



Assessment on Integration of ... Anka, N. H., Et. al (2025)

Assessment on Integration of Information and Communication Technology tools for Biology Concepts Teaching among Secondary School Teachers in Zamfara State, Nigeria

ANKA, Nafisatu Halilu¹

nafisahaliluanka@gmail.com

08038203430

OLATUNBOSUN, Mujidat Lukman²

olatunbosunmujidat@fugusau.edu.ng

08032068029

SULEIMAN, Shukura³

shukuragiwasule@gmail.com

08060730930

¹Department of Education, Zamfara College of Arts and Science, Gusau

²Department of Science Education, Faculty of Education, Federal University Gusau, Zamfara State

³Directorate of Collaboration and Linkages, Federal College of Education (Technical), Gusau, Zamfara State

Abstract

This study assessed the Integration of Information and Communication Technology tools for Biology Concepts Teaching among Secondary School Teachers in Zamfara State, Nigeria. The study was guided by four objectives and four research questions. The research design was descriptive survey. The target population of the study was 571 biology teachers from both public and private senior secondary school, out of which 234 respondents were selected using Crejcie and Morgan table to determine the sample size for a known population. The instrument used for data collection was questionnaire which comprises of 29 items including the demographic information of respondents. The instrument was validated by experts and its reliability was 0.73. The research questions were analyzed using descriptive statistics (mean and standard deviation). However, from the analysis of data, it was discovered that biology teachers do not have adequate knowledge of ICT, they also have limited access to ICT, which lead to poor use of ICT tools in schools in Zamfara State. Based on these findings, it was recommended that biology teachers should be sent to seminars, workshops, conference to update their knowledge on how to use ICT facilities in teaching and learning of biology

Keywords: Information and Communication Technology, Biology Concepts, Teachers

Introduction

ICT is any electronic product that stores, retrieves, manipulates, transmits, or receives information in a digital form (Yusuf, Maina, & Dare, 2013). The emergence of these technologies has reduced the world into a global village, and anyone or organization ignoring them is asking to be side tracked and placed on the periphery in the international arena. This new technological age is a revolutionary period whose impact is far surpassing that of the agricultural and industrial revolutions. Information has now become one of the most important tools that have transformed the world economy and changed many facets of life, including education. The Internet, which is one of the many components of ICT, has changed the way we work and interact with each other. The internet has increasingly become an invariable asset in education in terms of learning, teaching, and research (Amuoge and Ejike, 2016).



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Information and Communication Technology (ICT) is made up of diverse technological tools that can be used to communicate, disseminate, store, retrieve, and manage information. The National Teachers' Institute (NTI, 2011) simply defined information and communication technology (ICT) as a means of receiving, processing, storing, retrieving, and disseminating information through the use of computers and other telecommunication facilities. In addition, Gbadebo, Abimbola, Ademi, and Odupe, (2013) see it as a generic term that refers to technologies that are used for collecting, storing, editing, and passing information in various forms.

ICT is an aggregation of technologies vis-à-vis communication facilities that facilitates and helps to improve the nature in which messages are stored, relayed, and disseminated for pre-determined purposes. The use of information and communication technologies has received tremendous attention from both staff and students at Nigerian universities. Therefore, it has become an invaluable tool for learning, teaching, and research in Nigerian universities. It has been widely accepted as a channel through which students and researchers communicate in higher institutions of learning. There has been a positive impact of technological usage on students and researchers in Nigerian universities in their critical thinking, problem solving, and networking. The internet is regarded as one of the most important technological advancements of the 20th century and is anticipated to have a major impact on academic research in the near future. Its power comes from the network's extraordinary global expansion and its capacity to link multiple people and computers together, no matter where they are in the world. The university, as a research institute and a very important body that is relevant to national development, must continue to strive to create a suitable learning environment that will give students room to construct their own knowledge rather than embracing the traditional method. The rapid advancement of digital technologies has positioned the integration of Information Technology and Communication Technology (ICT) as a critical requirement for enhancing pedagogical practices across all educational disciplines (Mugabe, et al, 2023). According to Adebayo et al, (2022) integration of ICT is important as the biology deals with abstract, microscopic or dynamic concepts that are that difficult to visualize and experiment with traditional settings. In other word, modern educational policy increasingly encourage teachers to adopt ICT tools, such as multimedia, interactive simulations and Virtual Laboratories (VLs) to foster student engagement and improve learning outcomes.

The prevailing view among secondary school biology teachers is positive regarding the potential of ICT as a powerful instructional tool capable of making lessons more interesting, enhancing conceptual understanding and facilitating a collaborative, student-centered learning environment (Adebayo et al, 2022; Niyitanga, 2024). Afolabi, (2024) said teachers generally express a high level of self-efficacy and willingness to adopt these technologies, indicating a readiness for pedagogical change. Despite the strong and optimistic perception of ICT's pedagogical benefits, the level of integration remains a problem in many secondary schools. Ibrahim et al, (2024) observed that empirical evidence reveals a profound dichotomy between teachers' positive attitudes and their limited practical utilization. The successful implementation of ICT is obstructed by barriers; the most significant challenges cited by teachers include lack of adequate ICT infrastructure and internet connectivity, coupled with the absence of continuous in-training services focusing on the pedagogical integration of technology (Mugabe et al, 2023; Niyitanga, 2024). As a result, some teachers demonstrate a tendency to rely on conventional methods of teaching, partly due to the extra time required to learn, prepare and manage ICT – based lessons and the difficulty of controlling the class when using technology.



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Statement of the Problem

Zamfara State has been facing a massive failure in West African Examination Council (WAEC) and National Examination Council (NECO) results, and biology being one of the five basic subjects that a student must acquire before getting admission into tertiary institution to study science courses. From the data collected from WAEC Chief Examiner’s report in 2016, 50.0% students passed biology, while in 2017, 50.0% passed but in 2018, 47.0% students passed biology, and in 2019, 48.7% passed while in 2020, 49.0% students passed biology.

WAEC Biology Performance: Credit Pass Rate (2016 – 2020)

Year	Total % of candidates with credit pass (A1-C6) in Biology	Implied percentage of failure below credit (D7-F9)
2020	49.0%	51.0%
2019	48.7%	51.3%
2018	47.0%	53.0%
2017	50.0%	50.0%
2016	50.0%	50.0%

Source: Field work, 2024

Based on the above, these percentages show that, on average, over this five-year period, half of the students who took the WAEC Biology examination failed. This led the researchers to carry out an assessment on Integration of Information and Communication Technology tools for Biology Concepts Teaching among Secondary School Teachers in Zamfara State, Nigeria.

Objectives of the study

The objectives of the study are as follows:

1. To find out the level of knowledge of biology teachers in ICT in secondary schools in Zamfara State
2. To find out the accessibility of biology teachers on ICT in secondary schools in Zamfara State
3. To find the difference in level of knowledge of ICT between public and private school biology teachers in secondary schools in Zamfara State
4. To find the difference in the view of public and private school biology teachers on ICT accessibility in secondary schools in Zamfara State

Research questions

The following questions are raised to guide in carrying out this study.

1. Does the biology teachers have adequate knowledge of ICT in secondary schools in Zamfara State?
2. What is the level of accessibility of biology teachers on ICT in secondary schools in Zamfara State?
3. What is the difference in the level of knowledge of ICT between public and private school biology teachers in secondary schools in Zamfara State?
4. What is the difference in the view of public and private school biology teachers on ICT accessibility in secondary schools in Zamfara State?

Methodology



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This study used a descriptive survey method. This study is aimed at finding out the view of senior secondary school teachers on the use of information and communication technology (ICT) in teaching and learning of biology in Zamfara State of Nigeria. The population of this study consisted of all biology teachers teaching in both public and private senior secondary schools in Zamfara State. The population therefore comprises of 571 biology teachers from which 394 teachers are from public secondary schools and 177 teachers are from private secondary schools. This makes a total of 571 target population. Sampling makes it possible to draw valid inferences or generalization on the basis of careful observation of variables with a relatively small proportion of the population (Best and Khan, 2008). In this study only 234 teachers were sampled following krejcie and Morgan (1970) table of determining sample size of a known population in which 150 teachers are from public secondary schools and 84 teachers from private secondary schools. The choice of the school was purposive in as much as they had computers used for instructional purposes. This study investigates the teachers view on the use of information and communication technology in teaching and learning of biology. The instrument used in the collection of data is questionnaire. The questionnaire was designed by the researcher which consisted of two sections; section A demographic information which consisted of sex and types of school and section B contained 3 items with regard to research objectives.

Validity and Reliability of the instrument

The face validity was ascertained by two senior lecturers from Department of Science Education Federal University Gusau, Zamfara State. The terms of reference for the validation are to assess whether (a) the test items were in line with the subject matters they were supposed to test (b) the language of expression was simple and clear and to make sure if it contains the element needed to address the subject to study. The reliability of the instrument was determined through a pilot study with test-re-test method after administering the questionnaire to 20 respondents and was re-administered again after the interval of two weeks. The researcher personally visited all the selected schools to administer and collect the questionnaire on the spot to avoid loss of questionnaire. However not a single one was missing which gave a 100% return rate of 234 questionnaire. The data collection was analyzed using mean and standard deviation (descriptive statistics). Any mean response of 2.50 and above was considered positive (Agree) while any mean response below 2.50 was considered negative (Disagree) and t-test statistics was used to test the null hypotheses.

Presentation of Results

Answering of research questions

Research question 1: Does biology teachers have adequate knowledge of ICT in secondary schools in Zamfara State?

Table 1: level of knowledge of biology teachers

S/N	ITEMS STATEMENT	N	Mean	Decision
1	I know how to operate a computer/laptop	234	2.05	Rejected
2	I know how to operate a tablet/mobile device	234	3.05	Accepted
3	I can design products that are students centered by using ICT	234	1.51	Rejected
4	I know how to operate multimedia projectors	234	1.85	Rejected
5	I can use ICT to teach topics of biology that are better learned when employing specific teaching approaches	234	3.05	Accepted



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6	I can use strategies that combine biological content ICT are teaching approaches to support students understanding as they are learning biology	234	2.58	Accepted
7	I can use ICT to teach student to develop their biological problem solving through inquiry-based learning	234	2.58	Accepted
8	I can use ICT in teaching by employing direct instruction	234	1.87	Rejected
Average means score				

2.31

Source: Field work, 2024

Table 1 present the analysis of data on level of knowledge of biology teachers on ICT. Analysis reveals that items 2,5,6 and 7 had mean a score of above 2.50 while item 1,3,4 and 8`had a mean score below 2.50 the result indicated an average mean of 2.31 which shows that biology teachers does not have adequate knowledge of ICT in Zamfara state

Research question 2: What is the level of ICT accessibility of biology teachers in secondary schools in Zamfara State?

Table 2 ICT Accessibility of biology teachers

S/N	ITEMS STATEMENT	N	X	Decision
9	I used ICT laboratory once in a week	234	3.61	Accepted
10	I used ICT laboratory twice in a week	234	2.63	Accepted
11	I used ICT laboratory almost everyday	234	1.81	Rejected
12	I have personal computer at home	234	1.20	Rejected
13	We have personal computer in our office	234	2.21	Rejected
14	We have 24 hours power supply in my school	234	2.01	Rejected
15	We have 3G/4G network in our school	234	2.26	rejected
16	I can log in anytime with my device at the comfort of my home	234	2.00	Rejected
17	I can log in only when I am in the school premises	234	2.50	Accepted
Average mean score				2.30

Source: field work 2024

Table 2 shows that the analysis of data on the ICT accessibility of biology teachers. The table shows that item (9, 10 & 17) had a means score above 2.50, this indicated that biology teachers used ICT laboratory once in a week and they can only login when they are in the school premises while items 11,12 and 14 were rejected with a mean below 2.50 and an average mean of 2.30 which shows that biology teachers has limited access to ICT due to poor power supply.

Research question 3: What is the difference in the level of knowledge of ICT between public and private school biology teachers in secondary schools in Zamfara State?

Table 3: The difference in the level of knowledge of ICT between public and private school biology teachers

S/N	Type of school	Mean	Standard deviation
1	Public	2.12	0.354
2	Private	2.50	0.535

Source: field work, 2024



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Table 3 shows that public teachers have a mean of 2.12 with a standard deviation of 0.354 while private school teachers have a mean of 2.50 with a standard deviation of 0.535 and a mean difference of 0.38 which shows that the level of ICT knowledge private school biology teachers was higher than the public-school biology teachers.

Research question 4: What is the difference in the view of public and private school biology teachers on ICT accessibility in secondary schools in Zamfara State?

Table 4: The difference in the view of public and private school teachers on ICT accessibility

S/N	Type of school	Mean	Standard deviation
1	Public	2.22	0.21
2	Private	2.78	0.44

Source: Field work, 2024

Table 1.4 shows that the view of public and private biology teachers on ICT accessibility is 2.22 and 2.78 respectively with a mean difference of 0.56 which means that private school biology teachers have more ICT accessibility than the public school biology teachers.

Discussion of findings

The findings of this research corroborated with that of Olawale and Yusuf, (2023) who confirmed that availability and utilization of ICT for teaching biology is low, it also agreed the study of Osawuru, (2024) who said teachers had a strong desire to integrate ICT but faced challenges like limited ICT tools, poor internet, power issues and lack of training/technical support. Some studies point to the lack of electrical outlets in classrooms as a practical constraint (Rubach and Lacarides, 2021).

Conclusion

Based on the findings, it can be concluded that the majority factors that lead to failure of students in biology after integrating ICT in teaching and learning in Zamfara State are inadequate knowledge of ICT by biology teachers, also biology teachers have limited access to ICT to the extent that most their lectures and practical are done once or twice a week and this will hinder the teachers in helping students to communicate, share ideas and work as a team anywhere, anytime such as teleconferencing where students around the world are limited to meet together for a discussion related to a specific topic. Therefore, Teachers are expected to be trained on how to utilize ICT facilities in teaching and learning of biology, thus, make students to learn on their own as now the world is heading towards paperless society.

Recommendation

Based on the finding of the study the following recommendation one made

1. Biology teachers should be sent to seminars, workshops, conference to update their knowledge on how to use ICT facilities in teaching and learning of biology
2. Adequate ICT tools should be provided for biology teachers so as to have engaging classrooms where there will be meaningful learning.
3. Biology Teachers should be retrained on how to use various methods and techniques of teaching biology using ICT facilities.
4. Biology teachers should also create time to learn about ICT on their own.

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www.foefugusau.com.ng
des@fugusau.edu.ng

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