning).

**Table 4.12 multiple regression analysis**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	2.338	.201		11.645	.000	1.939	2.738
To chat on social media	-.160	.107	-.162	-1.501	.137	-.373	.052
To send and receive SMS	.244	.109	.260	2.250	.027	.028	.460
To browse on Internet	-.039	.107	-.042	-.369	.713	-.251	.173
To read and /or edit documents	-.119	.142	-.140	-.837	.405	-.400	.163
To send and receive e-mail	-.089	.101	-.101	-.880	.381	-.291	.112
To take pictures	.603	.154	.714	3.925	.000	.298	.909
To record voice	-.086	.116	-.101	-.740	.461	-.317	.145
To share files and documents	.028	.068	.038	.415	.679	-.107	.164

a. Dependent Variable: Self-directed Learning Activities

**Table 4.13 Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.591a	.350	.289	.35606

a. Predictors: (Constant), I use smartphone to share documents, to send and receive SMS, to browse on Internet, to chat on social media, to send and receive e-mail, to record voice , to read and /or edit documents, to take pictures

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + e \quad \text{where } e = 0.35606$$

$$Y = 2.338 + 0.028 X_1 + 0.244 X_2 - 0.039 X_3 - 0.160 X_4 - 0.089 X_5 - 0.086 X_6 - 0.119 X_7 - 0.603 X_8 + 0.35606$$

Where by:

X1 = Use of smartphone to share documents

X2 = Use of smartphone to send and receive SMS

X3 = Use of smartphone to browse on the Internet

X4 = Use of smartphone to chat on social media

X5 = Use of smartphone to send and receive e-mail

X6 = Use of smartphone to record voice

X7 = Use of smartphone to read and /or edit documents

X8 = Use of smartphone to take picture

Thus, self-directed learning Activities = 2.338 + 0.028 (share documents and files) + 0.244 (send and receive SMS) - 0.039 (browse on the Internet) - 0.160 (chat on social media) - 0.089 (send and receive e-mail) - 0.086 (record voice) - 0.119 (read and /or edit documents) - 0.603 (take pictures) + 0.35606

Table 4.13 shows that r=0.591, this meant that there was a moderately strong, positive correlation between independent variables which include usage of smartphone to share documents, to send and receive SMS, to browse on Internet, to chat on social media, to send and receive e-mail, to record voice, to read and /or edit documents, to take pictures and dependent variable (Self-directed learning activity). It showed that coefficient of determination (r<sup>2</sup>) = 0.350 which meant that the majority 35.0% of the variability in dependent variable (i.e. Y: Self-directed learning activities) depended on the linear relationship given by the multiple regression model that was developed for this study. The other 65.0% of the total variation in Y belonged to the factors that were out of control of the study.

### **4.3 Content Analysis of the Interview Guide:**

As necessity to this study, an interview to Mount Kenya University, Kigali Campus lecturers was conducted. In aim of gathering views from lecturer's perspective on usage of smartphone and self-directed learning.

Majority of the interviewed lecturers admitted that they owned smartphones and they used them daily life for communication purposes.

The majority of the lecturers agreed that smartphones are portable, small in size and one can access information easily regardless of where one is.

The majority of the lecturers preferred to communicate with students through face to face interactions.

Numerous lecturers admitted that self-directed learning should be encouraged because it makes learner to become long-life learner and it can also help students to learn more and do research by themselves.

Majority of the lecturers agreed smartphones are helpful because when they are connected to the internet students can use them to acquire more information from online information sources. In additional to that, information can be easily shared and access from any location.

The majority of the lecturers thought that it is a great way of acquiring and sharing knowledge since most students are already using social media. However, if knowledge is not correct or from reliable sources then the acquired knowledge may not be reliable and may need a proper control, sometimes it can have negative impact.

### **4.4 Summary:**

This chapter presents analysed and interpreted data collected for this study. This chapter provided demographic characteristics of sampled respondents, general usage of smartphone, self-directed learning activities, knowledge sharing and collaborative learning, self-guided reading and researching ,influence of smartphone on self-directed was analyzed using multiple regression.

## **5. SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Summary of major findings:**

The General objective of this study aimed at assessing the effect of smartphone usage on self-directed learning activities at Mount Kenya University Kigali, Rwanda. The study sought answers to the following research questions:

- i. How are smartphones used by student and lecturers at Mount Kenya University Kigali, Rwanda?
- ii. How is the usage of smartphone help in self-directed learning by students of Mount Kenya University Kigali, Rwanda?
- iii. How does smartphone usage correlate with self-directed learning activities at Mount Kenya University Kigali, Rwanda?

#### **5.1.1 Use of smartphone by students and lecturers:**

The study found that students and lecturers owned smartphones and they used them in their education lives and social lives. The analysis of the study indicated that 89 (93.68 %) of the respondents students owned smartphones and Majority of interviewed lecturers admitted to owning smartphones. The study found that majority of the students 90(94.74%) accessed the Internet on their smartphones and 55(57.89%) of the respondents confirmed to accessing the Internet several times in day.

In addition to that, 73 (76.84%) of the respondents confirmed to using social media applications in chatting with their colleagues and friends. 87 (91.58%) of the respondents agreed to participating in different self-directed learning activities. They confirmed that smartphones helped students to access the Internet anywhere and do research; students were able to access, read and share information easily. In their views the majority of lecturers used their smartphones for communication purpose. However they agreed that they preferred face to face communication when it can comes to communicate with their students on class related matters. Nevertheless, they also found self-directed learning to be interesting at higher learning institution level since it could help students to do the research, acquire new knowledge by themselves and be able to become long life learners .The interviewed lecturers put an emphasis on proper usage of smartphone in order to avoid negative impact that usage of smartphone can cause if it is misused in education environment.

### **5.1.2 Use of Smartphone in Promoting Self-directed Learning:**

As defined by Hiemstra (1994), self-directed learning involve various activities and resources such as self-guided reading, participation in study groups , electronic dialogues and others . This study focused only on two activities that are involved in self-directed which are; knowledge sharing and collaborative learning activities (i.e. group studying, interaction and sharing of knowledge among the group members), self-guided reading and researching activities.

The study found that students were heavily involved in knowledge sharing and collaborative learning activities in their daily and social lives. The study indicated that 83(87.36%) of the respondents used their smartphones in sharing information with their classmates and friends via social media applications (APPs), e-mails and Bluetooth. The most preferred smartphone APPs to use very frequently was WhatsApp and occasionally e-mail application. The study found that 86 (90.52%) of the respondents participated in different group learning activities .Also ,75(78.94%) of the respondents participated in group discussion , 77(81.05%) group assignments, 60 (63.15%) group presentation , 27 (28.42%) case study project , 20 (21.05%) debate and team paper 11 (11.58%). In addition, their smartphones helped them in the group learning activities, 71(74.74%) of the respondents confirmed that smartphone helped them to use social network apps to share knowledge, to follow and collaborate with group members.

Also the study revealed that students were also involved in self-guided reading and researching activities. The study found that 81(85.26%) of the respondents used their smartphones to do research on the Internet and 55(57.89%) of the respondents confirmed using their smartphones for reading class notes. In addition to that, 71(74.74%) of the respondents used Google search to search and acquire knowledge. Also, 51(53.68%) of the respondents use other websites, 43(45.26%) consulted friends via instant messaging .Furthermore the study revealed that 74(77.89%) of the respondents agreed to getting different electronic course references formats from their lecturers, 70(73.38%) of the respondents agreed to accessing those references using their smartphones.

### **5.1.3 Relationship between Smartphone usage and Self-directed Learning Activities:**

By using multiple regression analysis, the study found that correlation coefficient ( $r$ ) =0.626 .This meant that there was a moderately strong, positive correlation between usage of smartphone and self-directed learning activities. This means that the increase in usage of smartphone at Mount Kenya University, Kigali Campus is likely to promote the increase in among students ability to read and do research by themselves. Also, increase in smartphone usage is likely to significantly influence the knowledge sharing and collaboration learning activities at Mount Kenya University Kigali, Rwanda. The intervention of other factors in this case, Internet connectivity infrastructure, Phone companies' policies and laws of the government of Rwanda cannot be ignored or forgotten.

Similarly, Koh, Loh, & Hong (2013) also found that academic achievement and self-directed learning of students was affected with the smartphone-enabled curriculum. Students had higher academic achievement with the smartphone enabled curriculum compared to the worksheet-based curriculum. However, the results for self-directed learning were more complex. Although the smartphone seems to encourage self-direction, the extent of the learning depends.

### **5.2 Conclusion:**

The study found that there is a moderately strong correlation between usage of smartphones and self-directed learning at higher learning institution level in Rwanda, precisely at Mount Kenya University Kigali, Rwanda. The study discovered that smartphones help university students in communication, information access and sharing, interaction and collaboration learning which leads them to become self-directed learners .However challenges failed in the use of smartphone include: high cost of internet bundles, internet speed and scarcity of educational APPs.

### **5.3 Recommendations:**

In the short term, it is recommended that:

Mount Kenya University (MKU) Kigali, Rwanda lecturers, should play a big role in promoting the usage of smartphones for educational purposes, among students and usage of social network to promote knowledge sharing and collaborative learning.

Mount Kenya University Kigali, Rwanda should encourage students on the usage of smartphones in their learning because many students may still be unaware of the potential benefits of smartphones.

In the long term, it is recommended that:

The Ministry of Education should recognize and promote usage of smartphone in higher learning institutions, as way of bridging the digital divide.

The Ministry of Youth and ICT, should promote the usage of portable ICT tools including smartphones, to improve National ICT usage in all sectors.

#### **5.4 Suggestions for Further Study:**

Based on the findings of this study, more work should be carried out in future, to evaluate how lecturers can promote and implement the usage of smartphones for self-directed learning.

Being a case study, results from this study are hard to generalize. Therefore a more broad-based study is suggested which covers more or all universities in Rwanda, in order to give a better and more reliable picture on smartphone usage for self-directed learning at higher learning Institutions.

The stochastic model developed for this study suggested that there are other factors that may contribute to the self-directed learning among university students. A more detailed study need to be done on those other factors, once they are identified.

Smartphones are likely to evolve rapidly in terms of technology. A long term study should be carried out on how students use the evolving technology of smartphones for educational purposes, especially for self-directed learning.

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