

## The use of internet ready mobile phones for teaching and learning in undergraduate Biology classrooms

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**Abstract:** As a result of the development and spread of cheaper and more user-friendly computer technology and software (e.g., portable computers, Microsoft Word etc), the use of the Internet has increased dramatically. Nigeria's Internet penetration, student-computer ratio, bandwidth size and unreliable electricity supply constitute banes to the appropriate use of ICTs for teaching and learning in Nigeria. With the development of data communication infrastructure, users of mobile phones and tablet computers are able to access the internet anywhere in the world where there is mobile phone coverage or a Wi-Fi access point. This capability can make mobile phones ideal tools to not only deliver mobile-learning contents, but to ask students to interact with their teachers and peers. Contemporary University Education is information and communication technology driven and its objective is to educate its students using ICTs and teaching techniques that would enable its graduates become flexible learners that can easily adapt to the changing socio-cultural, technological and economic environment of the information society. The introduction of Global System for Mobile communications (GSM) and the consequent high use of mobile phones across the country and in university campuses in particular have given rise to reliable alternative for Internet connectivity, online knowledge sharing and technology rationalization. The research design adopted for this study is a randomised control group pretest-posttest quasi experimental design. Population of the study includes all undergraduate Biology students admitted by Ahmadu Bello University, Zaria and Usman Danfodio University, Sokoto in 2014/15 academic session into Federal College of Education, Zaria (F.C.E.Z.) study campus. All the students admitted to study BSc (Ed) Biology from ABUZ (22) served as the experimental group i.e. taught some Biology concepts with internet ready mobile phones, while students from UDUS (23) served as the control group i.e. taught with didactic lecture method. T-test comparison of Post-test of both groups at  $P \leq 0.05$  indicates a significant difference. The result shows that the use of internet ready mobile phones to teach enhanced academic achievement of students. Recommendation includes that the huge surge in mobile telephone use and ownership by students should be harnessed by teachers in Biology classrooms as a resource to improve teaching and learning.

### I. Introduction

The Internet is a massive, computer-linked network system used globally to access and convey information, either by personal or business computer users. It is also used for communication, research, entertainment, education and business transactions (Schneider, Evans and Pinard, 2006). The Internet was established in the early 1960s and subsequently became a mainstream communication vehicle (Moschovitis, Polle, Schuyler, & Senft, 1999; Schneider, et al., 2006). Since that time, there has been remarkable growth in the Internet's functionality, capacity, accessibility and convenience. These improvements have encouraged more people to use it more often and it has become a powerful application in modern society. Today, the Internet can link all online computers so that people can use it to communicate throughout the world (Schneider, et al., 2006). The Internet is a global linking of computers that allows information transfer. Due to the development and spread of cheaper and more user-friendly computer technology and software (e.g., portable computers, Microsoft Word etc), the use of the Internet has increased dramatically. As of 2010, the world's Internet use was 28.7% of the population. While this may not seem like a very large portion of the world's population, the growth in the use of the Internet has been dramatic. For example, between 2000 and 2010 as shown in table 1, the rate of growth of Internet use was 18% while mobile phone subscription is 22% (Internet World Stats, 2010b, International Telecommunication Union, 2011). The number of Internet users has increased worldwide. In 2011, 30.2% of the world's population were Internet users (2,095 million). There are many benefits associated with Internet use, such as access to needed information, worldwide access to news, events and interpersonal communication through email.

**Table 1: Worldwide Internet and Mobile Growth, 2000–2010**

	2000	2010	Annual Growth
Internet users (millions)	390	2,000	18%
Mobile phone subscriptions (millions)	738	5,300	22%

Source: ITU, 2011

Contemporary university education is information and communication technology driven. A university's objective is to educate its students using information and communication technologies (ICTs) and teaching techniques that would enable its graduates become flexible learners that can easily adapt to the changing socio-cultural, technological and economic environment of the information society. (Utulu, Alonge & Emmanuel, 2010). The proliferation of Information and Communication Technologies (ICTs) devices drive and their increase in the quest for their use in educational institutions have not only affected the structure of university education but has also affected the way teaching and learning is done in these institutions. The urgent need for the production of information society compliant workforce that are flexible learners and that can easily adapt to the fast changing socio-cultural, technological and economic environments has made the provision and adoption of ICTs for teaching and learning in Nigerian universities a primary challenge. In fact, several Nigerian authors have produced scholarly works that assessed the extent to which Nigerian universities have tried to infuse ICT based teaching and learning techniques (Utulu, Alonge & Emmanuel, 2010; Olatokun & Opesade, 2007; Erinosh, 2007; Obanya 2006; Ojokoh & Asaolu 2005). Obanya (2009) also reveals that the models for the delivery of higher education in the information society is distinct and has its own special characteristics. He enumerated six domains of futuristic view of University Education in the information society that should define requirements and objectives of University Education in Nigeria:

1. Assumptions: broad-based and personality development for adaptability
2. Student entry: lifelong learning skills with greater emphasis on EQ (Emotional Intelligence Quotient)
3. Organization of programs: flexible organization of programs
4. Teaching/learning: group and task oriented
5. The teacher: knowledgeable, field-oriented, highly creative, multi disciplinary compliant
6. The graduate profile: able learner with appropriate intrapersonal and interpersonal capabilities.

Mobile phone ownership is spreading rapidly among students. It seems to share the following common features in addition to being able to make a phone call, data communication capability through applications such as a web browser, an email, a calendar, an ability to compose and view documents, an ability to view and play photos, music and video clips, a camera to take photos, videos and a screen which doubles as a keyboard.

Furthermore, a user can add extra functions to their phones by downloading applications such as foreign language dictionaries and games (Watanabe, 2012). With the development of data communication infrastructure, users of mobile phones and tablet computers are able to access the internet anywhere in the world where there is mobile phone coverage or a Wi-Fi access point. This capability can make mobile phones and tablet computers ideal tools to not only deliver mobile-learning contents, but to ask students to interact with their teachers and peers. There are studies that surveyed students' ownership and use of various technologies including mobile devices in Australian higher education context. Oliver and Goerke (2007) surveyed 413 students in 2005 and 290 students in 2007. In both survey they asked students about ownership of four mobile devices: laptop computers, handheld computers (PDA), mobile phones and portable MP3 players (e.g., iPod). It was found that in both survey just less than half of the respondent owned a laptop computer, less than 10% owned a handheld computer, while more than 96% owned mobile phones. They also found that majority of students (93.4% in 2005, 86.6% in 2007) use the online resources for study purposes. Although it is not stated how these students access the internet resources, one would imagine it was done from a desktop computer, given that mobile internet was not widely available in those days. A larger scale study was conducted by Kennedy et al. (2008). They surveyed 2120 first-year students in 2006 at the University of Melbourne about their access to various technology hardware, including mobile phones and desktop computers and their use to access the internet resources. They found that 96.4% of students had unrestricted access to a mobile phone, 89.5% to a desktop computer, 63.2% to a laptop computer, and 10.8% to a PDA. Over 90% of students responded that they use the internet for study purpose, and most of them use it daily or weekly basis. However, when asked about accessing the internet from their mobile phones, either for study purpose or otherwise, only 32.2% responded affirmatively. Also watanabe (2012) discovered 76.3% of university students with smart mobile phones and unrestricted access to internet, that readily uses it for study purposes. The hallmark of this learning scenario is that it is technology based and also requires students to carry out learning independently, develop strategies among themselves and reach informed conclusions that will help them meet the learning objective(s).

Nigeria's Internet penetration, student-computer ratio and bandwidth size constitute banes to the appropriate use of ICTs for teaching and learning in Nigeria (internet world stats, 2010). The non-existence of a reliable power sector in Nigeria has also taken its toll on ICT adoption for teaching and learning. However, the introduction of Global System for Mobile communications (GSM) and the consequent high use of mobile phones across the country and in university campuses in particular have given rise to reliable alternative for Internet connectivity, online knowledge sharing and technology rationalization. The use of mobile phones for

knowledge sharing can be easily attained because most mobile phone sets possess the capacity of an Internet ready minicomputer and also have the potential to cover more of the cyberspace using telephony wireless connections. The population of students that own and use mobile phones also justifies this. (Utulu, Alonge & Emmanuel, 2010). Mobile phones are turning into multifunctional gadgets, but even as just a phone, they offer useful learning functions. Most of today's phones let you talk, photograph, do text messaging and browse the internet from anywhere. Learners' no longer need to rely on access to the computers at home or school in order to create, transfer, store and share digital information.

However, there are considerable efforts in the literature that cover ICT use for knowledge sharing and for teaching and learning purposes in Nigerian universities. Very little effort has been geared toward studying mobile phones as knowledge sharing tools. This is despite the fact that as far back as 2006, Nigeria has large mobile phone subscriber base which was put at about 22.3 out of 100 people (World Bank, 2009). This may have further increased as the sector has expanded in terms of subscribers and GSM service providers. The Nigerian Communication Commission (NCC, 2015) says that the number of internet users on the Global System for Mobile Communications (GSM) networks has increased from 72,322,802 in 2014 to 81,892,840 as at January, 2015. The information society and its consequent high demand for knowledge production and ICTs use has affected the way Education is valued. Most developed societies are adjudged as those with the best philosophy of Education that were able to develop sound pedagogy and teaching techniques and invest in Educational research instructional technology and multimedia. It is because of this that research on university Education and how to appropriately develop efficient and effective teaching models and techniques have been increasing. These include research areas that deal with how technological innovations of the information society are transforming the way teachers teach, how learners learn and how societies are adjusting their cultural transmission and socialization processes to the requirements of the information society (Dale & Povey, 2009; Reis & Karadag, 2009; Varis, 2007).

The postmillennial decade offered two changes in worldwide digital connectivity: a relentless spread in conventional Internet access via PCs and an even bigger surge in mobile telephone use worldwide (Donner, Gitau, & Marsden, 2011). Recently, studies are beginning to build up on the use of mobile phones for educational purposes. Such studies have relied on the methodologies used in previous studies that dealt with the use of multimedia (Vavoula et al. 2009). Markett et al. (2006) studied the use of short message service (SMS) to encourage interactivity in the classroom between students and teachers. Sharples (2000) also studied how mobile technology is being used to support lifelong learning. Studies of Utulu, Alonge & Emmanuel (2010) revealed that the mobile phone sets respondents claimed that they had mobile phone services that can support knowledge creation and sharing, can support verbal communication, text communication, multimedia data creation and communication, audio recording and communication and creation of photographs using mobile phone camera. Available services in respondents' mobile phones pointed to the fact that respondents who may want to use mobile phones to share knowledge when involved in learning can easily do so. It is in the light of these that the researcher intends to compare the achievement of undergraduate Biology students taught some Biology concepts with didactic lecture method and those taught with internet ready mobile phones to determine if the use of internet ready mobile phones enhances learning and can be adopted as a pedagogical tool for learning.

## **II. Significance of the study**

Combined with the right pedagogy, mobile technologies in learning can serve as:

1. The means for students to pursue lines of inquiry and interest in the academic disciplines and beyond.
2. The opportunity for learners to collaborate with teachers and peers and to express themselves and their ideas most effectively.
3. A vehicle for personalizing learning in ways that ensure each student is fully engaged in learning and is successful in attaining established learning standards.
4. Opportunities for student choice in the use of multimedia. To explore, research, think, synthesize, analyze, evaluate, communicate and express ideas in high quality products.
5. A platform and forum for students' voices.
6. Access to digital content and digital learning environment that provide multiple pathways to learning.
7. Connections locally and globally that add authenticity to school work. This enables students to learn while pursuing real-world issues and topics of deep interest to them, both individually and collectively, within their communities of interest and beyond.
8. Platforms from which to learn about and attain high standards in digital citizenship.
9. Opportunities for students to construct ideas, opinions, arguments and evidence-based reasoning collaboratively.
10. The result of this study may provide university libraries with basic knowledge of how students' mobile phones can serve as alternatives for desktops, laptop computers and incessant electricity problem which has rocked Nigerian universities. Since mobile phone have the capacities of mini computers and can be used to

access the Internet, they therefore become very important technology for students use. University libraries can begin to work out ways in which management, administrators, lecturers, librarians and students can better harness mobile phones as instructional technology that can be used to generate information and share knowledge.

### III. Statement of the problem

The prospect to be revealed in this study is that mobile phones possess the potential to become very reliable instructional technology that can be used by lecturers to achieve feats that have been hampered by technology. The fact that mobile phones can be used at any location where teaching and learning are taking place and still receive Internet signals makes them unique. However, much is still left to be done in terms of harnessing them for educational purposes and this may need the collaboration of various stakeholders. If proper assessment is done, universities in a country like Nigeria would make out good alternative to instructional technologies from mobile phones. The study was particularly aimed at assessing how mobile technology can be used as a reliable alternative in a society that digital technology has greatly challenged the attainment of its higher education goals. The increasing availability of the mobile Internet to resource-constrained individuals particularly students interests the researcher. Mobiles offer a confluence of portability, personal control and flexibility that make them appealing, disruptive, and ubiquitous (Castells, Fernández-Ardèvol, Qiu, & Sey, 2007). The researcher intends to harness this resource to determine how it will enhance teaching and learning.

### IV. Objective of the study

The objective of this research work is:

To compare the achievement of undergraduate Biology students taught some Biology concepts with didactic lecture method and those taught with internet ready mobile phones.

### V. Hypothesis

The null hypothesis postulated at  $P \leq 0.05$  is stated as follows:

There is no significant difference between achievement of Biology students taught with didactic lecture method and those taught with internet ready mobile phones.

### VI. Methodology

The research design adopted for this study is a randomised control group pretest-posttest quasi experimental design. Two groups of undergraduates from two different universities using Federal College of Education, Zaria as study centre, who are offering BIOL 112: Introductory Ecology which is a core Biology course, were used for the study. Balloting was done to determine the control and experimental group. All the students admitted to study BSc (ED) Biology from Ahmadu Bello University (FCE, Zaria study campus) in 2014/15 academic session served as the experimental group, while students admitted to study BSc (ED) Biology from Usman Danfodio University, Sokoto (FCE, Zaria study campus) in 2014/15 academic session served as the control group. An intact class of 23 students from UDUS was taken as sample for the control group, while all students that possess internet enabled phones i.e. 22 (84.6%) out of the total of 26 from ABUZ were taken as sample for the experimental group.

### VII. Instrumentation

Some topics from BIOL 112 course outline were chosen for this study. Students in both groups were taught by the researcher. This research was conducted for a period of four weeks each for both groups consecutively. Lecture method was used to teach the control group, while students in the experimental group were only guided with outlines from the topics and were allowed to study using their own internet ready mobile phones during lessons. The researcher provided internet access for students in the experimental group during the period of study. Pre and Post tests were administered to students before and after treatment respectively. Treatment was given to ABUZ students first because they resumed six weeks earlier than the UDUS students in the first semester of 2014/15 academic session. Both groups of students were not aware of the difference in teaching methods used by the researcher who is also the course lecturer. Data from both tests were collated and analyzed. Percentages, mean, standard deviation and t-test statistics were calculated using SPSS version 20.

Table 2: Result of Pre & Post test scores of Experimental group

ABUZ	N	Mean	Std. Deviation	Std. Error Mean
PRE TEST	22	19.82	4.905	1.046
POST TEST	22	54.73	9.004	1.920

**Table 3: Result of Pre & Post test scores of Control group**

UDUS	N	Mean	Std. Deviation	Std. Error Mean
PRE TEST	23	20.65	4.628	.965
POST TEST	23	35.22	9.040	1.885

**Table 4: Comparison of Pre&Posttestmean scores in both groups**

	ABUZ	UDUS	t cal	t tab	Df
PRE TEST	19.82	20.65	<sup>ns</sup> 0.601	2.021	43
POST TEST	54.73	35.22	*7.251	2.021	43

\*P ≤ 0.05, ns at P ≤ 0.05

### VIII. Discussion

Mean scores of Pre-test of both experimental and control groups (see table 2 & 3) have shown that all the subjects' initial knowledge level is similar. T-test analysis (in table 4) also indicates a no significant difference. Comparison of Post-test of both groups at  $P \leq 0.05$  (table 4) indicates a significant difference. This necessitated the rejection of the hypothesis which states that "there is no significant difference between achievement of Biology students taught with didactic lecture method and those taught with internet ready mobile phones". Data obtained has shown a superior performance of students in the experimental group. This can be attributed to the use of internet ready mobile phones during lessons. This study is similar to Donner, Gitau, & Marsden (2011), Utulu, Alonge & Emmanuel (2010), Vavoula et al. (2009), Markett et al. (2006) and Sharples (2000) who researched on the use of mobile phones for educational purposes. The effectiveness of this pedagogical method may be attributed to the learner centered strategy and the portability of the mobile phone which allows flexible access to learning materials from the internet and the fact that this device is personally owned by the students which enables them to plan, manage time and study at their own convenience. From the study, it was discovered that 84.6% of students in experimental group have internet ready mobile phones. This conforms to Oliver and Goerke (2007) who discovered that more than 96% of their students are owners of mobile phones. They also found out that majority of the students (86.6% in 2007) use the online resources for study purposes. Kennedy et al. (2008) also discovered that 96.4% of students had unrestricted access to a mobile phone. Studies of Watanabe (2012) also revealed that 76.3% of university students own smart mobile phones with unrestricted access to internet and they readily use it for study purposes. Since internet penetration, student-computer ratio and bandwidth size are barriers to the appropriate use of ICTs for teaching and learning in Nigeria, internet ready mobile phones can serve as alternative reliable resource for internet connectivity and online knowledge sharing. This study is supported by Nwafor (2007), Bichi (2002) who also reported the effectiveness of student centered strategies to achievement and retention of some Biology concepts. Shaibu (2014), Chinwe (2009), Owolabi (2006) and Silverthorn (2006) are also of the view that active teaching/ learning strategies will enhance academic achievement of students in Science.

### IX. Conclusion

Mobile phones represent new and fast growing development in ICTs innovation. Their adoption for teaching and learning models that have been adjudged information society compliant has also been growing. Mobile phones can be a great (and low-cost) technology tool in the classroom. Mobile phones have cameras and audio recorders which enables students to work on multimedia projects. They possess calculators and calendars which enhances a far better way to record homework or assignments than the print calendars students never carry around. In other words, mobile phones can allow students to create and share content and they can provide an important bridge between the classroom and home. Although there is no single best way to facilitate learning, education researchers recommend that teachers should enhance or replace the classic didactic lecture method with other activities especially in Sciences.

### X. Recommendation

This study recommends the following:

1. The huge surge in mobile telephone use and ownership by students should be harnessed by teachers in Biology classrooms as a resource to improve teaching and learning.

2. Biology teachers should be ready to use this innovative learning strategy for teaching in their classrooms.
3. Management and administrators of universities should encourage and motivate teachers and students to use this learning strategy as an alternative instructional technology in situations where internet penetration, student-computer ratio and bandwidth size are inadequate for appropriate use of ICTs for teaching and learning in Nigeria.
4. University libraries should work out ways in which management, administrators, lecturers, librarians and students can better harness mobile phones as instructional technology that can be used to generate information and share knowledge

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