AVAILABILITY, READINESS AND UTILIZATION OF SMAARTPHONES FOR LEARNING AMONG BIOLOGY STUDENTS IN COLLEGES OF EDUCATION GOMBE STATE, NIGERIA

BY

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MTech/SSTE/FT/2017/7272

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FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
NIGER STATE

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A THESIS SUBMITTED TO POST GRADUATE SCHOOL, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, IN PARTIAL REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTERS OF TECHNOLOGY (MTECH) IN EDUCATIONAL TECHNOLOGY, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE, SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION DEPARTMENT OF EDUCATIONAL TECHNOLOGY

NOVEMBER, 2021

DECLARATION

I hereby declare that this thesis: "**Availability, Readiness and Utilization of Smartphones for Learning among Biology Students in Colleges of Education Gombe State, Nigeria**" is a collection of my original research work and it has not been presented for any other qualification anywhere. Information from other sources published or unpublished has been duly acknowledge.

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Signature & Date

CERTIFICATION

This thesis titled: **"Availability, Readiness and Utilization of Smartphones for Learning among Biology Students in Colleges of Education Gombe State, Nigeria"** by MUSA, Jephtha Ali MTech/SSTE/2017/FT/7272 meets the regulations governing the award of the degree of masters of Technology in Educational Technology, Federal University of Technology Minna and it is approved for its contribution to scientific knowledge and literary presentation.

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DEDICATION

This Research thesis is Dedicated to the researcher's late father Mr Musa Ali late Grandfather Mal. Ali Dalti and to my dear mother Mrs. Jummai M. Ali.

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I lift up my voice of praise to you mighty God because when I lift up my eyes to the hills where does my help comes from, my help comes from the lord God Almighty the Creator of Heaven and the Earth.

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ABSTRACT

The Study investigated Availability, Readiness and Utilization of Smartphones among Biology students of Colleges of Education in Gombe State, Nigeria. The study adopted a Descriptive Survey research design. To guide the study, five specific objectives, five research questions and two research hypotheses were formulated and tested at 0.05 alpha level. The population of the study was 392 NCE I, II, III Students from Biology Department of School of Science Education in the two Colleges of Education in Gombe State. One hundred and eighty-two Students constitute the sample size for the study using research advisor sample size for determining table. The instrument for generating data for the study was a checklist and twelve researcher's designed questionnaire which was validated by two experts in Educational Technology Department from Federal university of Technology Minna and one expert in Counselling Psychology Department from Ibrahim Badamasi Babangida University Lapai Niger State. A Pilot test was conducted and reliability coefficient /index of 0.86 and 0.90 was obtained the instrument was administered on all the respondents and retrieved back immediately. A checklist was used to answer research question one, Mean and Standard Deviation were used to answer question two and t-test statistics was used to answer research question four and five respectively. A Decision rule of 2.50 mean score and above was considered agreed while mean below 2.50 was considered disagreed. From the result of question two findings reveal that the mean readiness scores of Biology students' towards the use of smartphone has a Grand mean score of 3.06. Also research question three shows that respondents agreed that smartphones are utilized for learning with Grand mean score of 3.04. From the result of the study hypothesis one revealed that the differences between male and female readiness of smartphone for learning biology is at t (2.932) = 0.20, p-value of 0.110 greater than 0.05 level of significance. Also from the study of hypothesis two that revealed the differences between male and female biology students' utilization of smartphones for learning at t (3.193) = 0.20, p-value of 0.122 greater than 0.05 level of significance. Among the recommendations is service providers should reduce internet service tariffs so that students can afford and use mobile services with ease.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The fundamental aspect of all human lives in a contemporary Society is technology and cannot be neglected because of its contribution in the welfare of human beings. The emergence of modern technology led to the invention of mobile phone which has become an essential part of people's daily life and a valuable means of information dissemination since its inception in the late 1990s' in Nigeria and in most developing countries. Mobile phone has become an instrument for the rapid increase in telecommunication accessibility in Nigeria as the number of telephone lines is about thirty million (Msuya, 2015). The above Nineteenth century telecommunication technology metamorphosed into the Smartphone in this recent century

In this 21st century, Smartphone's are being manufactured by numerous companies and are one of the fastest growing sectors in the technology industry. Operating systems include Google's Android, Apple's iOS, Research in Motion's BlackBerry, Nokia's Symbian, and the Windows Phone 7 platform. They are commonly used for patient monitoring and diagnostics in the Health sector by most developed Countries while in the educational

sector, they are used for acquiring knowledge (learning) by lecturers' student to more efficient medical education and communication, and Smartphone's serve a vital role in the practice of medicine today. In this review, we will be able to understand how the Smartphone has changed the field of internal medicine and medical education. Survey of the ways in which the Smartphone are used to better understand how that impact might be achieved. Consequently, we conclude this review with suggested apps for physicians based on anecdotal experience and suggest hanging studies that can better answer these questions (Sarrah *et al.*, 2014).

In Nigeria, the emergence of mobile phone has brought about a profound diversification of knowledge. However, it has also led to educational corruption and it restricts lecturers and students' commitment to serious academic work, which negatively affect their thinking process and communication (Jessica, 2013). She also added that "Nigerians have joined the rest of the world on social media sites such as Facebook, WhatsApp, and twitter with a quite number of them visiting those sites daily through their mobile phones, Nigerians are so active in these sites; even some of them are considering their site for Nigerian".

Smartphone has been in existence for about two to three decades to date when one of the largest communications and technology company "Apple" introduced smartphone to the free market, yet smartphone was already being produced and marketed since 1993 (Sarwar, and Soomro, 2013). Smartphones have developed more consideration and becoming increasingly popular in the market, following the release of another apple iPhone in 2007. The difference between the current smartphone and the previous one is that, the earlier version was more prominently used as equipment in a company, and the price was too expensive for the public users. Because of slow technological developments in the past, and the price, the users of smartphone were limited to business groups only the impact of these

smartphones fastens telecommunication through information communication technology these days.

Information communication technology (ICT) which refers to the technology that provides access to information through Telecommunication. It is similar to information technology (IT). But focuses primarily on communication technologies. These include the internet, wireless network, cell phones and other communication medium. In the past few decades people can communicate in real time with others in different countries using technologies. Modern information technologies have also created a ‘global village ‘in which people can communicate with others as if they were living next door.

Information communication technology in education was viewed as “"diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information." ICT implies the technology which consists of electronic devices and associated human interactive materials that enable the user to employ them for a wide range of teaching - learning processes in addition to personal uses in Education, it also broadcast material, online facility or CD-ROM can be used as sources of information in different subjects, it also facilitate communication for pupils with special needs, To use electronic toys to develop spatial awareness and psycho-motor control ,To use the Online resource like, email, Chat, discussion forum to support collaborative writing and sharing of information. It has also facilitated video-conferencing or other form of Tele conferencing to involve wide range of students from distant Geographic areas, For Blended learning by combining conventional classroom learning with E-learning learning systems, it processes administrative and assessment data, it creates a platform for exchange and share of ideas - among teachers for the professional growth as it helps in carrying out internet-based

research to enhance, educational process (Kale, 2016). Most of the learning processes through the use of ICT are mostly achievable with Smartphone's for an easy access.

Smartphone's are a class of mobile phones and of multi-purpose mobile computing devices. They are distinguished from feature phones by their stronger hardware capabilities and extensive mobile operating. A mobile phone that performs many of the functions of a computer, typically having a touch screen interface, Internet access, and an operating system capable of running downloaded apps.

The penetration of Smartphone into the educational circle has change its basic function from mere communication tool to learning tool. In recent years, the purpose of cell phone has shifted from a verbal communication tool to a multimedia tool, which is very useful in teaching and learning process (Amanda, 2015). Smartphone's are now use for surfing the web, checking email, snapping photos, updating social media status, and installing applications (Amanda, 2015). The presence of Smartphone among students is highly needed due to its portability and accessibility to current and reliable information. Students were asked to mention the types of mobile phones (brands) they owned and used in their daily activities. It was found that majority of students (61.1%) own Smartphone and are using TECNO Smartphone products, 27.8% are using Samsung and 7.8% are using Nokia; while 3.3% are using other brands (Msuya, 2015).

Smartphones were first produced in April 1973 the first cellular phone call was placed by a general manager at Motorola Ever since, mobile communication has drastically changed the way we work and live our lives (Terada, 2012). More recently, another technology is driving such change: the smartphone. Faster processors, improved memory, and smaller batteries in concert with highly efficient operating systems capable of advanced functions have paved the way for applications (commonly referred to as apps) that are affecting our

personal and work environments. Like other industries, the field of medicine experienced the resounding effects of the Smartphone. In fact, it may be among those industries where the impact has been most profound. The role played by the Smartphones can only be effective when they are readily available for use.

Availability of affordable devices (smartphones) is the growing ecosystem of refurbished devices, and increasing internet penetration are fueling the switch to Smartphone, especially in the African Region. In the larger African countries, like Nigeria and Kenya, Smartphone remain the primary medium to access internet services. The availability of these Smartphone is providing a new frontier for the application of educational technology within the academia for effective learning by learners. However, as with any relatively new technology, much has to be understood about the concept of mobile learning before it can be employed effectively. One of the most logical early steps is to understand the perception of the stakeholders, including lecturer and students. Mobile technology is providing a new frontier for the application of educational technology within the academia. However, as with any relatively new technology, much has to be understood about the concept of mobile learning before it can be employed effectively in education, lecturers can prepare PowerPoint presentations and upload to a Learning Management System rather than have to print a copy for each student. Students can read their course materials on their Smartphone's even while in bed, rather than have to go to the computer labs on the campus before having access to the materials. As explained previously, all these only speak of an efficient use of technology.

An official data on Smartphone availability among Nigerian college students is hard to come by, but it is an indisputable fact that owning a Smartphone has become a popular culture among Nigerian teachers and students (Liadi, 2016). Smartphone such as blackberry

and android are perceived as the most wanted accessory and to be up-to-date with the product among school students indicate that, 50.9% of senior secondary school students and teachers in Nigeria have one Smartphone; 24.8% have two Smartphones, 3.1% reported that they have more than two Smartphone while 21.2% admitted they do not have any Smartphone.

The possession of these mobile devices seems to have become normative and stands as one of the marks of student's identities on campus. It appears fashionable among Nigerian students to be seen with advanced mobile communication device such as Smartphones with high capacities and advanced features. In this regard, High Speed Packet Access (HSPA) connectivity, built-in virtual keyboards, high resolution digital still and video camera, pre-installed or downloadable Web 2.0 social software, and high capacity memory storage are standard features of the modern Smartphone's (Cochrane and Bateman, 2010). Students who are financially incapable to own a high-priced Smartphone tend to go extra-miles to possess these devices. Nigerian students presently have desire to acquire sophisticated and expensive mobile phones such as Blackberry Z10, iphone 5, Galaxy tab 5, and tab 6, techno C8, Infinix Hot/Note and others, Smartphone are available but not adequate among students in Nigerian Colleges of education (Latifat, 2014).

The realization that students are already engaging in mobile learning and an understanding of how students are supporting their learning in this way may prompt educators to examine the way their courses and programs are delivered. The implications for teaching and learning may be far-reaching, requiring educators to move beyond traditional didactic methods which still predominate at most institutions. They will need to explore and flirt with alternative pedagogies such as social constructivism or connectivism to meet their students where they want to learn. This is most likely a daunting proposition for most

educators, already overloaded with increased administrative duties and high teaching loads, and most likely lacking the skills and knowledge to implement mobile learning initiatives. Without tackling those meatier problems of pedagogy, this paper concludes with eight, entry level tactics to help educators embark on the mobile learning journey. Once comfortable with these methods, institutions may need to consider how educators can become skilled in mobile learning design and delivery.

The powerful features of the mobile technology should be creatively used to make the work effective and to achieve high results. Lecturers must not simply add technology to make learning efficient and effective they must plan for the creative use of these technologies in the classroom, their functional ability depends greatly on their Readiness for use by the User. Smartphones are often very ready for uses by users because its availability is quite different from its readiness to be used for academic purpose, given that students are already using mobile devices to support their study, it seems the most efficient and easy entry into mobile learning for educators lies in supporting what students already do (Tindell & Bohlander, 2011).

Adegbenro (2019) found that students frequently browsed lecture-unrelated websites, played games, involved themselves in social media and watched videos during class. This echoes the findings of Tindell and Bohlander (2011), who also added text messaging and sending pictures to those activities undertaken by students during class time. What is becoming apparent, however, is that students are also using their devices for class-related activities. This was acknowledged by Wallace, (2012) who stated that "students used their mobile devices for annotating lecture slides, taking notes, looking at lecture-related websites and looking at lecture-related documents. This literature forms the basis of the

first of the proposed tactics: the use of mobile devices in class should be allowed and students should be encouraged to use them for learning purposes (Sarrah *et al.,* 2014). However, the proper Utilization of smartphones are generally encouraged for use among college students for Learning because it yields a positive result.

Utilization of Smartphone's Technology in learning is powerful and it can be used in several great ways to make teaching and learning impactful. What can be done and what cannot be done is limited, basically by the creativity of the user. So, the more creative and innovative we get, the more results we'll see with using technology in class. However, I will provide a few examples just to help you get an Idea of what an effective use will look like. Students often require personal and quality feedback on the work they turn in. Lecturers can make use of the audio recording feature built into most smartphones to provide these personal and yet quality feedback to all students. Research has proven that students not just liked feedback given this way, but even preferred it when properly utilized for learning.

Furthermore, the efficient and effective use/utilization of smart phones preference leads to learning environments and examine the readiness of college students. In order to investigate preferences and attitudes with respect to mobile technology use in college education, 387 students at a state university have been surveyed. It has been observed that while students preferred their current portable laptops, those in higher classes were more inclined to favor mobile phones. The common problems of battery life and high cost of communication, both in Smartphone's and tablet systems, suggest that hardware quality and financial constraints seem to be two main factors in determining these technologies. While more than half of students expressed readiness for mobile learning, one quarter indicated indecision. Through

multivariate regression analysis, readiness to use mobile learning can be described in terms of perceived ease of use, perceived usefulness, personal innovativeness, self-management of learning, perceived device limitation, and availability. The attitudes and level of readiness to implementing Mobile Learning with Smartphone as a part of ubiquitous learning attempted to ascertain the extent students are interested in mobile learning. It also answers the question regarding the readiness of students to use mobile learning technologies.

When Smartphone's are effectively and efficiently utilize as expected by students, it brings about a totality of permanent change in behavior of the concern Student. As alternative learning infrastructure such as mobile technologies are becoming more common, and are challenging long held traditional modes of teaching Educators' attitudes toward use of wireless devices. Incorporating mobile Smartphone's in teaching can provide a chance for educators to lead innovative pedagogy. Study has shown based on an experiment with middle school students, college students and college instructors must utilize their phone for effective and efficient learning of a particular subject. Learn and study more ahead of students that lack or do not use their Smartphone for academic purposes.

The aim of this study is to it explored college students' readiness to utilize their Available smart phones in learning in Education: the types of usage they implement and suggest and whether they think that Smartphone should be implemented in academia as well as in all colleges. Most college students and their instructors needed much more technical assistance during the activities. College students were skeptical regarding the implementation of Smartphone in education (Alfawareh & Jusoh, 2014).

The education system must therefore modify its teaching methods for the oncoming wave of digitally-proficient students, their skills, experiences and needs. Teaching in the present era calls for reference to technological transformations as well as attention to definition of college lecturers, learners and curriculum for the increased incorporation of technologies argues that a shift in focus is necessary, from teacher-centered instruction to student-centered learning in which teachers take a secondary position as director, guide and supporter of the learning process

As the penetration of Smartphone in the society increases, there is a large growth in the use of Smartphone especially among youth. With the increasing number of teachers and students who have Smartphone, various aspects of their lives change, they begin to operate those gadgets to expand their teaching/learning experience and perform better in schools and in tertiary institutions as well (Woodcock, 2012).

The National Commission for Colleges Education, (NCCE) which is wholly owned and established by the federal government, with the mandate to address this dangerous trend by continually pursuing goals of quality assurance in teacher education, with basis on that seminal philosophy in the National Policy on Education; no education can rise above the quality of it teachers? appears overwhelmed by the enormity of the task before it. When the 1989 Education Act (Amendment Act 12 of 1993) was promulgated, it was meant to establish the National Commission for Colleges of Education (NCCE) with a primary mandate of supervising higher education in the country, in line with the utmost importance accorded to quality teacher education by the Federal Government.

The expectation on the agency is that teacher education should contribute to national development, ensure standardized and continuously reviewed the curriculum for the

colleges of education and strengthen the capacity of Nigeria Certificate in Education (NCE) graduates by way of establishing minimum standard and ensuring curriculum implementation. The UBE Act which was enacted in 2004, providing that all agencies of government directly responsible for teacher training, recruitment and licensing, pre-service Teacher Education at both the Nigeria Certificate in Education (NCE) and Bachelor degree Levels, should contribute in the overall teacher development in Nigeria. The question however remained on whether they are performing and on whether the MDG stet goals on teacher development in 2015 is achievable at this stage or not.

The NCCE has contributed little in the reform process of restructuring Teacher Education Program me, which was borne-out of huge publics outcry on the poor quality of NCE teachers, student? preferential option of university education, the exciting widespread practice of teachers teaching across a whole curriculum rather than their area of specialization and upgrade of minimum teaching qualification from the old Grade II certificate (TCII) to the Nigeria certificate in Education (NCE). Perhaps this should serve as a wakeup call on the commission to rise towards, revitalizing the process of producing quality teachers for the greater development of Nigerian education.

1.2 Statement of the Research Problem

In this 21st century Smartphone can be used to support, encourage and to improve teaching learning which give a latest output in the educational system. Despite students' positive feelings, they have also been faced with several challenges while integrating social media technologies into educational settings. This results into the growth of ICT because it is becoming a rich, reliable and guarantee site for enhancing and improving students and Lecturers resourcefulness.

Some students possess Smartphone, but have little or no knowledge of how to manipulate and utilize the phone to support their learning. Some students have electronic devices that can store, access, send, manipulate and read audio-visual information; but, they do not use them to record and share lectures (Liadi, 2016).

The major barrier to the integration of Smartphone in teaching and learning process in Nigeria is inadequate knowledge, experience and skills of mobile learning (Anigbo, 2015). In this contemporary age students need the knowledge and skills of modern technologies to develop and become digital immigrant moving towards becoming a global standard student who should be able to explore the internet for Educational purposes producing a twenty-one century students with good level of awareness to modern technology among other factors has prompted the researcher to embark on the survey research Availability, Readiness and Utilization of Smartphone for learning among Biology students of College of Education in Gombe State.

1.3 Aim and Objectives of the Study

The Aim of this research is to explore the Availability, Readiness and utilization of Smartphone for Learning among college of Education Biology Students' for Education purpose in Gombe State, Nigeria. Specifically, this study:

1. examine Availability of Smartphone among Biology students in Colleges of Education in Gombe State.
2. determine Biology Students' Readiness towards the use of Smartphones for learning in Colleges of Education Gombe State;
3. find out Utilization of Smartphones for learning among Biology Students' in Colleges of Education Gombe State;

4. determine Male and Female Biology Students' Readiness towards the use of Smartphones for learning among Colleges of Education in Gombe State and
5. determine male / female Biology Students Utilization of Smartphone's for learning in Colleges of Education in Gombe state.

1.4 Research Questions

The following research questions were drawn in line with the researcher's objectives to guide the study:

1. What is the mean availability of Smartphones for learning Biology among Colleges of Education in Gombe State?
2. What will be the mean Readiness Scores of Biology Students' towards the use of Smartphones among Colleges of Education Gombe State?
3. What is the mean Utilization Scores of Biology Students' towards use of Smartphones among Colleges of Education Gombe?
4. Are there any differences in the mean Readiness scores of Male and Female Biology Students towards the use of Smartphones among Colleges of Education Gombe State.?
5. Is there any mean difference between male and female Biology Students Utilization of smartphones for learning among Colleges of Education Gomb State.

1.5 Hypotheses

The following null hypotheses was tested at 0.05 level of significance.

1. There is no significant difference between male and female Readiness to use Smartphones for Learning Biology among Colleges of Education in Gombe State.

2. There is no significant differences between male and female Students Utilization of Smartphones for Learning Biology among Students in Colleges of Education in Gombe State, Nigeria.

1.6 Significance of the Study

This study will be significant to Students, pre-service Teachers, lecturers, Curriculum planners School authorities, government, and the society at large. It is expected that the study may possess all the potentials to assist in solving some educational problems through enlighten those in position to understand the expensive nature of education and stimulating them to provide adequate fund for the smooth enrolment of education at all level in Nigeria. Wireless devices serve as a "compass" for finding new information and enable access to location-based information on the basis of interest and personal need. Among the advantages of mobile learning are the ability to design cooperative, contextual, constructivist and authentic learning. This type of learning integrates mobile learning and flexible teaching strategies. Mobile devices can be used to investigate new content by turning passive data sources that contain huge amounts of information into interactive objects. This makes learning more relevant, allowing learners to access information at the right time and place. Providing the opportunity to interact with the learning materials enables a kinesthetic learning approach. Mobile resources can be an ideal way to provide immediate assistance to students through the devices they own and use themselves, to provide background on what is learned and enable individually-paced learning.

The aim is for students to efficiently and effectively use mobile devices to enrich the learning experience. In addition, orientation-enabled mobile devices have an advantage in reducing memory load, real-time support satisfaction and facilitate classroom management processes embracing these technologies that are broadly regarded as a nuisance, if used correctly, is certainly more constructive than the attempts to fight and resist technology in the classroom.

Furthermore, mobile phones and mobile applications offer a wide range of opportunities to educators and learners as well as the community by preparing its members for the wide range of subjects and skills necessary for the 21century. The ubiquity of mobile devices today along with the empowering potential of these devices makes mobile technologies a great candidate for integration in learning, and useful for the skills needed for employment in the future. While it is clear what educators and pedagogues think of mobile integration in the classroom, students' opinions are still underexplored. The aim of this study was to examine the extent to which the use of Smartphone’s for teaching affects students' motivation as well as students and instructors' attitudes toward the implementation of Smartphone in education: the types of usage they implement and suggest and whether they think that Smartphone should be implemented.

Finally, in academia all Schools Students are going to benefit from this study by understanding the contributions of Smartphone to education directly or indirectly. The study may enlighten the teachers to understand how to make effective use and management of Smartphone in and outside the classroom environment. It may also help them to explore and maximize the uses of relevant educational information and applications found free installed in Smartphone’s and these in play store and make use of the relevant ones in order to make teaching and learning more easier and also bust the academic performance of their

students which will foster students' creativity, reasoning skills and understanding in learning.

The study might also help curriculum planners (SUBEB, NERC, COAESU, NABTEB, NCCE and NUC) to serve as a tool that will help them organize various elements of a curriculum such as the core objectives (for example a competency to achieve) Subject, unit definition, activities, Assessments and resources during their yearly plan for School and institutions of learning to achieve objectives at the end. The study may also enlighten the researchers on the usefulness of Smartphone when searching information, due to its portability, reliability, quick accessibility to internet and low data consumption. This goes in line with reducing daily expenditure and maintaining economic stands of individual researcher and cost of the research at large.

School authorities may also benefit from the findings by understanding the importance of Smartphone in teaching and learning process so as to organize a seminar and workshops in order to enlighten and educate their staff (teachers) on how to utilize the Smartphone effectively and efficiently in and outside the classroom environment for the benefit of their learners.

The society at large may as well benefit from the findings of this study, knowing full well that the students are active part of the society. The result helps in enlightening college students about the negative impacts of mobile technology (Smartphone's) on social life which in turn influence students' academic performance.

Governments at all level are investing fewer amounts in to educational sector when compared to the educational needs of the society at large. The finding of this study may enlighten government on the importance and contribution of mobile technology devices to

the development of education, the needs to expand learning environment from traditional classroom to modern ways of learning (learning anywhere and anytime) and need to invest a good amount in to educational sector in order to make those gadgets available to the schools for easier accessibility to students at all time. Government should also try to send teachers to enroll in programs that will help them in using this educational equipment and equip them with the basic knowledge and skills of how to integrate them in teaching and learning process.

1.7 Scope of the Study

Geographically this study will cover Federal College of Education (Technical) Gombe and College of Education Billiri Gombe State. The state is located in the Northeastern part of Nigeria, is one of the country's 36 states; its capital is Gombe and it has 11 local Government areas. The state has an area of 20,265 km² and a population of around 2,365,000 people as of 2006, the researcher decided to use the two Colleges of Education in Gombe state due to proximity. The Study was limited to variable such as Availability, Readiness and Utilization of Smartphone's for Learning among Biology Students of Two Colleges of Education in Gombe state, Nigeria. The researcher carried out this study within six weeks.

1.8 Operational Definition of Terms.

The following terms and variables that will help for more clarification and understanding as used for the purpose of this study:

Smartphones -are referred to as mobile phone that performs many of the functions of a computer, typically having a touch screen interface, Internet access, and an operating system capable of running downloaded apps.

Availability- refers to the accessibility of a Smartphone that is suitable and ready for use by College Students.

Readiness- refers to the state of preparedness of Smartphone systems for use or being operated to perform its task by the user.

Utilization- *refers to the* act of using a smartphone in an effective way.

Effective- refers to an act of success or achieving the results that you want:

Efficient - refers to the act of achieving maximum productivity of a Smartphone with minimum waste of time.

Colleges of Education- these are Colleges / Schools that provides a qualitative teacher Education geared towards developing teachers who will be able to face challenges facing education by providing excellence opportunity

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

The conceptual framework of the study is presented in the figure 2.1.

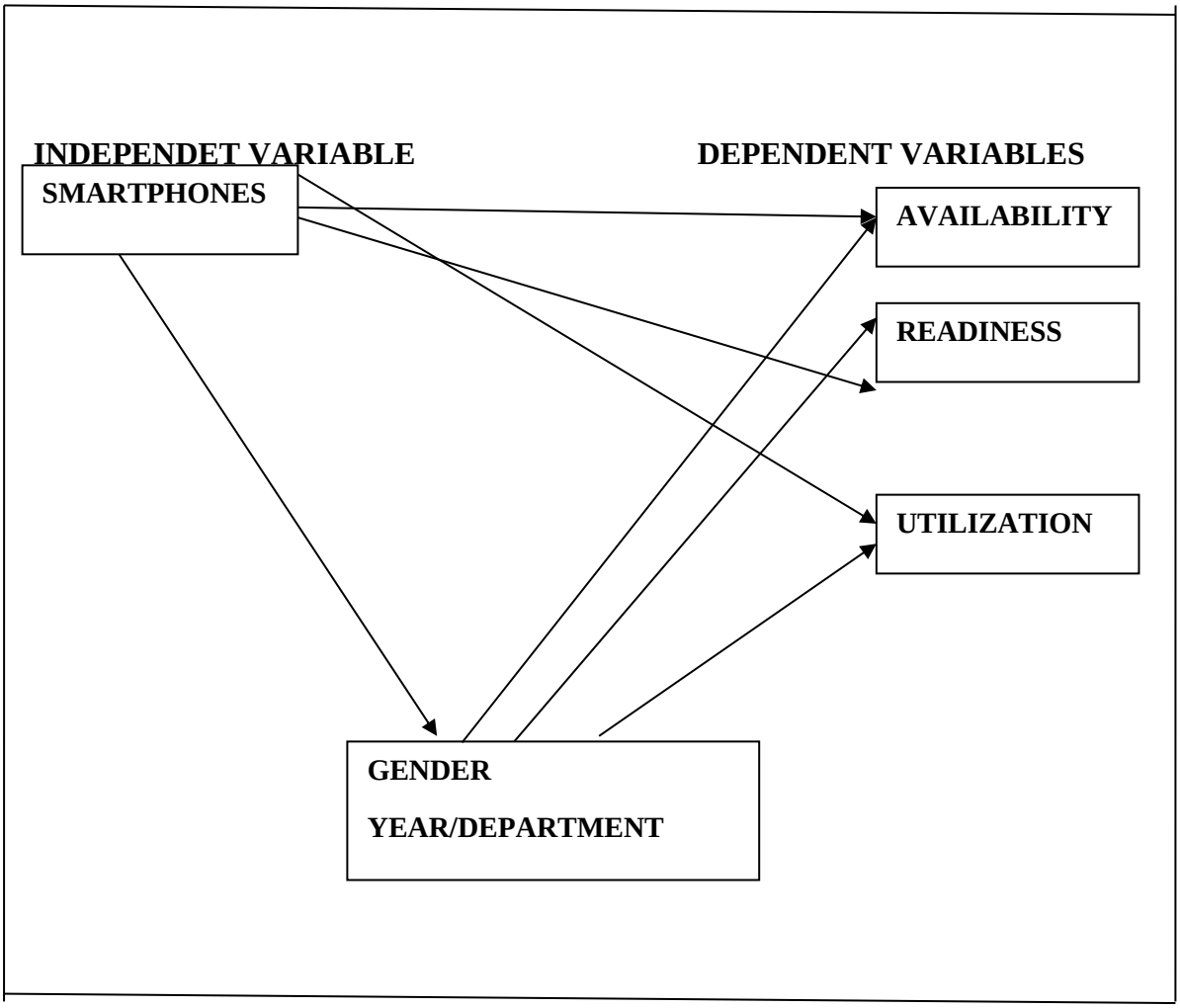

Figure 2.1: Conceptual Framework of Variables of the Study

Mobile technology refers to devices that are both transportable and offer instantaneous access to information (Coates *et al.,* 2009). The technology includes, "iPhones, MP3 player, Personal Digital Assistants, USB Drive, E-Book Reader, Smartphones, Ultra-Mobile PC and Laptop / Tablet PC" (Adeeb & Hussein, 2009). Personal Digital Assistants

(PDAs) and Smartphone are mobile devices that are agents of real-time communication (Chang *et al*., 2012). The characteristics of mobile technology are - portability, flexibility, simplicity of use and its unique ability to integrate with other technology systems (Alder & Fotheringham, 2012). Mobile technology has become a significant force in learning and it transition to more affordable and compact device with greater dependability and connectivity (Franklin *et al.,* 2007). In addition to its advantageous size and convenience, the technology permits multiple tasks such as note taking, telephone, email, music, video / audio recording, picture taking and GPS navigation (Akkerman & Filius, 2011). When compare with traditional computer, mobile technology demands less structure, which explain its simplicity in terms of operation and maintenance (Carillo *et al.,* 2011).

The flexibility of mobile technology allowed students to extend their learning experience so that it can occur at any-time and any-where (Chen, *et al.,*. 2009). Mobile technology facilitates access to personalized learning content (Shuller & Winters, 2013). Along with the ability to learn outside the traditional classroom setting, this is also in line to support independent learning and the development of met cognitive skills (Wong, 2012). Access to mobile technology allow students to design their own learning contexts in terms of when, where and how they feel they learn best, and learning become increasingly self-directed (Wong, 2012).

One market research firm estimates that 72% of US physicians use a Smartphone, and the research firm expects this number to rise to 81% in 2012 (Jeong 2011). Today Smartphone's are being manufactured by numerous companies and are one of the fastest growing sectors in the technology industry. Operating systems include Google's Android, Apple's iOS, Research in Motion's BlackBerry, Nokia's Symbian, and the Windows Phone 7 platform. From patient monitoring and diagnostics to more efficient education and

communication, Smartphone serve a vital role in the practice of medicine today (Menon, 2011). In this review, we will the available literature to understand how the Smartphone has changed the field of internal medicine and education. We also see the ways in which the Smartphone is used to better understanding and impact might be achieved by students that maps for biology based on anecdotal experience and suggest studies that can better answer educational questions to students on the process learning anywhere and at any time a student uses his Smartphone (Park & Yang 2011).

Smartphone's availability to students in Higher education and secondary school is common with those in the rest of the world, are grappling with the issues surrounding the implementation of mobile learning. Across the sector, institutional leaders are excited by the potential of mobile learning and the extraordinary affordances of rapidly evolving mobile devices. For most schools in developing countries, it is prohibitively expensive to supply devices to students, instead most informally for Bring Your Own Device (BYOD) strategies, and leaving it up to IT departments to determine whether and how this range of devices is supported (Rose, 2013).

A project at the College of Southern Queensland has been undertaken to explore the rates of ownership of various mobile devices among the student population and how students are using those devices to support their study. In spite of the institutional ambivalence towards supporting a range of mobile devices and operating systems, many students are using their own devices to informally support their learning. Even so, educators have been reluctant to engage with mobile learning, sometimes going to the other extreme of banning device use in class. Given that students are already engaging with mobile learning, it could be that the adoption of mobile learning strategies rather than an embarkation into unknown territory for learners is even more so for educator.

The portability and flexibility of mobile technology encourage students to transport their individual learning environment with them (Looi *et al.,* 2012). Mobile technology makes learning to be flexible and movable which extend the learning environment from school to home (Chen *et al.,* 2009). Access to personal device and the portable nature of mobile technology allow learners to build links between school and everyday life, bridge gap between formal and informal learning contexts, and transcend the limitations of their immediate environment (Shuller & Winters, 2013).

Opportunities are created through mobile platforms, which give learners an additional avenue to continue with the discussion that already been terminated in the physical classroom (Kuzu, 2011). Students can easily work on projects and assignments outside the classroom and are not restricted to work on stationary computer (Franklin *et al.,*. 2007). Traditional classroom hours are defined and mobile technology generates an unrestricted avenue for learning to continue outside the normal classroom hours (Chang *et al.*, 2012).

Collaboration is fostered with mobile technology, Collaboration is highlight by Kearney and Schuck (2012), as the third main benefit of mobile learning in addition to personalization and authenticity. Collaboration is defined as the ability to engage in discussion about learning which is supported by technology, as well as the ability to transfer and collaborate on learning content. The degree of collaboration is facilitated by a personalized approach to learning whereby all students' have access to mobile technology. (Vant, 2013), mobile device supports collaborative learning thanks to their portability and mobility (they are small enough to be carried in one hand). He further says that, accessibility of mobile device (ease of use and ability to turn on instantly), the ability to create, access and display information in multiple modalities (text, video, audio, graphics)

and the ability to communicate and share information; these are cited as facilities of mobile technology that support collaboration between students' and between teachers and students.

The advantage of adopting mobile learning is that, young people have access to mobile technology in their individual lives and increase their access to instant communication and personalized content in school (West, 2013). It has also been states that, students' perceptions of using mobile technology differ greatly. So teachers should incorporate mobile technology alongside with other methods of teaching in other to reach students' learning capacity (Snell & Siddli, 2013).

Mobile technology provides greater accessibility to both teaching and course content. Power & Shohel (2010) he observes that, students' share information through mobile devices when working on group project which increases collaboration. Mobility can nurture collaboration by bridging the gap in learning situation (Looi *et al.,* 2012). Mobile technology generates educational opportunities and positively impact students' engagement more especially students in remote locations with limited resources (Carillo *et al.,* 2011). Learners who participate in social networks for educational purposes have the opportunity to retrieve relevant information and share it to create better communication.

However, mobile technology has the potentials of disruption, isolating participants and limit social interaction (Blake *et al.,* 2012). The mobile technology that effectively reduces the level of interaction between students can result in a less cohesive learning (Adeeb & Hussain, 2009). Building an interactive and successful online community is challenging and if care is not taken, it may result to the formation of negative team (Jarvela & Laru, 2008). Although a student may possess a mobile technology device, ownership does not

mean that they will decide to apply it for learning purposes, only that the opportunity to do so exists (Akkerman & Filius, 2011).

2.2.1 Emergence of mobile phones in Nigeria

In Nigeria, as in most other developing countries, the mobile phone became instrument for the rapid development in telecommunication accessibility. Before digital mobile telephone was introduced to Nigeria in the late 1990s, the country had less than few telephone lines. Omeruo (2009), states that, before the spread of mobile phone in Nigeria, the number of telephone lines was about thirty million.

The Global System of Mobile Communication (GSM) was launched in Nigeria in 2001. GSM was then one of the second generation (2G) mobile technologies. GSM in Nigeria proved to be an instant success because it dominates the digital cellular market. Econet Wireless (which later had a lot of metamorphosis changing from Econent to Vmobile, Celtel and now Airtel) was the first GSM mobile phone network to establish in Nigeria. Later, MTN, Mtel and Glo establish their branches. However, the story of mobile telecommunication in Nigeria is not just about GSM, as the Code Division Multiple Access (CDMA) also contributes their quarter. Companies like Starcomms, Visafone and Bourdex are leaders in CDMA technology. In many ways, the mobile phone contributed a lot to the development of Nigeria. Ling (2003), mobile phone has fundamentally affected our societal accessibility, safety and security, co-ordination of social and business activities. It has become part of culture of every region in Nigeria.

Mobile phone does not only contribute positively in enhancing economic activities of the Nigeria's, but also improve students' academic performance. El-Hussein and Cronje (2010), using mobile phone to deliver higher education content will enhance learning and

training at higher education level. Mobile phones provide support for students' in learning and training through their capabilities as: enables quick content delivery, support time in project-based group work, engage students' in learning-related activities in a diverse physical location and enhance availability and accessibility of the information network.

There has been a slight change in traditional learning process through the use of mobile phone, shifting the world of learning to be more collaborative, learner-centered and enhancing students learning experience. (Nielsen & Webb, 2011), mobile phone as a means of communication and texting become popular in enhancing students' innovative skills in education. Students use texting and phone call to communicate ideas and facts which are the powerful means of effective and efficient learning. The benefit of mobile phone integration into students' learning is useful with the mobile phone capabilities of sending text message, call connectivity and accessing internet which support learning (Eteokleous & Ktoridou, 2009).

Kinsella (2009), when university lecture hall become large, mobile phones will be used to solve the problem of communication between lecturer and students, but a piece of software to support the adoption of the mobile phones is needed. Attewell, (2005). view that, students send anonymous text messages of questions and comment to the phone number displayed in the application; then each student can see the resulting communication on a big screen behind the lecturer. This application connects students with the lecturer in such a way that, students get their answers in a controlled manner. The support of this software or application platform has turned the mobile phone into a small classroom (Kinsella, 2009).

Scornavacca *et al.* (2009) through the use of SMS novel application, students' communication has grown which influence students' learning experience, more especially in larger [- classes. When mobile phone is use in a large classroom, students appear to be

more engage in learning process. Use of mobile phone in education increase teachers should accept the initiative of using mobile device as a learning tool. Barker, *et al* (2006), lament that, the use of mobile phone in learning increase group participation in activities done during classroom lesson.

Other great benefits of mobile phone include, keeping contact with friends, members of family, conducting business transactions, locating important places and searching relevant educational information. Many people possess more than one mobile phone for different purposes, which could be business, personal or academic. All of the above are not possible without reliable internet connection to the mobile phone which makes Smartphone to be more relevant than any other mobile phone.

2.2.2 Concept of smartphones

There is no universal or exact definition for the term Smartphone. However, Smartphone has gone beyond what Alexander Graham Bell first conceived when he invented the original telephone in 1870s (Madden, 2010). Smartphones are mobile phone with more advanced features and greater computing capacity than a cell phone. Smartphones have been in existents since 1993 when IBM company developed the first Smartphone called ‘’Simon’’. Since then, Smartphone have been termed as small computer, offering the kinds of power you had in your desktop or laptop computer (Smartphone 101 2006). One of the biggest advantages of Smartphone is the ability to access internet without difficulty.

Smartphone is a mobile phone with advance mobile operating system which combines the features of a personal computer operating system with other features useful for mobile or handheld use (Barnwell, 2016). Smartphone’s are usually pocket-sized, typically combine the features of a cell phone and personal digital assistants (PDAs), such as the ability to

place and receive voice call, create and receive text messages, calendar, media player, video games, GPS navigator, digital camera and digital video camera. All Smartphone can access Internet and run variety of third-party software components called "apps". They typically have a color display with a graphical user interface that covers 70% or more of the front surface. The display is often a touch screen, which enables the user to use a virtual keyboard to type words and numbers and press onscreen icons to activate "app" features. Smartphone became widespread in the late 2001s. Most of the Smartphone produced from 2012 onward have high-speed mobile broadband 4G LTE, motion sensors, and mobile payment features.

A mobile operating system (OS) is an operating system for Smartphone, tablets, PDAs, and iPhones. Mobile operating system combines features of a personal computer with other features useful for mobile phones such as, a touch screen, cellular, Bluetooth, Wi-Fi, GPS mobile navigation, camera, video camera, speech recognition, voice recorder, music player, near field communication and infrared blaster (Tosta, 2014).

Some common Smartphone operating system includes Android, Window mobile, Cyanogen Mod, EMUI, Fire OS, HTC Sense, Symbia, BlackBerry and TouchWiz. The most commonly used in developing countries are Android, Touch Wiz and blackberry (Portio, 2009). Android was developed by Google and is the most popular and commonly used OS in Nigeria (Ezemenaka, 2013). The first version of smartphone with android OS was 1.0 - API Level 1 and the current version is 7.0 – Nougat produce by LG Electronics Company.

The acceleration in the use of Smartphone and the emergence of an exciting class of mobile Internet devices such as IPhones, Netbooks, Smartphone and Tablets create an explosion of data transfer across wireless networks (Abu-Hassna & Amin, 2014). Such full-featured

devices give the consumer a multi-media viewing with listening experience, higher-resolution photography, and a richer set of applications like web browsers, global positioning system navigation GPS and vast educational applications (Ashraf, *et al.*,. 2009). The 21st century creates smartphone that are incredibly powerful and easy to use. Smartphone market has witnessed intense competition among vendors who are trying to overshadow each other through product innovations like the inclusion of new features (Portio, 2009). New generation companies like Techno, Gionee, itel and Huawoo increases the rate of competition in smartphone market due to the manufacture of highly sophisticated smartphones that are capable of competing with highly expensive iPhones produced by mega companies such as Samsung, Apple and HTC product. Beyond that, the market is also fragmented with local players (Portio, 2009).

Global sales of Smartphone for 2008 reached 139.3 million devices, up to 13.9 percent increase when compared with that of 2007 and the global Smartphone sales in the first three quarters of 2009 was 120.8 million and the fourth quarter of the same year 2009 reached 53 million to push sales for the year to 173.8 million, a rise of 15% when compare with that of Gartner Research 2008. In the first quarter of 2010, Smartphone account for 17.3 percent of all mobile handset sales (Portio, 2011).

The number of Smartphone being bought is continually increasing due to the decrease in price and improvement in the technological innovation as well as increase in number of attractive games and educational applications (apps) which are now available in Smartphone. They now perceived to be much more than just a phone and are increasingly coming to resemble a personal computer/pocket computer. Their connectivity to internet makes it possible to run applications and store data the same way as a computer does. Over the past decade, computers have become smaller each year, from desktop computers to

laptops and from laptops to netbooks. Smartphones are also becoming next computer of this generation.

Smartphone sales over the past few years have increased greatly due to the increased competition among companies, hence the prices of smartphones are now falling and data rates and charges begin to decrease which makes it easier for mobile phone users to afford a smartphone. The rise in the demand of smartphones changes the way people perceived the phone and people can now send e-mail, view documents, use social networks and browse the internet from their smartphones which decreases the need for laptop or desktop. With 3G data access, Wi-Fi support and new full featured mobile browsers; users are able to enjoy a good rendering of a laptop Internet experience with their smartphones (Cochrane & Bateman, 2010).

With the explosion of mobile applications, smartphone users are able to rely on tailored programs that make certain tasks easier on a smartphone than on a traditional computer. Many tasks are much more easier to do on a smartphone compared to laptops, people can watch movies before going to bed instead of holding a laptop in front of them, people can check their email in the morning without waiting for their laptop to boot and most importantly it is more portable and easier to carry, people can keep a smartphone in their pocket while on the move instead of moving around with laptop case in their hand or on their back. Allen, (2009), “A survey of smartphone owners” found that 35% of their data usage is at home, this is very interesting as one would assume that most usage of the Smartphone would be outside home.

Kibona and Rugina (2015), states that, in United State of America, students are spending an average of 2.7 hours on the mobile Internet connection, managing their personal finances, visiting social sites and downloading relevant educational documents.

These figures show how people are spending hours per day using their smart phones. The nature of time spent using smart phones seems to be high and this shows how people interact with their smartphone daily.

Similarly, use of Smartphone's has become increasingly popular among college of education students. Ransford (2009), users of smartphones in colleges have been raised from 23% to 73%. It is noted that some faculty supports the used of smartphones in classroom and found it as a potential learning tool for students Frydenbery *et al.* (2012). The City University of Hong Kong has embarked on a long-term program to develop and integrate mobile learning activities into the context of undergraduate courses Vogel, *et al* (2007).

Nowadays, Smartphone have several features that are comparable to an average computer. They can also engage students in far more dynamic ways than a laptop or a tablet computer (Walsh, 2010). Cochrane and Bateman (2010), there are more than four billion mobile phone users' worldwide, but only about 800 million computer owners. Diamon *et al.* (2011) nine out of ten college students with smartphone access internet from their device, which increases their ability to obtain applications for social networking, download e-books and access relevant educational materials. Generally, the use of smartphone by college students' is leading to a new concern in the academic world (Woodcock, 2012). Smartphone usage among students is growing exponentially. The use of Smartphone changes students' academic activities. Due to the increase use of personalized content, students can easily obtain information they need in real time. Smartphone creates connection to social sites such as Facebook, Twitter, and WhatsApp and help create online communities between students' and teachers. In future, students will be able to exert more

power in educational related activities in a way that they could not have imagined before using Smartphone (Cairncross, 1997).

Johnson and Smith (2009), smartphones are in use in campuses and is of great benefit to students in terms of social, economic and academic activities. Smartphone becomes necessity for students of colleges and universities. In fact, most students' in colleges and university campuses carry Smartphone, either for reading e-mails, texting messages, accessing web or making phone calls (Thornton & Houser, 2005).

2.2.3 Users of smartphones in Nigeria

An official data on smartphone availability among Nigerian college students is hard to come by but it is an incontrovertible fact that owning Smartphone has become a popular culture among Nigerian students. Smartphone such as blackberry, Techno, Vivo and Sampson is perceived as a must have accessory among students in colleges. Smartphone seems to have become normative and stands as one of the marks of student identities on campus. It appears fashionable among Nigerian students to be seen with advanced Smartphone device with full capacities for advanced features. In this regard, HSPA connectivity, built-in virtual keyboards, high resolution digital still and video camera, pre-installed or downloadable Web 2.0 social software, and a high capacity memory storage Cochrane and Bateman (2010) are standard features often looked out for in a Smartphone. Latifat (2014) says that, Nigerian students presently have inclination to acquire Blackberry Z10iphone 5 and Galaxy tab 5 suggesting that sophistication and currency are important to Nigerian student buyers of Smartphone (Adegbenro, 2019).

As it appears, high price that comes with genuine and sophisticated Smartphone seems of less concern to Nigerian Smartphone buyers. Not minding the correctness, price tags of an

item is often equated with its quality. Indeed, in the Nigerian social milieu, social valuation of the price tag a Smartphone comes with affects how carriers of the device are assessed (Latifat, 2014). Of course, while there is no denying the fact that cheap made in China Smartphone brands are increasingly found among Nigerian students, students have been found to often prepare to pay as much as N150, 000 (about $650) for a piece of Smartphone directly imported from European America (Herald News, 2013). Nigerians in general and students in particular would rather 'hustle' to find the means to buy smartphones of their desires than been with regular phones or cheap China-made Smartphones.

However, this fixation is not without its implications. For example, Adegbenro (2019) observed that, students who are ordinarily financially incapable town a high-priced smartphone "tend to go extra-miles to possess these devices there-by resorting themselves to various immoralities and criminalities" in the process. Consequently, across a range of social currents concern has been expressed about the seeming desperation of Nigerian students to acquire smartphones (Ajewole & Fashola, 2012). In the editorial of a Nigerian national newspaper "the craze for smartphones among Nigerian students" was described as "frightening".

Similarly, on social flat forms, commentators often speak of transition in the Nigerian mobile phone industry and the frenzy that surrounds the diffusion of these communication gadgets among youth. Comments like 'blackberry craze on Nigerian campus and 'the craze for hi-tech phones among youth' are not uncommon (Uzegbu, 2014). In 2011, a Nollywood (the Nigerian movie industry) comedy produced by Sylvester Obadigie titled "Samson S7" sufficiently reveals the fascination of Nigerian youth with smartphones and the attendant desperation to add this gadget to their collection of accessories. The question is what factors drive the frenzy for adoption of Smartphones among Nigerian college students? It is

tempting to examine the indicators of smartphone adoption presented in literature (Chung & Shin, 2013) and conclude that they are likely the same for young people elsewhere in the world. Purchase decisions on technology are not always based on rational concepts such as perceived ease to use or benefits of a technology (Kim *et al.,* 2014). Extra functional interpretations (for example social standing and self-image) often intervene in purchase decisions. It is a good guess to suggest a connection between Nigerians 'taste for Smartphone and the tendency to project specific image of "prosperity and wealth" (Camilia *et al.,* 2013).

Smartphone is a mobile phone characterized as small device that allow students to access and process information at the palm of their hands, and embark on the use of tools at anytime and anywhere (Ching *et al.,* 2009). Adenya and Oyeyinka (2018), notes that, educational institutions have witnessed an increase in the use of smartphones by students in recent times.

A study carried out at Ball State Hanley Institute for mobile media research on students' use of smartphone, revealed that, students are not only using their smartphone for voice call, but also, they are using the phone to send e-mail, send text, download, listen to music and access social media sites. The study also found that 49% of students use smartphone to access websites for entertainment, 52% use it for movie viewing, 61% for news, 87% for weather reports while 57% searching information related to their courses and 51% reported making one or more calls per day (Park, 2005). Cheung (2008), students use their smartphones for tagging location, status update, and broadcasting where they are and what they are doing to their friends. Students also use it to grab pictures of what is going on. They also share photographs through Facebook. Cheung, (2008), boys tend to use their smartphones for recreational and communicative purposes such as playing games, listening

to music, sending or receiving e-mails and accessing internet while girls are more likely to use the device for maintaining social contacts by using features such as text-messaging or using the phone as a phonebook. Students see smartphone usage as pleasant, helpful and easy while others said it associate with anxiety, distraction divided attention from normal school program.

Redd (2011), learning activities performed with smartphones are flexible and interactive, making it so enjoyable for students. The integration of many devices' functions such as (computer, personal digital assistants, portable media players, internet connection and cell phone) in to single portable device termed as smartphone, make it to have greater advantage over laptop with the development of educational applications which give students first-hand access to educational documents from different learning environment (Holzinger *et al.,* 2005). Generally speaking, educational development worldwide has shown ways to provide an experience through the use of smartphone as learning tool (Kukulski, 2007).

Smartphones have become cheaper, affordable, fashionable, stylish and much more popular among students. College students are always up to date with the latest advancement in mobile technology. Smartphone become highly beneficial to students in achieving their educational goals. Smartphone help students to access any information or knowledge whenever and wherever they need it. Smartphone provide greater functionalities which give students opportunities to access all the available knowledge and information online and also connect them with specialist all around the world (Kukulski, 2007).

Smartphone significantly transformed the way students learn in the classroom and after school hours. Smartphone is not only a medium for communication and entertainment; it also serves as a medium to be used for learning new ideas and information that a student

cannot get from reading books (Redd, 2011). Students can get vast knowledge and information from different websites. Different educational website provides required information to students, helping them to study relevant information during examination, assignment, projects and presentations (Ames, 2018).

Students are benefiting from using smartphone in various ways such as: - helping them to keep track to their assignments, exams, social events, exchange email with their project group members, watch tutorials after lectures, doing online research, using search engines, dictionaries or encyclopaedias, reading e-book, writing essays and listening to lectures while cycling their bike (Naseer, 2013).Students are always emailing, or chatting on blogs, wikis, WhatsApp, Facebook and others social networks with friends, class mates and lecturers, so using smartphone makes it easier to stay in contact with people and to respond faster to their social and educational needs. A student at Ball State University said "I like the ability to receive e-mails in my smartphone instead of computer, because it may be an emergency," Whitney Motley, a mathematical student states that, if a class is cancelled, I don't have to get up and check my e-mail because it would be right in-front of me, in my smartphone (Grigg, *et al.*, 2018).

College Students can download e-book with their smartphones and can read lectures-slides through their smartphone instead of printing them and bring them to class which increases heavy load in student's school bag (Tosta, 2014). Students can also take notes and record lectures in class with their smartphone. If there is a topic which a student does not know much about, he can look up the information via his smartphone as any information he needs is available online. Smartphones provide a way or forum for students and lecturers which lead to interaction and create avenue for fun, motivation and modern way of learning from participation, interaction and collaboration (Naseer, 2013).

The innovative ways of learning using podcasts and videos are now giving students great opportunities for learning. Many classrooms, colleges and universities lecture halls are equipped with modern technological gadgets that aid modern ways of learning. Campus information, study materials and assignments are being posted online using smartphone. Lecturers began to podcast lessons and send the link of educational videos for students to view using an internet accessing device such as smartphone (Madden, 2010). Students who have smartphone are more likely to access social media and spend time engaging with others. From an educational standpoint, this means that, they become digitally oriented and left others mingling between analog and digital migrants.

Naseer (2013), if students are not able to keep up with the needed work in the classroom particularly in applying the knowledge gained in the school in solving specific problem and translates the information to demonstrative learning experience. Therefore, we began to conceptualize new ways in which technology can motivate students to advance in addressing school assignments.

Smartphone provides access to modern society, a massive quantity of educational and learning resources. In developing countries, Smartphone can easily compensate the limited access to internet which in turn helps in educational development and expanding students learning capacity (Sarwan & Soomro 2013). students that combine their personal live with their students live influenced by the use of smartphone; this finding can be understood as a statement that, students can have a classroom at home or wherever making use of communication and educational applications offered by smartphones. In addition, smartphone changed the way we gather information, receive instructions from teachers, do homework and collaborate with classmates (Jubien, 2019).

Smartphone offer a wide range of functions which is useful for teachers and students (Wong, *et al.,* 2004). Certainly, Smartphone technology allowed students to engage in educational activities using what they are accustomed, to support or improve students' completion of school assignment (Naseer, 2013). Tayseer, and Alcheikh, (2014), there is a correlation between students Grade Point Average (GPA) and their use of social networks; student's uses social sites to look for school related information, others for social related activities. However, many of them encourage the idea of having online study groups. This indicate that some students use social sites for social purpose while others are busy creating online study groups which help in busting their academic performance.

Liadi (2016) students using smartphone educational applications enjoyed and performed very well in a course, so they exceeded the performance of a comparison group with statistically significant differences. In addition to this Tosta, (2014) smartphone are phenomenon that has changed daily life and learning styles of students, forced changes in teaching strategies for teachers and changed the rules and policies of educational institutions; Since these technological devices become all in one and very popular in educational communities in every country around the world.

Ames, (2018), the availability of always-on connectivity meant that the students had to exhibit the techno-social practices of balancing their extended networks with the immediate surroundings and to limit the negative impacts of smartphone usage (for example social pressure, and multi-tasking). The use of mobile devices may lead to the development of checking habit that involves brief and frequent content consumption e.g., checking emails and Facebook updates (Cui & Roto, 2008), Smartphone applications allowed college students to access information quickly, thus increase their academic performance. (Ecycle

2012), smartphone can help students create flash cards, make presentations instantly, get answers to questions, record films, record voice, and then send them to their computer.

With the increased number of smartphone users among students, growing number of educational applications available in play store, decrease in size and price of smartphone, additional technological advancement in modern smartphones, bust in battery life which gives it additional advantage over laptop in educational environment, cheap internet access through smartphone, makes learning to be mobile, free cheap and easier access to educational documents without restrictions, quick information delivery and accessibility and makes learning anytime anywhere. Smartphone has huge impact on students' achievement (Kibona & Rugina, 2015)

However, some Skeptic parents worry about children wasting their time in the classroom using personal technology. So, in highlighting the constraints to effective learning: Park (2005), poor concentration, distraction and divided attention are closely associated to the use of smartphone during lecture hours.

Smartphone technology contributes much more negatively than positive in terms of distorting or diverting students' attention during lesson. Students' who have smartphones are more likely to access social media tools and spend more time engaging with others instead of concentrating on their academic activities (Stollak *et al.,* 2011). Abu-Hassna and Amin (2014), the difference in students' academic performance due to age and gender do not appear to be particularly significant; most significant differences appear due to the mobile devices used or technologies available that destruct their attention during and after the lesson . Kuznekuff and Titsworth (2013), students who use their smartphones during lectures tend to write down less information, recall less and perform worse in multiple-choice test than those who abstain from using their smartphones during lectures.

Lapointe *et al.* (2013), the use of smartphone for cheating in the classroom has increased. This could be through exchanging text messages with other students, using Internet to browse answers, using advanced calculators and phone applications, taking snapshots of course materials, or reading notes that are saved on the smartphone to provide help during test or examination. Kirshner and Karpinski (2015), users of the social network sites usually had lower Grade Point Averages (GPA) because they are online most of the time and utilized very little time for their studies in comparison with students who do not use Social Network. Kirshner and Karpinski (2015), social network sites had adverse impacts like procrastination, lack of concentration or distraction and poor time management which also affect students' academic performance. Alavi *et al.* (2012), an increase reliance on smartphone by college students may signal the evolution of smartphone use from habit to addiction. Addiction simply means repeated use of substance despite the negative consequences suffered by the addicted individual.

Addiction in the use of smartphone among college students has an advanced effect on student health and academic performance. Kim (2019) smartphone abuse is increasing in the 21st century among college students, exploring their Smartphones in their free hours. Smartphone overuse can be a sign of Smartphone addiction which lead to student lack of attention and poor time management Mahmood, *et al.,* (2014) said smartphone addiction has major impact on student academic performance and social life. Lee *et al.* (2015) the higher the addiction level to smartphone, the lower level of self -regulated learning the students had, as well as low level of flow when studying. He further states that, smartphone addicted learners are constantly interrupted by other applications on their smartphones when they are studying, and they don't have enough control over their smartphone learning plan and its process.

Grosseck *et al.* (2011), majority of students spend more time for social usage and less for academic purposes, even if they take part in discussions about their assignments, lectures, study notes or share information about research resources. Barker and Cochran (2012), there is a significant negative relationship between time spent by students using Online Social Network (OSN) and their academic performance. The time spent using OSN was found to be heavily influenced by the attention of students on his academic activities. He also says that, the higher the attention spent on OSN, the lower the time spent on academic activities. Furthermore, Junco (2012), time spent using online social network have negative impacts on overall GPA of particular students.

Alfawareh and Jusoh (2014) found that, 91.7 percent of students used smartphones to log on to student portal, 60.9 percent never used for Blackboard access. It is pathetic to note that 66 percent never used their smartphones for taking notes in a classroom, 66.9 percent never used to record class lectures and 46.5 percent has not at all used them for downloading materials related to class. Kibona and Rugina (2015) attempted to study the use of smartphones among the students of Ruaha Catholic University (RUCU) in Tanzania and how it affected their academic performance. The results also revealed that, smartphones bring negative results on students' performance academically because the majorities GPAs of the surveyed respondents were found to be below 3 point.

Chen and Denovelles (2013) found that students need more academic friendly devices such as tablets, smartphone and additional support to integrate mobile technologies into learning related activities. Bomhold, (2013) found that, use of search engines was very low (10.4%) among most frequently used apps, while a significant number (75%) of them used the apps to find academic information. Nam (2013) indicates that, most of smartphone usage was for

real time communication with significant difference in terms of gender and no statistical difference was found towards academic usage smartphone.

Hossain and Ahmed (2016) attempted to explore the use and perceptions of smartphones among Dhaka University students for accessing academic information. The survey was conducted among 316 students and nearly two-thirds of the respondents utilized their smartphones as a means to access academic information. Among them, half of the students used smartphones to record class notes. Students had positive perceptions towards smartphones as a tool for academic use. Although there were some differences in the terms of gender, age, place of origin, and duration of using them due to the fact that smartphones were new to them.

2.2.4 Gender and smartphone utilization

Most scholars agreed that, gender gap exist in the use of smartphone among college students as well as the general population. Furthermore, some gender differences had been found in attitude towards mobile technology, intensity of Internet use, online applications preferred and experience in cyberspace. Smartphone usage differs based on gender of the participant. Females spend more time on their phones than males, they spend on average per day 166.87 minutes (SD = 91.95), while males spend 154.26 minutes (SD = 92.78). Women spend more time in communication and social apps while men spend more time playing games.

Another research finding indicate that, boys scored higher than girls for using their mobile phones for sending emails, playing games, listening to music, and sharing pictures and videos. Boys are often taught to explore and be more creative with technology; they tend to use mobile devices as a gadget. Girls traditionally have perceived themselves as less skilled in terms of technology. It is argued that it has a lot to do with gender socialization. “If this

perception continues, it can limit young girls. It can impact the types of jobs and courses that girls take', hence it could lead to a different type of digital divide' (Cotten, *et al.,* 2009).

Technologies were not utilized in similar ways by men and women and as a result some differences still existed (Mitra *et al.,* 2005). Another research among Chinese and British students found that men in both countries used email and chat, played games and were confident about their smartphone more than their female counterparts (Kirkup & Li, 2007). It was suggested that women had to increase their level of involvement with smartphone and both teachers and parents had to support them. However, another study contradicted these findings and reported that gender had no significant effect on any of the dimensions of smartphone attitude studied (Shaw & Gant, 2012).

Female students possessed more positive attitudes toward smartphone than males. Another research pointed out that males tend to try new things, while females preferred traditional ways. However, girls tend to use smartphone media more often than males (Trifonova *et al*., 2006). Gender difference was also found regarding the use of web applications. Male college students were more likely to use the Internet for recreational purposes, information gathering and entertainment while females preferred to use the Internet for communication (Shaw & Gant, 2012).

Furthermore, females tend to be social as they used e-mail and instant messaging more than their male peers (Media Report for Women, 2000). Gender differences also exist in sending and receiving electronic mails through smartphone, messaging was the most important function of the Internet used by females (Wilson, 2012). Females actually used the email more than males (Boneva, *et al*., 2001). Females made more calls and sent more SMS messages with smartphone than men did. Also, teenage girls used their devices more

frequently so as to express their feelings while boys were more interested in the technical aspect (Doring, *et al.,* 2005). Saunders and Quirke (2002) states that, males expected the new technology to offer to them easy and quick answers, they also work alone or sometimes in pairs. On the other hand, females were interested in the quality of the product and they preferred interactive group work. It is worth mentioning that females tend to study online more than men as online learning may be appropriate for women's lifestyles and they were also more likely to look for further views of education (Selwyn, 2006). Moreover, Selwyn (2006) reported that as the current situation changes, educational technology can be seen as a predominantly feminine activity.

Economides and Grousopoulou (2008), Females appear to make more phone calls than male. Moreover, they take more photos and record more sounds than their male peers. In addition, they listen more hours to the music than men and they tend to send and receive more messages from friends. On the other hand, males tend to access Internet via their smartphone devices than females. Furthermore, both groups find reasons in order to reduce the usage of their mobiles, but men mention more reasons than women do. They believe that loss of time and addiction are reasons of decreasing the use of the devices.

Smartphone utilization among students also has Goal number five of the United Nations (UN) education for all policy is to provide equal opportunity for education regardless of gender bias by the year 2015 (United Nations Educational, Scientific and Cultural Organization, 2013). The greatest opportunity to achieve this is to facilitate informal learning by using mobile devices. However, gender differences can be observed among students depending on the nature of smartphone they owned, these differences exist in context and usage scenario. Boys are more active in free exploration and learning new applications - games in particular. They discover the basic functions of the phone faster.

Girls are more focused on the learning task, but may be accidentally interrupted by problems in operating the device. However, research on using smartphones to support different learning tasks did not show significant differences by gender (Evans, *et al.*, 2013). The increasing adoption of mobile devices could help girls break through the misconception of technology as a "male thing". However, the use of smartphone devices does not show similar gender differences. Both genders love those gadgets, but parents and teachers do not point out that girls as well as boys can create sophisticated applications with them (Grimus, 2013). The notion of boys being more tech-savvy than girls seems a misconception. It restricts girls internally from entering a more technological way of life as they grow. To leverage the meaning that girls may not see themselves as technical, but love their smartphones, they can tap into technology with their gadgets and increase their confidence in technology. Getting to know technology doesn't necessarily mean that one needs to know things like computer programming. Constant encouragement and exposure to smartphones can open girls' minds to pursue and support their technical knowledge (Grimus, 2013).

2.3 Theoretical Framework

This study is guided by two basic theories namely; Diffusion of innovation theory (Rogers, 2003) and Uses and gratification theory (Katz and Blumler 1974). The rapid diffusion of smartphones innovation and the increase uses and gratification of smartphones to human being; generates great impacts on student's academic activities in educational environment.

2.3.1 Diffusion theory of innovation

Rogers's theory of diffusion of innovation is one of the oldest social science theories. It originated in communication to explain how over time an idea or product gains momentum, and diffuses (spread) through a specific population or social system. Doing something differently than what they had previously been done. The key adoption is that the person must perceive the idea, behavior or product as new or innovative. It is through this that diffusion is possible.

Diffusion is the process of spreading a given idea or technology over time, via specific channel or through a social structure Katz and Blumber (1974), for a diffusion of innovations to take place, the following stages must be followed;

1. Awareness
2. Interest
3. Evaluation
4. Trial
5. Adoption stage

Different types of innovations require different kinds of adoption units; Bittner, (1989), the new technology can lead someone into getting aware of the existence of an item or products, from there he develops interest in it, make attempt to evaluate it and give it a trial touch before making his mind to accept or reject it. The diffusion of innovation theory by Rogers, (2003) was set to examine how new ideas are spread among people through technological innovations. It is the theory that seeks to explain how, why and at what rate new ideas and technology spread through culture.

Adoption of a new idea, behavior, or product does not happen once in a given social system but rather it is a process. Some people are quicker in adopting new innovation than others. Everett Rogers, a professional in the field of sociology, popularized the theory in 1962 in his book tittle “Diffusion of innovation”. He categorized adopters in to five basic groups namely: innovators, early adopters, early majority, late majority and laggards (Rogers, 2003). The change agent center’s around the conditions which increases or decreases the likelihood of a new idea or product to be adopted or not. That is to say, they help the audience in deciding on the best idea or product to adopt by influencing their option about a particular situation.

Innovators

Rogers (2003), innovators are willing to experience new ideas. Thus, they should be prepared to cope with unprofitable and unsuccessful innovations, and a certain level of uncertainty about the innovation. Also, Rogers added that innovators are the “gatekeepers” bringing the innovation in from outside of system. They may not be respected by other members of the social system because of their venture-sameness and close relationships outside the social system. Their venture-sameness requires innovators to have complex technical knowledge.

Early Adopters

Compared to innovators, early adopters are more limited with the boundaries of the social system. Rogers, (2003), since early adopters are more likely to hold leadership roles in the social system, other members come to them to get advice or information about the innovation. In fact, “leaders play a central role at virtually every stage of the innovation process, from initiation to implementation, particularly in deploying the resources that carry

innovation forward" (Light, 2003). Thus, as role models, early adopters' attitudes toward innovations are more important. Their subjective evaluations about the innovation reach other members of the social system through the interpersonal networks. Early adopters' leadership in adopting the innovation decreases uncertainty about the innovation in the diffusion process. Finally, early adopters put their stamp of approval on a new idea or product by adopting it (Rogers, 2003).

Early Majority

Rogers (2003), although early majority have a good interaction with other members of the social system, they do not have the leadership role that early adopters have. However, their interpersonal networks are still important in the innovation-diffusion process. The early majority adopts the innovation just before the other half of their peers adopts it (late majority). As Rogers stated that, they are deliberate in adopting an innovation and they are neither the first nor the last to adopt it. Thus, their innovation decision usually takes more time than it takes innovators and early adopters.

Late Majority

Similar to the early majority, the late majority includes one-third of all members of the social system who wait until most of their peers adopt the innovation. Although they are skeptical about the innovation and its outcomes, economic necessity and peer pressure may lead them to the adoption of the innovation. To reduce the uncertainty of the innovation, interpersonal networks of close peers should persuade the late majority to adopt it. Then, the late majority feels that it is safe to adopt the innovation (Rogers, 2003).

Laggards

Rogers (2003) view that, laggards have the traditional view and they are more skeptical about innovations and change agents than the late majority; As the most localized group of

the social system, their interpersonal networks mainly consist of other members of the social system from the same category. Moreover, they do not have a leadership role. Because of the limited resources and the lack of awareness and knowledge of innovations, they first want to make sure that an innovation works before they adopt it. Thus, laggards tend to decide after looking at whether the innovation is successfully adopted by other members of the social system in the past. Due to all these characteristics, laggard's innovation decision period is relatively long.

In addition to these five categories of adopters, Rogers (2003) further described his five categories of adopters in two main groups: earlier adopters and later adopters. Earlier adopters consist of innovators, early adopters, and early majority, while late majority and laggards comprise later adopters. Rogers identifies the differences between these two groups in terms of socio-economic status, personality variables, and communication behaviors, which usually are positively related to innovativeness. For instance, the individuals or other units in a system who most need the benefits of a new idea or technology (the less educated, less wealthy, and the like) are generally the last to adopt an innovation (Rogers 2003).

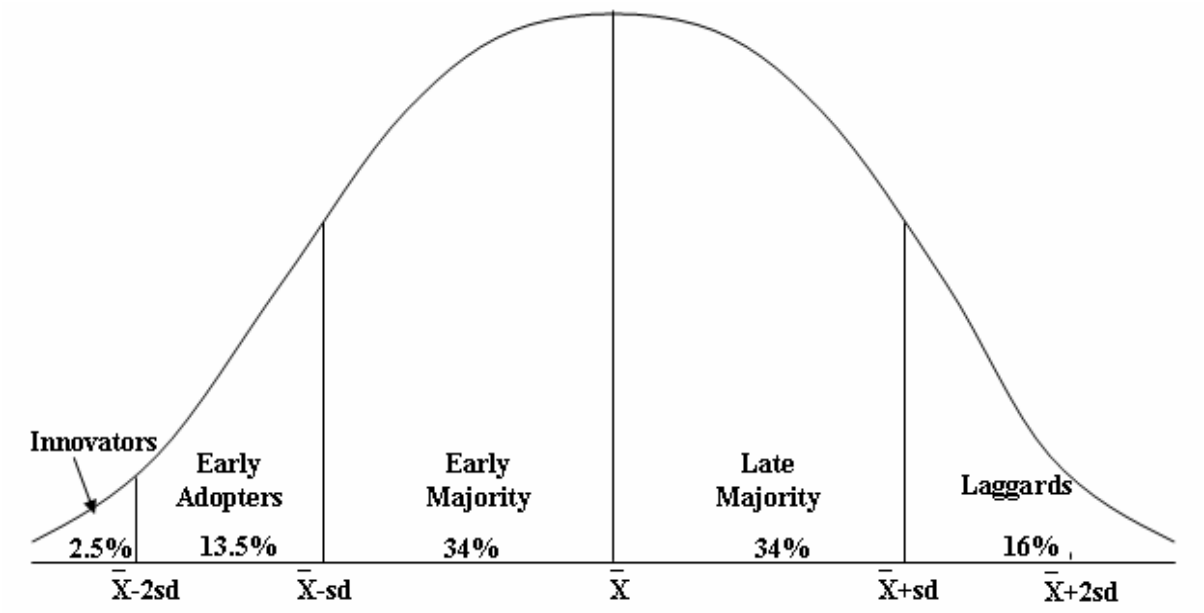

Figure 2.2: Adopter Categorization on the Basis of Innovativeness
Source: (Rogers, 2003)

Rogers (2003), incomplete adoption and non-adoption do not form this adopter classification. Only adopters of successful innovations generate this curve over time. In this normal distribution, each category is defined using a standardized percentage of respondents. For instance, the area lying under the left side of the curve and two standard deviations below the mean includes innovators who adopt an innovation as the first 2.5% of the individuals in a system.

2.3.2 Uses and gratification theory

Uses and gratification theory (UGT) is an approach to understanding why and how people actively seek out specific media to satisfy specific needs. It was originated in the 1974 by Katz and Blumber as a reaction to traditional mass communication research emphasizing the sender and the message. It focuses is not on the question, 'what media do to people' but rather 'what people do with the media'. It discusses how users deliberately choose media

that will satisfy given needs and allow one to enhance knowledge, relaxation and social interactions.

Uses and Gratification Theory also known as functional theory, is concerned with the social and psychological origin of needs, which generate expectation of the mass media which leads to different patterns of media exposure, resulting in need gratification and other consequences, mostly unintended ones (Katz & Blumler 1974). It is purely audience centered and addresses needs like surveillance, excitement, guidance, relaxation, tension release, socialization, escape and integration (Rosengren, 1985).

These uses (exposure to the media) and gratification (benefits) are determined by the needs of members of the audience. Such needs may include information, entertainment, self-esteem education and prestige. Through the uses and gratifications research, communication scholars have shown that everywhere, people selectively expose themselves to mass media content, choosing any media-messages that would serve the function of satisfying or gratifying their needs.

Provided a useful meta-categorization of gratification factors in which they identified three types of gratification sought by consumers, namely content gratifications, process gratifications and social gratifications. Content gratifications apply when consumers use a particular medium for the content it provides them (for example, entertainment, information and education). Process gratifications apply when consumers use a particular medium because they enjoy the process of using the medium (for example, surfing the web, control over viewing). Finally, social gratifications apply when consumers use a particular medium to gratify their need for social interaction (for example, friendship, interpersonal communication and keeping in touch.

2.4 Empirical Studies

Atsumbe, *et al.* (2012) availability and utilization of e-learning infrastructures in Federal University of Technology, Minna: The study used a descriptive survey research design. A sample of 182 lecturers and 382 students selected randomly and used as respondents for the study. Structured questionnaire known as Availability and Utilization of E-learning Infrastructures Questionnaire (AU-ELIQ) was used to obtain data from respondents for the study. Mean was used to analyze the data collected and the hypotheses were tested at 0.05 level of significance using t-test statistical tool. Gambari, *et al* (2017). The findings reveal that, Students have electronics devices that could facilitate e-learning but are ineffective in using them for learning purposes.

Rellinger (2014), The Diffusion of Smartphones and tablets in Higher Education: A Comparison of Faculty and Student Perceptions and Use Their research design was Correlational survey research design and the sample size was 76 faculties' members and 416 students. The instrument used for data collection was non-experimental questionnaire. Data was analyzed using descriptive statistics including mean, standard deviation and range. The research findings indicate that, both faculty members and students strongly agreed that, using smartphone/tablet displayed greater benefit over not using the device for teaching and learning. The finding also indicates that, both faculty members and students felt compatible with the smartphone/tablet usage in teaching-learning process. The result also shows that, learning with smartphone/tablet is easier with more practice due to the less complexity of the device.

Exploring Students' Mobile Learning Practices in Higher Education: The research was survey design and the sample size was 2,012 participants. The instrument used for data collection was survey questionnaire. Statistical tools were mean and standard deviation.

The finding indicates that, that more than 91 percent of respondents owned a small mobile device such as an iPhone, Android, or iPod Touch. However, only 37 percent owned a mobile tablet and 27 percent owned an e-book reader. The study also indicates that, students who had access to mobile devices used them for academic purposes. 82 percent of tablet device owners said they used the device for academic purposes, while only 58 percent of small mobile device owners and 64 percent of e-book reader owners reported doing so Chen and Denoyelles, (2013); Elogie *et al.* (2015), factors influencing the adoption of smartphone by undergraduate students: the research design was survey in nature and the sample size was 250 respondents. The research instruments used was structural questionnaire and the statistical tool used to analyze data was simple percentage, frequency distribution, mean and chi-squire. The research finding indicate that, most of the respondents (50.9%) have one smartphone; 24.8% have two smartphones, 3.1% reported that they have more than two smartphones while 21.2% admitted they do not have any smartphone.

Ezemenaka (2013) said that the usage and impact of Internet enabled phones on academic concentration among students of tertiary institutions. Survey research design was used and the sample size was 200 students. The instruments used for data collection were survey questionnaire and interviews. The statistical tools used for data analysis were pie-chart, bar-chart and chi-squire. The findings reveal that, majority of respondents indicated that they browse and source for academic information as students and chatting came second, while Networking was the third in the terms of important and blogging was the least. In a nutshell, students browse more with their mobile phone searching for academic information. The finding also indicating that, 64% of students reveal that their mobile

phone aid them towards examination preparation while 31% reveal that it does not, but rather distract their attention.

Economides and Grousopoulou, (2008), Use of mobile phones by male and female Greek student: The study used a descriptive survey research design. A sample of 416 students was selected randomly and a structured questionnaire named smartphone utilization (SU) was used to collect data. The statistical tools used are simple percentage and unpaired t-test was applied in order to statistically test the relationship between genders and their preferences. The research findings indicate that, both genders use their mobile phone mostly for taking photos and activating the reminder. However, they record less sounds than sent and received. In addition, they prefer to create their own photos, video and sounds than to download. Students are not using their mobile phone to improve their learning habit or search relevant educational documents.

Nam (2013), Evaluation of University Students' Utilization of Smartphone: the research design was survey in nature, 136 university students were used as a sample size and the instrument used for data collection was researcher design questionnaire. The statistical tools used for data analysis was simple percentage, t-test and ANOVA. The finding revel that, there was no statistical difference in the most frequent usage of smartphone between male and female students and the finding also reveal that, there was no statistical difference in perceived satisfaction to usages of smartphone between males and female students.

Valk *et al.* (2010), Using Mobile Phones to Improve Educational Outcomes: An Analysis of Evidence from Asia: The research design was experimental research design and the sample size was 267 students. The research instrument used was pre-test, post-test. The statistical tools used for data analysis were mean, standard deviation and t-test. Research finding reveals that, mobile phones are useful devices used by students for effective

learning and mobile-based learning is effective as face-to-face learning. The result also reveals that, mobile phones helped to improve educational outcome, improve access to education and promote new learning.

Farley *et al.* (2015) carried out a case study from an Australian regional university: the research was descriptive survey research design, the sample size was 749 respondents and the instrument used for data collection was mobile learning questionnaire design and validated. Statistical tools used for data analysis was simple percentage and chi-squire. The finding identified that, only a very small proportion of students do not own or have access to a smartphone (<5%) and most students have more than one mobile device. Ownership of or access to tablet computers is widespread with only 29% of students reporting that they could not access one, a number which will decrease as these devices become cheaper and more widely available.

Taking Survey with Smartphone, a look at usage among college students survey design was used and 568 students were used as a sample. In terms of instrument used for data collection, the researcher uses questionnaire. The statistical tool used for data analyses where mean, standard deviation and z-test. Research findings indicate that, smartphone users are more likely to have weaker academic achievement than computer users. He also mentions that; smartphone users are at higher risk of losing data than PC users at any point and at any level.

Ja'afar *et al.*, (2015) perception of students toward utilizing smartphone in the classroom; the study adopted survey research design and the sample size was 700 students. Online questionnaire was used during data collection. The statistical tools used were pie-chart, simple percentage and t-test. Based on the research finding, the result shows that, out of the total 700 participants, 89% of the responded indicating that they own a smartphone, while

the remaining 11% mentioned that they don't have a smartphone, which reflects majority of the participants own a smartphone. This shows how popular smartphones are among students in secondary school. According to the research finding, 35% of the participants stayed in neutral position about usefulness of using smartphones as a learning tool in class environments, 33% disagreed about the benefits of smartphone use in the classrooms, while 32% agreed that the smartphone usage in the classroom is of greater benefit. There is only one percent difference between those who consider a use of smartphone in classroom detrimental and those who deem it advantageous. Another finding indicates that, 36% of participants believe that smartphone makes learning more interesting, while 34% disagree with the statement. From these two findings, it can be noted that, even though smartphone use in the classroom might be detrimental in student learning, but it adds flavor to learning by making it more interesting. The analysis of the survey also shows how the students are using their smartphones both in and outside of class environment in order to enhance their learning. It should be noted that, majority of smart phone owners utilize their smart phones in the classroom.

Mokoena, (2012) smart phones and regular cellular phone: assessing smartphone impact on student's education at the University of Zululand. The research design used was descriptive survey method and the sample size was 386 students. The instrument used for data collection was questionnaire. Statistical tools used were median test/ Wilcoxon's signed rank test, chi-square test, Friedman test (non-parametric ANOVA), and binomial test. The research findings indicate that, 56.88% of the respondents are using smartphone while the remaining 43.12% are using regular cellular phone. The result indicate that majority of students are moving toward owning smartphone rather than a regular cellular phone. The

result further indicates that, smartphones are useful tools to enhance student's performance in any learning environment.

Kibona and Rugina (2015) investigated in a study: review on the impact of smartphones on academic performance of students in higher learning institutions in Tanzania: The design used was survey research design and 456 students were used as a sample size. The instrument used for data collection was observation. The research findings indicate that, students are moving very fast toward technology advancement especially in the field of mobile phones. It is possible that every student regardless course of study owns a smartphone due to either mob psychology or for educational needs. Those who owns smartphones at Campus are very busy and attentive to message notifications of either WhatsApp, twitter, Instagram, Facebook and other social networks making them vulnerable to time management as they use most of the time chatting each other rather than discussing about academic subjects. He further observed that, females and some few male students use most of their time taking self-pictures using their smartphones so that they can upload or share in social network about the status and where they are at that particular time.

Jumoke *et al.* (2015) analysis of mobile phone impact on student academic performance in tertiary institution: the study adopts survey research design. 506 students were used as a sample and the instrument used for data collection was questionnaire. Correlation coefficient and Pearson Product Moment (PPM) correlation was used as statistical tools. The research finding indicates that, poor academic performance of students is dependent on indiscriminate use of mobile phone.

Rabiu, *et al.* (2016) investigated in a study: impact of mobile phone usage on academic performance of secondary school students: survey research design was used for the study,

the sample size was 300 respondents. Questionnaire and interview were adopted as an instrument for data collection. The statistical tools used to analyze data were frequency distribution, simple percentage, mean, standard deviation and t-test. Finding of the study revealed that, mobile phone usage significantly influences academic performance of male and female students in senior secondary schools. Furthermore, the findings indicated that, the frequency of mobile phone usage does not significantly influence academic performance among male and female senior secondary school students.

Jena (2014), The Impact and Penetration of Smartphone Usage in Students Life: The research design was survey in nature and questionnaire was used for data collection. The study sample was 310 students randomly selected from population. Inferential statistics (t-test and chi-square) was used as a statistical tool. Research finding indicate that, gender difference exists in terms of smartphone utilization and smartphone usage greatly affect student academic performance in colleges of education.

2.5 Summary of Literature Reviewed

A smartphone is a portable telephone that can make and receive calls over a radio frequency link while the user is moving within a telephone service area. The rapid advancement in the technology of mobile phone lead to the invention of highly sophisticated mobile phone known as smartphone which creates more pressure on curriculum developers, curriculum executers and students on how to drive the benefits of it in a smarter, effective and efficient way. Smartphone is a mobile phone with more advanced features and greater computing capacity than a cell phone. Smartphone has added advantages over normal cell phone which lead to the increase in the number of smartphone users among students. Some of the advantages includes- growing number of educational applications available in Google play store, decrease in size and price of smartphone,

additional technological advancement in modern smartphones, bust in battery life which gives it additional advantage over laptop in educational environment, cheap internet access through smartphone, make learning to be mobile and collaborative, free or cheap and easier access to educational documents without restriction; quick information delivery and accessibility and makes learning anytime anywhere. All of the above contribute positively toward enhancing student's academic performance and make learning simple and easier. However, despite the above-mentioned positive contributions, it also has some common negative effects toward learning if it were not properly used.

Diffusion of innovation theory was used to better understand how smartphone innovation spread through educational community and becomes an instrument or tool for communication, collaboration and information searching through internet connectivity. Furthermore, uses and gratification theory were used to understand why and how people are actively searching out for a specific media to satisfy their specific needs. The theory emphasis is on people exposure to media and the kind of benefit they drive from it. The theory focuses on what people do with the media rather than what media do to the people. Educators are always searching for relevant media that will satisfy educational needs of the student's and enhance their academic performance at all level. Relevant studies were reviewed and are available in this chapter for perusal.

However, upon all the literatures reviewed, none was found on the assessment of the availability, readiness and utilization of mobile smartphone among pre-service teachers in either secondary schools and/ or colleges of education in Nigeria. Hence, this is the major gap that this study tries to bridge. Apart from assessing the availability and utilization of mobile smartphone, the study also included different variables such as pre-service teachers

and gender as well as change in the research location. This research work is unique to that of the reviewed author.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The design for this study was a descriptive survey research design that deal with series of questions and other prompts for the purpose of gathering data from respondents. Survey research is the process of collecting representative sample data from a larger population and used the sample to infer attributes of the population (Chukwuma, 2012). This design was adopted because the study is concerned with the collection of people's opinions which served as the primary source of data.

3.2 Population of the Study

The population for this study comprises of 392 NCE I, II, III Biology students of Federal college of Education (technical) Gombe and College of Education Billiri Gombe State.

3.3 Sample and Sampling Techniques

The sample for this study was a representation of Biology Department in the school of science which was selected from the two Colleges of Education in Gombe State. A total of 182 NCE II Biology Students was used as the target population by chance. The researcher adopted research advisor table to determine 182 sample size.

Table 3.1 Distribution of Population among Biology Students of Colleges of Education in Gombe State, Nigeria

S/No	Institutions	No of Students	sample population	Male	Female
1	NCE 1	151	69	39	30
2	NCE 2	128	58	37	21
3	NCE 3	113	55	36	19
	TOTAL	392	182	112	70

Source; HOD Biology Dept. COE Billiri and Exam officer FCE(T) Gombe 2019/2020 academic session.

3.4 Research Instruments

The instrument used for data collection are a checklist and a structured questionnaire titled Students' smartphones availability, Readiness and Utilization questionnaire (SSAQ) which was adapted from Anigbo (2015) questionnaire. The questionnaire consisted of two sections; Section A and Section B, Section A deal with respondents' demographic / Biodata while section B contain twenty-four questions. Section B was sub-divided into five. Sub-section one contains a Table of a Checklist on Availability and type of phone owned by Student. sub-section two contains Six questions on Readiness of smartphone, sub-section three contain Six questions on Educational Utilization of smartphone for learning among Biology Students' in Colleges of Education in Gombe State.

The questions were structured in line with four scales which was modified into four responses: Strongly Agreed (SA) = 4, Agreed (A) = 3, Strongly Disagreed (SD) = 2 and Disagreed (D) = 1. Hilary (2003) says that, the number of choices on the scale should be evenly balanced and retains a continuum of positive and negative statements with which the respondent is likely to agree or disagree in order to help in reducing or avoiding problem of bias.

3.5 Validity of the Research Instrument

The instrument (questionnaire) was validated by two experts from the Department of Educational Technology, Federal University of Technology, Minna and one from Department of Counseling Psychology, Ibrahim Badamasi Babangida University Lapai. The questionnaire comprises of Eighteen questions, all corrections, modifications and suggestions were observed accordingly before producing the final copy. Moreover, the

instrument had undergone a series of proof reading and corrections from colleagues and course-mates before submitted for validation.

3.6 Reliability of the Research Instrument

The instrument for data collection was subjected to pilot testing. The reason for pilot testing is to ensure reliability of the instrument before data collection. The researcher pilot tested the instrument on 30 NCE II Students from Biology department of School of Science Federal College of Education (T) Gombe. Who are part of the population but are not part of the sample. The instrument was administered randomly to the thirty students and collected back after completion. The administration was done and a reliability coefficient of 0.90 and 0.85 from the variables Readiness and Utilization was obtained using Cronbach alpha statistical instrument was used to establish the reliability coefficient. George and Malley (2003) Alpha coefficient above 0.70 is considered acceptable. This confirms the acceptability of the coefficient obtained and reliability of the instrument. The exercise was done in three days.

3.7 Method of Data Collection

A letter of introduction was collected from the Department of Educational Technology Federal University of Technology Minna which introduce the researcher to the management of the institutions concerned. The researcher train an assistant on the fundamental principle of Data Collection regards the Study in two days after which the distribution, administration and collection of the instruments for further Analysis. The whole exercise take place within the period of six weeks in the two selected Colleges of Education in Gombe State.

3.9 Method of Data Analysis

Mean and standard deviation were used to answer the research questions and independent t-test was used to test all the null hypotheses at 0.05 level of significance and a decision mean level of 2.50. using Statistical Package for Social Sciences (SPSS) version 22.0.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Research Questions

Research Question One: Determine the Availability of Smartphones among Biology Students' in Colleges of Education in Gombe State.

In answering research question one, descriptive statistic was used. Table 4.1 shows the analysis.

Table 4.1 Types of Smartphones Available for Learning among Biology Students' of Colleges of Education in Gombe State.

S/ NO	TYPE OF SMARTPHONE OWNED BY STUDENTS	Number available	Percentage (%)
1.	Android OS	25	13.74
2.	Apple IOS	10	5.49
3.	Gionee	12	6.59
4	HTC Dream	14	7.69
5	Nokia E	01	0.55
6	Nokia Symbian N72-760	10	5.49
7	Samsung galaxy Note 10 series	05	2.75
8	Techno	48	26.37
9	Infinix Hot / Note	35	19.23
10	Specify others not above	20	10.99
11	I don't own a phone	00	00.00

Table 4.1 shows the Smartphones Available among Biology Students of Colleges of Education in Gombe State. It shows that it is Techno Smartphones Biology Students own most with 48 (26%), followed by Infinix Hot / Note with 35 (19.23 %), Android OS with 25 (13.74%), other types of phones with 20 (10.99%), HTC dream with 14 (7.69%), Gionee phones with 12 (6.590%), Apple IOS with 10 (5.49%), Nokia Symbian with 10 (5.49%), Samsung galaxy Note 10 series with 05 (2.75%) while the least type of phone owned is Nokia E with 1(0.55%). The

table revealed that all Students own a Smartphone. Thus, the Availability of Smartphones is high among Biology Students in Colleges of Education Gombe State.

Research Question two: What is the mean Readiness scores of Biology Students' towards the use of Smartphone among Colleges of Education Gombe State.

In answering research question two, Descriptive Statistic of Mean and Standard Deviation was used. Table 4.2 shows the analysis.

Table 4.2: Mean Readiness scores of Biology Students towards the use of Smartphone among Colleges of Education Gombe State

S/N	Items	Mean	SD
1	I am ready to access Educational applications with my Smartphones.	3.00	1.00
2	I am ready to use my Smartphone 3G /4g service for learning.	3.10	0.90
3	My Smartphone is ready to access Educational Learning Sites.	3.15	0.85
4	My Smartphone is ready for storage of Digital files for future use.	3.02	0.98
5	My Smartphone is ready to Access social media sites Facebook, twitter, WhatsApp.	3.05	0.95
6	I am ready to download and save social media information (video, pictures, messages etc.) tp aid learning.	3.08	0.92
	Grand mean	**3.06**	

Decision mean: 2.50

Table 4.2 shows the mean and standard deviation of Students response on Readiness of Biology Students smartphones in College of Education Towards utilization for learning with a total number of 182 responded to six items each. The table revealed computed Mean Score of 3.00 with Standard Deviation of 1.00 for item one, mean score of 3.10 with Standard Deviation of 0.90 for item two, Mean Score of 3.15 with Standard Deviation of 0.85 for item three, Mean Score of 3.02 with Standard Deviation of 0.98 for item four, Mean Score of 3.05 with Standard Deviation of 0.95 for item five, Mean Score of 3.08 with Standard of 0.92 for item six. Respondent agreed with all the six items, the least mean

score was 3.00 while the highest mean score was 3.15 and the grand mean score was 3.06 which is greater than the Decision mean (2.50) this implies that Biology Students' Smartphones are Ready for utilization is high towards Learning in Colleges of Education Gombe.

Research Question three: What is the mean Utilization scores of Biology Students' towards use of Smartphones among Colleges of Education Gombe State?

In answering research question three, Descriptive Statistic of Mean and Standard Deviation was used. Table 4.3 shows the analysis.

Table 4.3 The mean scores of Biology Students' towards Utilization of Smartphones among Colleges of Education Gombe State

S/N	Items	Mean	SD
1	When I use my Smartphones, it helps me increase my motivation to learn Biology more	2.98	1.02
2	Using Smartphone enable me accomplish learning task more easily with my classmates	2.87	1.13
3	Smartphone enables me to communicate more easily with my classmates and lecturers. Through group chat	3.02	0.98
4	Efficient use of Smartphone enables me do my Biology Assignments effective and efficiently.	3.11	0.89
5	When I use Smartphones, it has Specific Biology Applications that Aid in my Critical thinking of Learning.	3.14	0.86
6	Using Smartphones with specific Educational Software has increased my Test scores in the College.	3.09	0.91
	Grand Mean	**3.04**	

Decision mean: 2. 50

Table 4.3 shows the mean and standard deviation of Students' response on Utilization of Smartphones for learning among Biology Students' in Colleges of Education, with a total number of 182 responded to six items each. The table revealed computed Mean Score of 2.98 with Standard Deviation of 1.02 for item one, mean score of 2.87 with Standard Deviation of 1.13 for item two, Mean Score of 3.02 with Standard Deviation of 0.98 for

item three, Mean Score of 3.11 with Standard Deviation of 0.89 for item four, Mean Score of 3.14 with Standard Deviation of 0.86 for item five, Mean Score of 3.09 with Standard of 0.91 for item six. Respondent agreed with all the six items, the least mean score was 2.87 while the highest mean score was 3.11 and the grand mean score was 3.04 which is greater than the Decision mean (2.50) this implies that Biology Students' Utilization of Smartphones is high towards Learning in Colleges of Education Gombe.

4.2 Hypotheses Testing

All hypotheses were tested at 0.05 level of significance.

HO_1: There is no significant difference between male and female Readiness of Smartphones for Learning among Biology Students' in Colleges of Education in Gombe State, Nigeria

In answering the hypothesis one, t-test statistics was used, Table 4.4 shows the analysis.

Table 4.4: **Difference between Male and Female Biology Students Readiness to use Smartphone for Learning in Colleges of Education Gombe State**

Gender	No	$\bar{x}$	SD	Df	t-cal.	p-value
Male	92	2.93	0.54	180	0.20	0.110
Female	90	2.94	0.38			

Ns= not significant at 0.05

Table 4.4 shows the t-test of male and female biology students' Readiness to use Smartphones for learning. The table indicates that the stated null hypothesis was accepted. This was because t (2.932) = 0.20, p-value of 0.110 greater than 0.05 level of significance. By implication, the stated null hypothesis was established thus: there was no significant difference between male and female Readiness of Smartphone for Learning among Biology Students in Colleges of Education Gombe State**.**

HO_2: There is no significant difference between male and female Biology Students in the Utilization of Smartphones for Learning in Colleges of Education in Gombe State, Nigeria.

In answering the hypothesis two, t-test statistics was used, Table 4.5 shows the analysis.

Table 4.5: Difference between Male and Female Biology Students' Utilization of Smartphones for Learning in colleges of Education Gombe

Gender	No	$\bar{x}$	SD	Df	t-cal.	p-value
Male	92	3.19	0.50	180	0.226	0.122
Female	90	3.22	0.36			

Ns= not significant at 0.05

Table 4.5 shows the t-test of male and female in the Utilization of Smartphones for learning. The table indicates that the stated null hypothesis was accepted. This was because t (3.192) = 0.20, p-value of 0.122 greater than 0.05 level of significance. By implication, the stated null hypothesis was established thus: there was no significant difference between male and female Biology Students in the Utilization of Smartphones for learning in Colleges of Education Gombe State.

4.3 Summary of Findings

1. Smartphones are available among Biology Students' in Colleges of education in Gombe State.
2. Biology Students Smartphones are ready for utilization towards Learning in Colleges of Education Gombe State.
3. Biology Students in Colleges of Education in Gombe State Utilized their Smartphones for learning Biology effectively.
4. There is no significant difference between Male and Female Readiness to use Smartphone for Learning Biology among Colleges of Education Gombe State.

5. There is no significant difference between Male and Female Biology Students' Utilization of Smartphone for Learning in colleges of Education Gombe State

4.4 Discussion of Findings

The study reveals that, smartphones are Available among Biology Students' in Colleges of education and the commonest smartphones used is Techno smartphone products. The result from the findings reveals that, out of the 182 respondents on Smartphones availability ,Tecno products has 48 (26%), followed by Infinix Hot / Note with 35 (19.23 %), Android OS with 25 (13.74%), other types of phones with 20 (10.99%), HTC dream with 14 (7.69%), Gionee phones with 12 (6.590%), Apple IOS with 10 (5.49%), Nokia Symbian with 10 (5.49%), Samsung galaxy Note 10 series with 05 (2.75%) while the least type of phone owned is Nokia E with 1(0.55%)and the least which is Nokia E 1 with 0.55% while 0 with .00% represent those that don't have a smartphone.

The finding disagrees with that of Elogie *et al.* (2015) who reveals that, 50.9% of college students have one smartphone; 24.8% have two smartphones, 3.1% have more than two smartphones while 21.2% admitted they do not have any smartphone. In the same vein the finding also disagrees with that of Msuya (2015) who found out that, most students own a smartphone; these smartphones are equipped with cameras, true color displays, external memory cards and sound stereos. Alfawareh and Jusoh (2014) revealed that, 94.4 percent of students owned a Smartphone, and majority of them used it as a computer and a digital camera. Seifert (2014) reveals that, smartphone is available among students of colleges of education; in addition, the finding reveals that, 74% of students owned a smartphone and 26% did not.

The finding also reveals that most Biology Students' in Colleges of Education Gombe has Smartphones that are ready for academic utilization. their smartphones have a 3/4G service, search relevant educational documents, read, download and save social media information, e-book and send educational SMS and e-mails. This finding is in line with that of Msuya (2015) who found out that, most students own a smartphone; these Smartphones are equipped with cameras, true color displays, external memory cards and sound stereos. Similarly it agrees with (Tindell & Bohlander, 2011) that Smartphones are often very ready for uses by users because its availability is quite different from its readiness to be used for academic purpose, given that students are already using mobile devices to support their study, it seems the most efficient and easy entry into mobile learning for educators lies in supporting what students already do

Findings from the research also reveals that College Students' Utilize their smartphones for Academic purposes is in line with the finding of Seifert (2014), who found that, college students, use their smartphones for surfing the Internet, as a GPS locator, manage their learning, visit social site, record lessons, set lectures alarm, snap pictures and write notes. It also agrees with the finding of Ezemenaka (2013) who reveals that, students browse more with their smartphone searching for academic information. It was also supported by the finding of Wulystan *et al.* (2012) who says that, students use their smartphones to download course related materials, while some mentioned that, they use their smartphone for taking photos during study activities. Basing on these findings, most students used their smartphone for various academic purposes.

The result of the study also reveals that, smartphones should be used for learning. However, they disagreed with the idea of allowing them to use their smartphone during lectures. This finding is in line with a study that, students commonly use smartphones for learning and

consider smartphones to be very useful for their academic work: they use smartphones to access course materials, search library catalog, discuss course assignments with peers and take notes (Zvjezdana *et al.,* 2015). Alfawareh and Jusoh (2014) also found that, 91.7 percent of students used smartphones to log on to student portal. Hossain and Ahmed (2016) attempted to explore the use and perceptions of smartphones among Dhaka University students for accessing academic information. The survey was conducted among 316 students and nearly two-thirds of the respondents utilized their smartphones as a means to access academic information. Among them, half of the students used smartphones to record class notes. He concluded that, students had positive perceptions towards smartphones as a tool for academic work.

The finding of the study shows that there was no significant difference between Male and Female Readiness to use Smartphones for Learning among Students in Colleges of Education Gombe is in line with this finding, Evans *et al.* (2013) states that, female students are more focused on learning task than male students. Wilson (2012) stressed that, female students send and receive electronic mails through smartphone than male students. Andone and Błaszkiewicz (2016) also states that, women spend more time in communication and social applications while men spend more time playing games. Another finding indicates that, boys scored higher than girls for using their smartphone for sending emails, playing games, listening to music, and sharing pictures and videos (Cotten *et al.*, 2009). Female college students possessed more positive attitudes toward smartphone than males. Male college students were more likely to use smartphone for recreational purposes, information gathering and entertainment while females preferred to use the smartphone for communication (Shaw & Gant, 2002). However, research on the use of smartphones to

support different learning tasks did not show significant differences between male and female students (Evans *et al*., 2013).

The study finally reveals that there was no significant difference between Male and Female Students' Utilization of Smartphone for Learning among Biology Colleges of Education Gombe. Female faced more challenges in the educational utilization of smartphone than their male counterpart. In support to the finding, Evans *et al*. (2013) lament that, male is more active in free exploration and learning new applications than females' students. Male discover basic functions of smartphones faster and easier than female student. In addition, female students are more focused on the learning task than male students.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

It was deduced from the study that: Smartphones are owned by all Biology students' in Colleges of Education Gombe State, their Smartphones are Ready for use towards Learning, they Utilized their Smartphones for Learning. However, there is no significant difference in Male and Female Readiness and Utilization of Smartphones for learning Biology among Colleges of Education in Gombe State.

5.2 Recommendations

The following recommendations were drawn based on the research findings;

1. State government should be organizing seminar, conferences, workshop to enlighten Students and teachers on the contribution of using smartphones for learning in Colleges of Education.
2. Government should be encouraged to provide reliable internet connections enhance learning computer courses in Colleges of Education
3. Government, NGOs, NCCE and school organizations should encourage use of smartphones in teaching learning process
4. Students should imbibe the habit of Supporting and encouraging their Learning using their Smartphones.

5.3 Contribution to Knowledge

Smartphones enables students for better educational purposes. As this also enables their teachers/lecturers to be able to give student assignments/classworks. It helps to boost students inquisitiveness in class.

5.4 Suggestion for Further Studies

The following research should be considered for future studies:

1. Impact of Smartphones on the Academic Achievement of Student's in Colleges of Education in North-Central, Nigeria
2. Influence of Gender on Smartphone Readiness and Utilization among Students in Colleges of Education in North East Nigeria.

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APPENDIX 1

SURVEY QUESTIONNAIRE

"AVAILABILITY, READINESS AND UTILIZATION OF SMART PHONES AMONG BIOLOGY STUDENTS IN COLLEGES OF EDUCATION GOMBE STATE, NIGERIA".

This questionnaire is designed to elicit responses, opinions and views on the above subject matter. Any information you give will be used purely for the purpose of this research work and will be treated confidentially.

SECTION A: STUDENT BIODATA INFORMATION

Name of College _____Level (NCE)_____Department_____

Gender: ` (a) Male [ ], (b) Female [ ],

Age: (a) below 18 [ ] (b) 19-25 [ ], (c) 26-35 [ ], (d) 36 and above [ ]

SECTION B

Instruction: Please read each statement and tick (--------) the column that best reveals your feelings

SA = Strongly Agree, A = Agree, D = Disagree and SD = Strongly Disagree

A. The Type of Smartphone Availably Owned for Learning among Biology Students of Colleges of Education in Gombe State.

	S/ NO	TYPE OF SMARTPHONE OWNED BY STUDENT	YES	NO
	1.	Android OS		
	2.	Apple IOS		
	3.	Gionee		
	4	HTC Dream		
	5	Nokia E		
	6	Nokia Symbian N72-760		
	7	Samsung galaxy Note 10 series		
	8	Techno		
	9	Infinix Hot / Note		
	10	Specify others not above		
	11	I don't own a phone		

B. The Readiness of Biology Students in Colleges of Education

Towards the Use of Smartphone's for Learning in Gombe State.

S/N	Questionnaire Items	SA	A	D	SD
1.	Most college Students have a phone				
2.	Most college students Smartphone have a 3G /4g service.				
3.	Smartphone have a video call service.				
4.	Smartphone have a memory card for storage of Digital files.				
5.	Smartphone Access social media sites Facebook, twitter, WhatsApp etc.				
6.	Smartphones download and save social media information (video, pictures, messages etc.)				

C. The Utilization of Smartphone's for Learning among Biology Students in Colleges of Education in Gombe State, Nigeria.

S/N	Questionnaire Items	SA	A	D	SD
1.	Smartphone help me increase my motivation to learn Biology more.				
2.	Smartphone enable me accomplish learning task more easily.				
3.	Smartphone enables me to communicate more easily with my classmates and lecturers.				
4.	Smartphone enables me do my Biology Assignments effective and efficiently.				
5.	Smartphone have Specific Biology Applications that Aid in my Critical thinking of Learning				
6.	Smartphone with specific Educational Software has increase my Test scores in the College.				

APPENDIX II

RELIABILITY TEST ON READINESS OF SMARTPHONES FOR USE

/VARIABLES=RSP1 RSP2 RSP3 RSP4 RSP5 RSP6

/SCALE ('ALL VARIABLES') ALL /MODEL=ALPHA.

Reliability

[DataSet1] C:\Users\UncuulPEE\Documents\DATA FOR ANALYSIS.sav

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded [a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.781	10

RELIABILITY TEST ON UTILIZATION OF SMARTPHONES

/VARIABLES=USP1 USP2 USP3 USP4 USP5 USP6

/SCALE ('ALL VARIABLES') ALL

/MODEL=ALPHA.

Reliability

[DataSet1] C:\Users\UncuulPEE\Documents\DATA FOR ANALYSIS.

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded [a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.832	10

APPENDIX III

RELIABILITY TEST ON READINESS OF SMARTPHONES FOR USE

/VARIABLES=RSP 1 RSP2 RSP3 RSP4 RSP5 RSP6

/SCALE ('ALL VARIABLES') ALL /MODEL=ALPHA.

Reliability

[DataSetl] C:\Users\UncuulPEE\Documents\DATA FOR ANALYSIS.sav

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	valid	20	100.0
	Excluded [a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.851	10

RELIABILITY TEST ON UTILIZATION OF SMARTPHONES

/VARIABLES=USP 1 USP2 USP3 USP4 USP5 USP6

/SCALE ('ALL VARIABLES') ALL /MODEL=ALPHA.

Reliability

APPENDIX IV

Required Sample Size†

Population Size	Confidence = 95% Margin of Error				Confidence = 99% Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
100,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department, She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factor that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument.

Thanks for your anticipated assistance.

Head of Department, Signature, Date & Official Stamp)

Student's Surname: MUSA Other Names: AZ

Registration Number: Programme:

Title of the Instrument:

ATTESTATION SECTION

Summary of the Remark on the Instrument:

I hereby attest that the above named student brought his instrument for validation

Name and address of institution:

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for.....
2. Clarity and simplicity for the level of the language used.....
3. Suitability for the level of the targeted audience .....
4. The extent in which the items cover the topic it meant to cover.....
5. The structuring of the Questionnaire.....
6. Others (grammatical errors, spelling errors and others.....
7. General overview of the Instrument.....

Suggestions for improving the quality of the Instrument

1. .....
2. .....
3. .....
4. .....
5. .....

Name of Validator.....

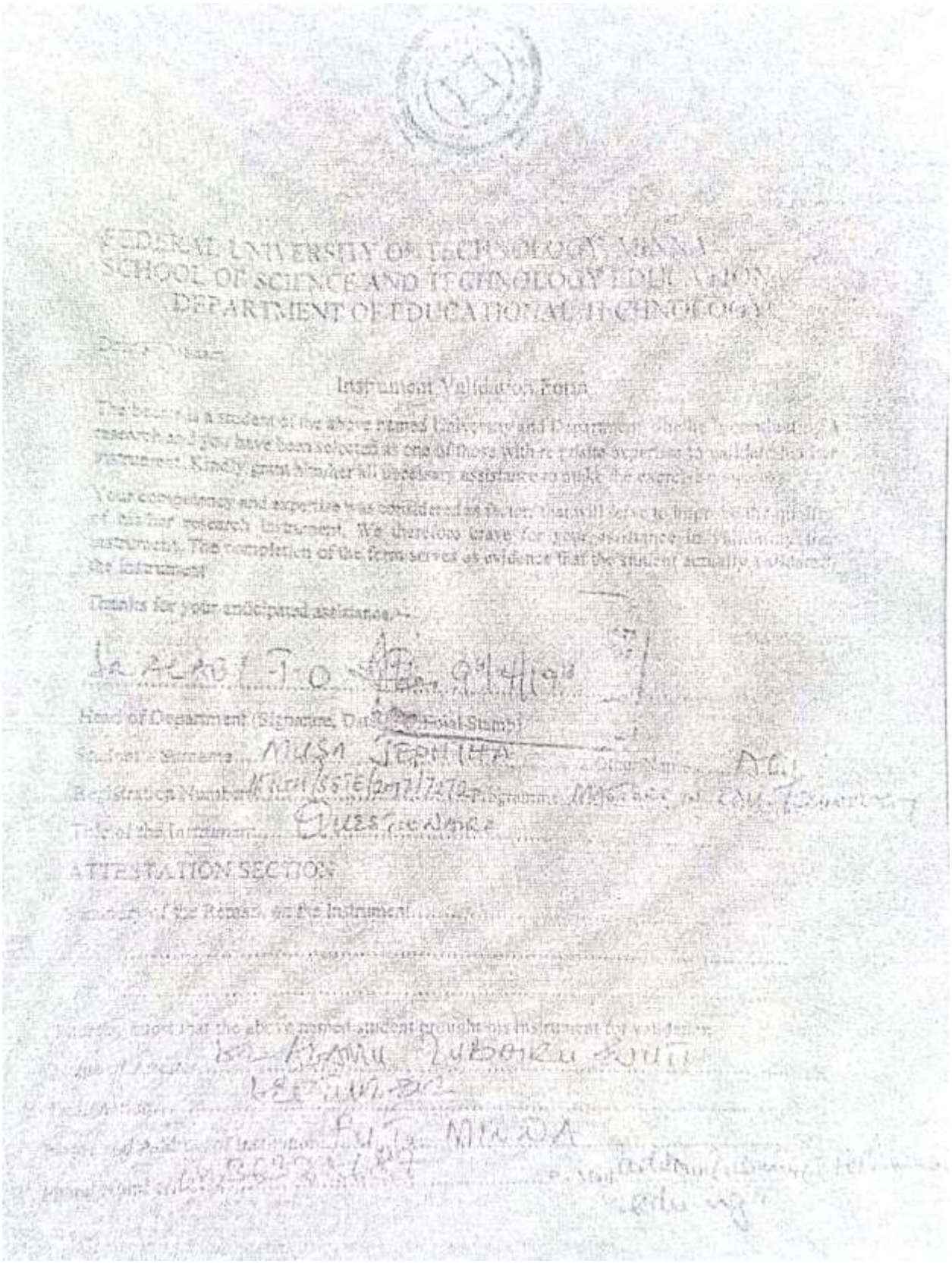
Area of Specialization.....

Name of Institution.....

Signature.....Designation.....

.....Date.....

Thank You



FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Instrument Validation Form

Head of Department (Signature, Date & Official Stamp)

ATTESTATION SECTION

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for APPROPRIATE
2. Clarity and simplicity for the level of the language used CLEARLY THE INSTRUMENT
3. Suability for the level of the targeted audience IS WITHIN THE TARGETED AUDIENCE
4. The extent in which the items cover the topic it meant to cover COVERED
5. The structuring of the Questionnaire STRAIGHT
6. Others (grammatical errors, spelling errors and others MINOR
7. General overview of the Instrument THE INSTRUMENT IS SUBJECT TO BE REVIEWED FROM TIME TO TIME

Suggestions for improving the quality of the Instrument

1. INSTRUMENT COULD BE REVIEWED AS TIME GOES
2. .....
3. .....
4. .....
5. .....

Name of Validator Dr ADAMU ZUBAIRU BELLO

Area of Specialization EDUCATIONAL TECHNOLOGY

Name of Institution F.U.T. MINNA Designation LECTURER

Signature ..... Date 15/09/2019

Thank You

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF EDUCATIONAL TECHNOLOGY

Dear Sir/Madam,

Instrument Validation Form

The bearer is a student of the above named University and Department. She/he is conducting a research and you have been selected as one of those with requisite expertise to validate his/her instrument. Kindly grant him/her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quality of his/her research instrument. We therefore crave for your assistance in validating the instrument. The completion of the form serves as evidence that the student actually validated the instrument.

Thanks for your anticipated assistance.

26 SEP 2019

Dr. AGABI .....

Head of Department (Signature, Date & Official Stamp)

Student's Surname: MUSA JEPHTHA Other Names: ACI

Registration Number: MTECH/SSTE/2017/7272 Programme: M.TECH

Title of the Instrument: QUESTIONAIRE.

ATTESTATION SECTION

Summary of the Remark on the Instrument: Candidate should look at every section of the instrument and ensure that the items in each one address the aim of the section.

I hereby attest that the above named student brought his instrument for validation

Name of Attester: Dr. SCA APARA

Designation: A. Professor

Name and Address of Institution: I.B.B. University Lapai

Phone Number: 08167556432 E-Mail: ....

Please comment on the following

1. Appropriateness of the instrument for the purpose it's design for ....
   Fairly appropriate
2. Clarity and simplicity for the level of the language used ....
   Clear and simple
3. Suitability for the level of the targeted audience ....
   Suitable
4. The extent in which the items cover the topic it meant to cover ....
   Please look at the items all over and re-organize them
5. The structuring of the Questionnaire ....
   OK
6. Others (grammatical errors, spelling errors and others) ....
   OK
7. General overview of the Instrument ....

Suggestions for improving the quality of the instrument

1. – Candidate should recode all items in section B
2. to ensure they measure ease of use
3. in learning
4. Items in all the sections should be carefully
5. worded to address the instruction of each section

Name of Validator: Dr SEA APARA

Area of Specialization: Counselling psychology

Name of Institution: IBB University Lapai Designation: Professor

Signature: [signature] Date: 14/10/2015

Thank You

COLLEGE OF EDUCATION

P.M.B 011, BILLIRI, GOMBE, NIGERIA

DEPARTMENT OF NATURAL SCIENCES

Motto: For Service and Development

Provost: Dr [illegible]
Dean: [illegible]
H.O.D: Sanda, Amusuwa B.Sc [illegible], M.Sc., Solid State Physics [illegible]

Ref: COEB/SSE/BIO/VOL 1/002

Tel: +23480 5879 5576, +23470 6795 8172
Email: [illegible]
Date: 20th August, 2019

Federal University of Technology, Minna
School of Science and Technology Education
Department of Educational Technology

REF: STATISTICS OF BIOLOGY STUDENTS IN C.O.E BILLIRI, GOMBE STATE

Reference to your letter dated on 16/04/2019 requesting to assist your student (Musa Jeptha Ali with identity number **M.Tech/SSTE/2017/7272**) with information to help him complete his research work titled **"Assessment of availability, readiness and utilization of Smartphones among Biology Students of Colleges of Education in Gombe State".**

2. Below is the Statistics of 2018/2019 Biology Students in the Department.

S/№	levels	No of Students
1	NCE III Students	46
2	NCE II Students	33
3	NCE I Students	36
	TOTAL	115

Thank you

Yours sincerely

SANDA Amusuwa
Ag. Head of Department