



INFORMATION AND COMMUNICATION TECHNOLOGY ICT: A PATHWAY FOR EFFECTIVE PERFORMANCE OF BIOLOGY STUDENTS

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Abstract

Biology is a science subject studied living things. ICT encourages Biology teachers to be more creative, more influential and more mindful of the implicit and explicit impacts our words have on students, and to explore new ways to make our classrooms more diverse. Students should be given confidence to ask, inquire, explore and be creative and initiators. The focus of this paper is to confirm, if the biology students aware of ICT in their schools, if ICT are available in their school, if ICT can improve performance of Biology students and if there is any challenges of ICT in Nigeria. The design of the study was survey and the study area is Ogbomoso and its environs in Oyo State Nigeria. It was confirmed that 66.33% of the biology students have aware of computer at school while 66.67% were aware of computer at Home. The result of hypothesis also shows the post-test mean score of 60.67 for the experiment group and standard deviation of 15.72, which is greater than mean of control group 55.38 with standard deviation of 17.06. This shows that students exposed to ICT achieved higher mean score than those not exposed to it. 93 % of the students agreed that unexpected power failure problem was found to be the biggest challenge of usage ICT in the studied area. Therefore, the author recommended that Government should provide sufficient and constant electricity supply to all the communities in Nigeria including rural areas and remote places where schools are located and let these schools be connected to the electric supply. Also, all Biology teachers must engage in constant self-development in ICTs

Key words: *Biology, ICT, Teacher, Student, School, Home, Challenges*

Introduction

We are living in 21st century, which encompasses the Information Age - an era marked by rapid adoption of new technologies (Holland, 2015). Many new technologies, Information and Communication Technology (ICT henceforth) being the forerunner, have influenced the way we live, communicate, socialize, learn or educate. Introduction of ICT in almost all the sectors of our lives have created a new global economy that is powered by technology, fuel by information and driven by knowledge (US Department of Labour, 1999). Advent of the knowledge economy and global economic competition compel governments to prioritize educational quality, lifelong learning and the provision of educational opportunities for all. It is widely accepted that access to ICT in education can help individuals to compete in a global economy by creating a skilled work force and facilitating social mobility (Wallet & Melgar, 2014).

As Biology teachers, technology encourages us to be more creative, more influential, and more mindful of the implicit and explicit impacts our words have on students, and to explore new ways to make our classrooms more diverse. By using digital tools and thinking creatively, we can increase the diversity of speakers in our class, broadening the suite of potential role models and of voices we can leverage. In turn, this diversity of voices can change class and societal perceptions as to who a person in STEM can be, broadening perspectives and improving retention of women, students, and first generation students. Additionally, by creating peer-to-peer networks across institutions, cultures, and countries, our use of technology can help students learn to navigate and ultimately negate internal stereotypes, improving retention and enhancing performance (Miyake et al., 2010 referenced by Olorode, 2018).

At present, education is under constant changing and multiplicity in policies, methods and procedure. At different levels of education system change is always welcomed per required but change should always be in harmony with certain aspects i.e. society, religion, state etc. The present situation calls for comprehensive change in almost every level of education so that practical and dynamic approach can be given to existing and new field of education. The crux of this modern education is to awaken the hidden curiosity and interest of the learner, nourishing his behaviours, attitudes and believes in order to develop

basic and essential skills of lifelong learning and ability to think critically and to judge himself and others in a more beneficial manner (Samreen *et al.* 2012). Students should be given confidence to ask, inquire, explore and be creative and initiators. Having an inquisitive mind is the beginning to lifelong learning that surely leads to success. Before modern education was incorporated students were passive listeners and teacher was an autonomous body who knew what, when and how of education. But in recent years, the superiority is shifted towards students. They keep the individual learner focused on what is being taught by the teacher in the classroom session (Samreen *et al.* 2012). Information and communication technology makes a lesson or a lecture more interesting and a memorable experience not only for students but for teachers as well. They play a vibrant role in focusing the attention of individual student towards the teacher or the topic. Human beings' five senses are the doorway for effective learning, especially seeing, hearing and touching bring maximum knowledge for the individual.

Jerome Bruner a psychologist at New York University submits that research has shown that people remember,

- ❖ 10% of what they hear
- ❖ 20% of what they read
- ❖ 80% of what they see and do (Lester, 2012)

Audio-visual aids are most effective tools for developing flawless communication and interaction between student and content as well as student and teacher. These aids not only help to save the time of teacher but also help in developing and arousing curiosity, creativity and motivation. It emphasizes on the comprehension of knowledge and concept as well as keeps working on developing sound foundations for higher and further studies.

Information and communication technology (ICT) is the technology which supports activities involving the creation, storage, manipulation and communication of information (Amez & Landover, 2012). It can also be said that ICT is a relatively new field that combines the technology of computers with that of communication information and communication technology which involves the use of electronic means to collect data, process, store, retrieve and make available different types of messages to anybody seeking to get or use it anytime, anyhow and anywhere in the world for the pursuance of educational advancement.

According to Olorode (2018) referenced Honey and Mandinach (2003) the three major reasons for ICT in manpower development and training are that

- i. A tool for addressing challenges in training and learning
- ii. A change agent and
- iii. A central force in economic competitiveness.

As a tool for addressing challenges in training and learning, technology has capabilities for delivery, management and support of affective teaching and learning. Information and Communications Technology (ICT) are the computing and communication facilities and features that variously support teaching, learning and range of activities in education and other sectors. The ICT related activities were the following:

- a) Broadcast materials or CD-ROM sources of information.
- b) Devices to facilitate communication for learner or students with special needs.
- c) E-mail to support collaborative writing and sharing of resources.
- d) Electron toys to develop spatial awareness and psychomotor control
- e) Internet-based research to support scientific enquiry
- f) Integrated learning system (ILS) to teach basic numeracy.
- g) Keyboards effects and sequencers in music teaching
- h) Micro-computers and other devices to teach literacy and writing
- i) Video-conferencing to support the teaching of modern foreign languages
- j) Communication technology to exchange administrative and assessment data (Olorode, 2018).

Amez & Landover, (2012) opine that ICT is the technology which supports activities involving the creation, storage, manipulation and communication of information, together with their related methods, management and application. Ololube , Ubogu and Ossai (2007) move further that the introduction of ICT usage, integration and diffusion has initiated a new age in educational methodologies, thus it has radically changed traditional method of information delivery and usage patterns in the domain as well as offering co- temporary learning experience for both instructors and students. For developing countries, ICTs have the potential for increasing access to and improving the relevance and quality of education (Nwosu and Ugbomo, (2012). They further state that when used appropriately, different ICTs help to expand access to education

strengthen the relevance of education to the workplace and raise educational quality by creating an active process connected to real life.

Abimbade, Aremu and Adedoja (2013) submit that computer has the ability to manage information with high speed and accuracy so that teaching and learning can be managed with greater efficiency and efficacy. They also assert that computer assisted instruction (CAI) has positive influence on students' academic performance.

Statement of Problem

The importance of Biology as one of science disciplines cannot be over stated. It lays the foundation for other science subjects. Since Biology is the study of living things, its importance is in no small measure on all living things both plants and animals include human beings. ICT, which is new development, can improve academic performance of the Biology students if it is effectively used. ICT has made the world a small global centre; the Nigerians' students should therefore not be left out in the new development.

Purpose of the Study

The main purpose of this study is to confirm the important of ICT in academic performance of biology students. Specifically, this study wants to confirm if the Biology students are aware of ICT in their schools, if ICT is available in their school, if ICT can improve performance of Biology students and there are any challenges of ICT in Nigeria.

Research questions

1. Are the Biology students aware of information and communication technology in their various secondary schools?
2. Is information and communication technology available in their school and if it there are they allow them to use it?
3. Can the use of ICT improve academic performance of Biology students in all our various secondary schools?
4. What are the challenges confronting the use of ICT in our secondary schools?

Hypothesis

One major hypothesis formulation on this paper is “there is no significant difference between Biology students thought with information and communication technology (ICT) and though thought with conventional method of teaching.

Methodology

The design of the study was survey and the study area is Ogbomoso and its environs in Oyo State, Nigeria. Two schools were chosen in each of five local government areas making a total of ten schools. A total of three hundred (300) students (respondents) which comprised 150 male and 150 female SSS1- SSS 3 students were used in this study to give total sample of 300 respondents. The sample then comprised thirty (30) students in each school randomly selected from ten different schools in Ogbomoso area in Oyo State.

The survey questionnaire was divided mainly into two parts, where the first part deals with age, gender and level or classes of the students. The second part was designed to gather information about their knowledge on ICT and its educational application, attitude towards the use of ICT and the challenges they face while using ICT for teaching learning purpose. Collected data were analyzed using Microsoft Office Excel and the results were compared with existing literatures.

For the purpose of hypothesis the study adopted a randomized pre-test, post-test control group design which entails the use of two groups using measured or observed twice. The first measurement serves as the pre-test, the second as the post-test. Random assignment was used to form experimental group and control group. The measurement or observations were collected at the same time for both groups. Simple random sampling was used to assign students to Experimental and control group. The instrument used in the study is a likert-type response scale, and contained 20 items ranging from Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD). The items were scored on the basis of the weight of each point. That is, 4,3,2,1 for SA, A, D, and SD respectively. The instruments were face and content validated by specialists to ensure clarity, arrangement and suitability in addressing the purpose of the study. The reliability coefficient was 0.76. The instruments were administered by the researcher and the research assistants to the two groups at

the same time. In the ten sampled secondary schools, five serve as treatment group and the other five as control group. The hypothesis was confirmed using mean rank and standard deviation.

Information has been collected from Biology students of secondary schools in Ogbomosho, Oyo State Nigeria. Table 1 categorizes surveyed students according to gender, age group and classes.

Table 1: Profile of Surveyed Biology students (300)

Variable		Number	Percent (%)
Gender	Male	150	50
	Female	150	50
Age group (years)	10-14	120	40
	15-19	140	46.67
	20-24	40	13.33
Levels / Classes	SS1	100	33.33
	SS2	100	33.33
	SS3	100	33.33

Results

Finding of our study are described in the following section:

Awareness of Biology students to ICT in their schools

The students were asked to respond on a three- point scales: Always, Sometimes and Never on the questions whether they have awareness of computer and internet at home and at school when these are required for school work.

Table 2: Survey response about ICT knowledge of biology students

Awareness of computer & internet	Always	Sometimes	Never
Awareness of computer at school	100 (33.33%)	90 (30%)	110 (36.67%)
Awareness of computer at home	80 (26.67%)	120 (40%)	100 (33.33%)
Awareness of internet at school	70 (23.33%)	125 (41.67%)	105 (35%)
Awareness of internet at home	50 (16.67%)	113 (37.67%)	137 (45.67%)

According to Table 2, most of the Biology students have awareness of computer at school 33.33% “Always” and 30% “Sometimes”; at home 26.67% “Always” and 40% “Sometimes”. Concerning having internet connections at school, 23.33% chose “Always” and 41.67% chose “Sometimes”, while on living it at home those who chose “Always” 16.67% and those who chose “Sometimes” were 37.67%. However, a good number of students responded that they do not

have access to computer or internet at school. These constitute 36.67% and 35% respectively and at home they were 35% and 45.67% respectively.

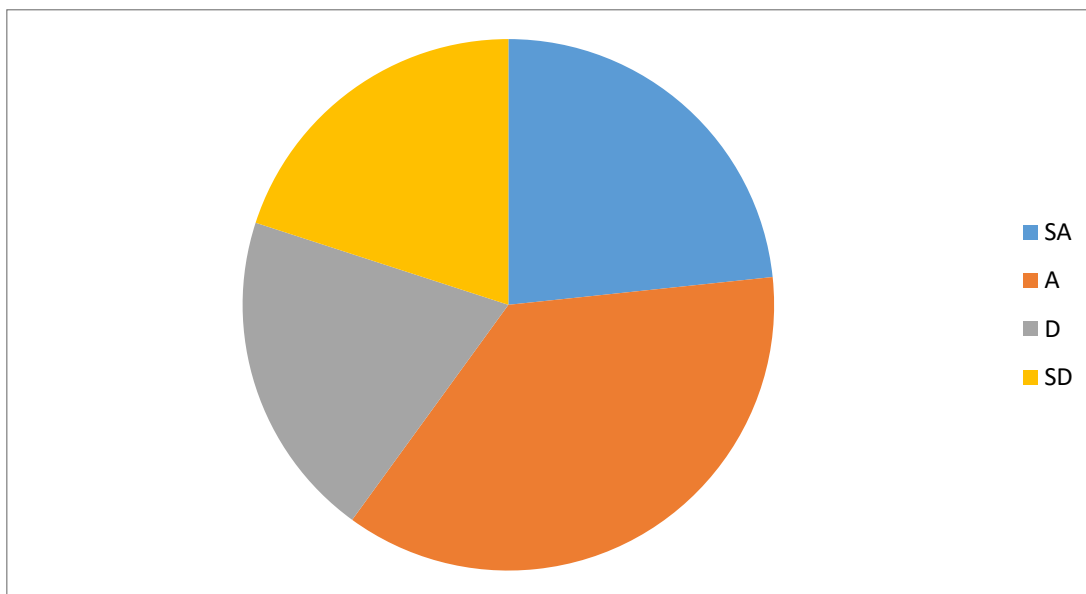
Use of ICT for learning Purpose

The students were asked how often they are allowed to use ICT for learning process in their schools and their responses are shown in table 3:

Table 3: Use of ICT for learning purpose

Purpose	Percentage (%)		
	Always	Sometimes	Never
Accessing education Materials from internet	5 %	25 %	70 %
Doing assignment	10 %	27 %	63 %

It was found that 5% of the students always use internet for accessing educational materials, whereas 25% students chose sometimes while a larger percentage (70%) of the students do not use internet to accessed internet for any learning purposes. Also, for doing assignment, 10% said they always use internet to solve any assignment while 27% said they are sometimes, whereas, 63% students said they never made any attempt to use internet. In addition to that, the students were asked if ICT can improve their performance on Biology.



SD = 20% SA= 23%
 D= 20% A = 37%

Note: SA= strongly agree, A = Agree, D = Disagree and SD= strongly disagree

Figure 1: Using ICT to improve teaching and learning process

It was found that 180 students agreed that the use of ICT can improve performance of biology students while 120 students disagreed to this idea (figure 1).

Table 4: *Challenges faced by biology students in using ICT*

Several challenges were identified during the study, which are shown in table 4

Challenges	Percent (%)				
	SA	A	N	D	SD
Unexpected power failure	53	40	6	1	0
Lack of computer in school	25	31	15	24	5
Inadequate of human skills and knowledge in ICT	15	20	30	20	15
High cost of computer hardware and software	25	35	20	10	10

Note: SA= Strongly agree , A = Agree, N = Neutral, D = Disagree, SD = Strongly disagree

Unexpected power failure problem was found to be the biggest challenge for the students and teachers, 93 % of the students agreed the effects of power failure on the usage of ICT in Nigeria. The second biggest challenge was high cost of computer hardware and software, which was strongly agreed by 25% and agreed by 35% students. Also, lack of computer in school was another factor hindering the use of computer in the schools. 22% chose strongly agree, 31% agree, 15% neutral, 24% disagree and 5% strong disagree. Then the next challenges are inadequate of human skills and knowledge in ICT. Strongly agree is 25%, agree 20% while many of the students were neutral on this case (30%), 20% chose disagree and 15% strongly disagree.

Testing for hypothesis

Table 5: *Mean and standard deviation of Experimental and Control groups for testing hypothesis one with state that there is no significant difference between Biology students thought with information and communication technology (ICT) and though thought with conventional method of teaching.*

Groups	N	Pre-test		Post-test	
		Mean (x)	SD	Mean (x)	SD
Experimental	150	51.27	12.62	60.67	15.72
Control	150	50.88	13.60	55.38	17.06

Source: Author's Analysis, 2021. (* SD= standard deviation)

Table 5 showed the pre-test comparison between the mean achievement scores of students in both experimental and control groups at the commencement of the study. The table reveals that the mean score of experimental and control is 51.27 and 50.88. The table also shows the post-test mean score of 60.67 for the experiment group and standard deviation of 15.72, which is greater than mean of control group 55.38 with standard deviation of 17.06. This shows that students exposed to ICT achieved higher mean score than those not exposed to it. Therefore non hypothesis is rejected while alternate hypothesis was accepted which state that there is significant difference between Biology students thought with information and communication technology (ICT) and though thought with conventional method of teaching

Discussion

The finding shows that most of the Biology students have access to computer at school always (33.33 %), (30%) sometimes while (36.67%) never, while at home, (26.67%) always, (40%) sometimes and (33.33%) never. 23.33% also claim they have better internet access at school always and (41.67%) sometimes while at home (16.67%) always and (37.67%) sometimes. Most of the Biology teachers in an oral interview however opined that they have less number of computers in their schools and it is sometimes difficult for them to arrange classes for practical class.

The fact that there are challenges against the use of ICT in schools agrees with the report of Kwacha (2007) which asserts that in Nigeria, most ICT facilities are not sufficient to enhance quality education to learners and teachers, even where they exist, they are not sophisticated enough to stand the test of time like the ones acquired in the developed countries. Nwosu and Ugbomo (2012) state that problems of quality and lack of resources are compounded by the reality faced by educational institutions the battle to cope with ever increasing students' numbers.

Collaborative learning in ICT supported learning, encourages interaction and cooperation among students, teachers and experts regardless of where they are. Apart from modelling real – world interactions, ICT supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners’ teaming and communicative skills as well as their global awareness. It models learning done throughout the learner’s lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields.

This study confirmed that 66% of the respondents agreed that ICT can improve performance of biology students but in Nigeria, electricity power supply is erratic and this affects most of the ICT operations in her institutions of learning and at homes, thus causing frequent damage of the existing ICT equipment which hinders ICT usage in enhancing quality education. According to Ndukwe (2007), nearly all ICT equipment infrastructure and terminals depend on electricity to energize and unless this vital source is always available and reliable, Nigerians will not be able to fully enjoy the benefits that the digital revolution offers and that overcoming the energy crises is a major pre-requisite for Nigerian to achieve its vision 21st century of national transformation.

Tinuoye and Adogbeji (2003) opine that the most common problems associated with the effective implementation of ICT are personnel, cost of equipment, management attitudes, inconsistent electric power supply and inadequate telephone lines, particularly in rural areas and non-inclusion of ICT programmes in teacher’s training curricula. Pelgrum (2001) implementation include the following: insufficient number of computers, teachers’ lack of ICT knowledge/skills, difficulties to integrate ICT to instruction, scheduling computer time, insufficient peripherals, inadequate copies of software, insufficient teacher time and lack of technical assistance. In addition, Agbato (2013) summarizes these barriers as limited equipment, inadequate skills, minimal support, time constraints and the teacher’s own lack of interest or knowledge about computer. Quality ICT facilities should be made available, accessible and equally made easy for staff and students to obtain in order to improve quality of education in Nigeria.

The results of hypothesis confirmed that the experiment groups performed better in Biology than the control group due to the intervention given to them using ICT strategy. These findings have strong implications for the Biology

teachers, school administrators, government and curriculum planners in the sense that when exposing students to ICT, it will improved students' achievement, attitude and interest toward Biology, which in turn yield the desired expectation.

Recommendations

In order to overcome major hindrances of ICT in enhancing quality Biology education and bringing about national transformation, the under listed recommendations should be considered:

- Government should provide sufficient and constant electricity supply to all the communities in Nigeria including rural areas and remote places where schools are located and let these schools be connected to the electric supply.
- Government should initiate more projects to improve the condition of workers through the use of ICT. Local Government should make computer training centre available at the grassroots for all primary and secondary school students for easy understanding of computer usage.
- Government at all levels of educational system should make ICT a matter of priority, improve the funds needed in ICT training for Biology teachers, students and supporting staff.
- Every Biology teacher must engage in constant self-development in information and communication technology.
- Educational institutions' libraries should be fully automated in order to be part of cyberspace libraries. No libraries of educational institutions can effectively support teaching, learning and research without adequate internet access and connectivity.
- Nigeria educational system needs radical overhauling to make it information technology-focused and friendly. This is essential if institutions will produce information technology-skilled graduates that will be able to rub minds and fare favourably well with their colleagues in other developing and developed countries.

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