

Teachers' Readiness for Information and Communication Technology in Teaching of Biology in Secondary Schools in Ekiti State, Nigeria

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ABSTRACT: *This study investigates the readiness of teachers for Information and Communication Technology (ICT) integration in the teaching of Biology in secondary schools within Emure Ekiti, Ekiti State, Nigeria. The research aims to assess students' performance in Biology, examine the availability and utilization of ICT for teaching Biology, and explore the potential influence of ICT on students' performance. A descriptive survey design was employed, with data collected from 10 Biology teachers and 90 students across five secondary schools in Emure-Ekiti. The research instruments, Information and Technology Equipment Checklist (ITEC) and Biology Performance Inventory (BPI), were used to gather data on ICT availability, utilization, and students' performance in Biology. The study revealed a low level of availability and utilization of ICT facilities in the sampled schools. However, the level of students' performance in Biology was found to be moderate. The findings suggest that the availability and extent of ICT utilization have a significant impact on students' performance in Biology. Recommendations include government intervention to provide ICT facilities in secondary schools, enforcement of ICT utilization through inspectorate departments, and active engagement of Biology teachers in incorporating ICT tools in their teaching methods.*

KEYWORDS: Teachers' Readiness, ICT, Teaching, Biology

INTRODUCTION

Biology is a widely studied subject. It's popular because many students already have preconceived notions about how biological systems work, giving them faith in their capacity to comprehend Biology. They have, in fact, used their own informal inquiry processes to make sense of their local biological world. Many of the concepts' students have about Biology have been worked out by themselves through observing, creating hypotheses,

observing again, refuting or improving their views (although in an informal way). This kind of 'working out' of biological principles is a fun approach to think about biology teaching and learning.

Science's importance in the development and fulfilment of a country's needs is undeniable. For example, substantial developments in science and technology have aided nations in promoting efficiency, self-sufficiency, and humanity's overall well-being through inventions/innovations in telecommunications, transportation, health, agriculture, and other fields (Ado, 2009). Science has an impact on all areas of our lives, including what we eat and wear, what we do for a living, what we do for fun, what we think and feel, and even how we are born and die. Science's products and procedures have an impact on almost every aspect of our life.

Despite all the efforts by the Government and many non-governmental organisations to encourage and facilitate ICT integration in teaching and learning, research shows that in most of the educational institutions, there is very little integration, especially in science subjects. If there is to be effective ICT integration in teaching and learning, the teacher must be prepared both intrinsically (sufficient ICT integration skills and positive attitude towards ICT integration) and extrinsically (be provided with sufficient ICT resources and be accorded the necessary support by the administration). It is against this background that the researcher found it useful to investigate teachers' readiness to integrate ICT into the process of teaching and learning, considering that the teacher is a key player in the success of any educational program. The aim of this study is to investigate the readiness of Biology teachers in integrating the use of ICT in leaning process. Students' performance has continued to be poor and if this trend is allowed to continue it will be detrimental to the welfare of those who lived in the state and the whole country. It is against this background that the researcher found it useful to investigate teachers' readiness to integrate ICT into the process of teaching and learning, considering that the teacher is a key player in the success of any educational program.

Information Communication and Technology (ICT) has become an important part of most organisations and businesses these days. There is substantial evidence that if in the right hands and used appropriately for specific purposes in specific contexts; ICT can be an effective tool in positively impacting the quality of human life. Plomp et al. (2007) confirm the positive impact of ICT on people's lives by indicating that: "Information and communication technologies are rapidly changing the way individuals live, firms do business, governments' administer, and nations interact". Education has been identified as one of the public sectors most influenced by technological developments (Okebukola & Akinbola 2006).

New technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before (Smeets, 2014). According to white paper on e-Education (2004), ICTs can enhance educational reform by enabling teachers and learners to move away from

traditional approaches to transformed teaching and learning. In a transformed teaching and learning environment, there is a shift from teacher-centered, task-oriented, memory-based education to an inclusive and integrated practice where learners work collaboratively, develop shared practices, engage in meaningful contexts and develop creative thinking and problem-solving skills (White Paper on e-Education, 2004). Ogunkola and Olatoye (2014) further point out that technology can play a part in supporting face-to-face teaching and learning in the classroom.

There has been a national concern in Nigeria due to the relatively lower performance of Biology in the national examination and due to the fluctuating levels of enrolment (candidature). Due to the low enrolment teachers would consult them individually and the little or few ICT equipment available can be sufficient in matching their number hence more conceptualization. Ogunbanwo, (2014) notes that poor performance in science may be attributed to several factors such as attitude, teaching approaches/ method, content and resources mobilisation and management. Bybee (2011) observes that many African countries continue to use teaching methods that are over four decades old, teaching is teacher-centered, and typically encourages passive learning styles.

The flow of information from the teacher as sage to the student as receptacle. This is further confirmed by Abdullahi (2010) who defines teacher centred teaching style as: A style of instruction that is formal controlled and autocratic in which the instructor directs how what, and when students learn. Gambari (2010) carried out research to find out whether the science teacher in Nigeria was integrating computers in their subject's topic areas. The findings were that majority of them do not integrate computers in their general teaching and learning processes. Gambari (2010) point out that few teachers used computers – based technologies for instructional purposes and observed that computers are not being integrated into most instructional curricula. The traditional teaching methods used by most of the teachers continue to face a global resistance due to changing level of technology. This is because the changing level of technology has made learners more inquisitive, critical, and informed. This, in turn, puts pressure on the education sector to embrace modern technology in its various undertakings.

The government of Nigeria, however, recognises the importance of ICT in teaching and learning. This is evidenced by its effort to address the issue of ICT integration in classroom teaching and learning. In 2007, the Nigeria government, through the Ministry of Information and Communication, Adopted the National Information and Communications Technology (ICT) Policy. Other than the government, other indigenous and non-indigenous non-governmental organisations have engaged great effort in the endeavour of promoting ICT integration in teaching and learning. The use of computer technology can improve the quality of instruction by assisting teachers in the complex task of managing and supporting instructional programs in schools. According to Smeets (2014), when teacher effectively integrates the computer into classroom teaching and learning, the speed of the management of students' data, search for information, and presentation of learning materials is greatly increased. In Nigeria, the biology syllabus in secondary schools is greatly compressed to

include many topics that require more time allocation to be learned at higher cognitive skill while the time for syllabus coverage has always been shortened due to over increasing school program.

Consequently, Biology has been poorly performed in National Examination. According to Ibe (2016), poor performance in sciences can be solved using computer for instruction. Poole also emphasises that use of simulations enables students to enjoy more effective than students not using a computer.

The purpose of this study is to examine the teacher's readiness for ICT in teaching of Biology in secondary schools in Emure Ekiti, Ekiti State Nigeria. Specifically, the study examined

- i. the performance of students in Biology in secondary schools in Emure Local Government Area of Ekiti;
- ii. the level of availability of information and communication technology for teaching and learning of Biology in secondary schools in Emure Local Government Area;
- iii. the extent of utilization of information and communication technology for teaching and learning Biology in secondary schools in Emure Local Government Area;
- iv. if availability of information and communication technology will influence students performance in Biology in secondary schools in Emure Local Government Area; and
- v. if utilization of information and communication technology will influence students' performance in Biology in in secondary schools in Emure Local Government Area.

Research Questions

This study attempted to answer the following questions:

1. What is the performance of students in Biology in secondary schools in Emure Local Government Area?
2. What is the level of availability of information and communication technology for the teaching and learning of Biology in secondary schools in Emure Local Government Area?
3. What is the extent of utilization of information and technology for teaching and learning Biology in secondary schools in Emure Local Government Area?

Research Hypotheses

The following research hypotheses were generated for this study

1. Availability of information and communication technology for teaching and learning Biology in secondary schools will not significantly predict students' performance in Biology.

2. Utilization of information and communication technology for teaching and learning Biology in secondary schools will not significantly predict students' performance in Biology.

METHODOLOGY

The descriptive research design of the survey type was Adopted in the study. The research was descriptive because it described the existing situation regarding availability and utilization of information and communication technology to the teaching and learning of Biology in secondary schools in Emure Local Government Area without manipulation of variables. The population of this study consisted of all the Biology teachers and students of all secondary schools in Emure-Ekiti. The sample for this study consisted of 10 Biology teachers and 90 students which were selected from 5 secondary schools in Ekiti State. The sample was selected using simple random sampling and purposive sampling techniques.

Two research instruments were used to collect relevant data for the study. These are Information and Technology Equipment Checklist (ITEC) and Biology Performance Inventory (BPI). Information and Technology Equipment Checklist (ITEC) consists of section A and B. Section A sought for bio-data of the respondents which include the name of school, location of school, sex, qualification, Area of Specialization, year of experience, while section B contained 25 items where their availability and utilization was put into consideration. Biology Performance Inventory (BPI) sought for the performance of students in Biology.

The face and content Validity of each instrument was done by experts in Test and Measurement, and Biology Education to determine the level of appropriateness of the instruments in measuring what they purport to measure and ensure that the instruments contained the appropriate items that could actually produce the intended responses. The reliability of ITEC was established through the test re-test method. The instrument was administered on Biology teachers from two schools that were not used for the study. After two weeks, the same instrument was re- administered on the same set of sample. The scores of the two tests (i.e test and re-test) were thereafter correlated using Pearson Product Moment Correlation which yielded coefficient value of 0.811.

The researcher personally administered the two instruments with the aid of two research assistants. Copies of ITEC and BPI were administered by the researcher and the research assistance in the selected secondary schools. The data collected for this study were analyzed using descriptive and inferential statistics. The questions raised were answered using descriptive statistics of means and standard deviation. The hypotheses were tested using linear regression. All the hypotheses were tested at 0.05 level of significance.

RESULTS**Research Questions**

Research Question 1: What is the performance of students in Biology in secondary schools in Emure Local Government Area?

To answer the question, frequency counts and percentage analysis were used to analyze the data to deduce the answer to the question.

Table 1: Percentage of students' cumulative performance in Biology

Grade	Frequency	Percent	Cumulative Percent
Fail	18	8.7	8.7
Pass	45	21.7	30.4
Credit	83	40.1	70.5
Very Good	37	17.9	88.4
Distinction	24	11.6	100.0
Total	207	100.0	

Table 1 reveals the level of performance of students which was classified as distinction, very good, credit, pass and fail in Biology. The table shows that 24 students representing 11.6 percent had distinction (Grade A) in Biology, 37 students representing 17.9 percent had very good (Grade B), 83 students representing 40.1 percent had credit (Grade C), 45 students representing 21.7 percent had pass (Grade D & E) while 18 students failed (Grade F) Biology. Most of the students had grade C in Biology in secondary schools in Emure – Ekiti, Ekiti State.

Research Question 2: What is the level of availability of information and communication technology for the teaching and learning of Biology in secondary schools in Emure Local Government Area?

Table 2: Frequency and Percentage analysis of availability of information and communication technology for teaching and learning Biology (No of Schools – 5)

S/N	Information Technology	Adequate		Inadequate		Not Available	
		F	%	F	%	F	%
1.	Computer laboratory	0	0.0	1	20.00	4	80.0
2.	Local Area Network	0	0.0	0	0.00	5	100.0
3.	Video tape	0	0.0	0	0.0	5	100.0
4.	Interactive white board	0	0.0	0	0.0	5	100.0
5.	LCD projector	4	80.0	1	20.0	0	0.0
6.	Computers	1	20.0	1	20.0	3	60.0
7.	Printers	4	80.0	1	20.0	0	0.0
8.	Television	1	20.0	1	20.0	3	60.0

9.	Internet	0	0.0	1	0.0	4	80.0
10.	CDROM	0	0.0	1	0.0	4	80.0
11.	Instructional Software	0	0.0	1	0.0	4	80.0
12.	Smart/White Board	2	40.0	1	20.0	2	40.0
13.	Photocopy Machines	4	80.0	1	20.0	0	0.0
14.	i-pad	1	20.0	1	20.0	3	60.0
15.	School dedicated website	0	0.0	0	0.00	5	100.0
16.	Projected video package	0	0.0	0	0.00	5	100.0
17.	Laptops	2	40.0	3	60.0	0	0.0
18.	External storage facilities	0	0.0	2	40.00	3	60.0
19.	Electronic messaging	0	0.0	1	0.0	4	80.0
20.	Handsets	0	0.0	1	0.0	4	80.0

Table 2 revealed the level availability of information and communication technology for the teaching and learning of Biology in secondary schools in Emure Local Government Area. Schools with the recommended numbers of information and communication technology facilities are classified as adequate while schools without the recommended numbers are classified as inadequate and schools without any are classified as not available. The table revealed that none of the sampled schools have adequate information and communication technology facilities. The table also revealed that the highest adequately available information and communication technology facilities are the LCD projectors, printers and photocopy machines with 80.0% of the sampled schools having them in their schools.

The table showed that none of the schools have all the recommended information and communication technology as they all fall below the recommendation standard by Federal Ministry of Education (2013).

Research Question 3: What is the extent of utilization of information and technology for teaching and learning Biology in secondary schools in Emure Local Government Area?

Table 3: Frequency and Percentage analysis of utilization of instructional materials (N=100)

S/N	Information Technology	Frequently used (FU)		Hardly used (HU)		Not used (NU)	
		F	%	F	%	F	%
1.	Computer laboratory	6	6.0	11	11.0	83	83.0
2.	Local Area Network	0	0.0	5	5.0	95	95.0
3.	Video tape	0	0.0	0	0.0	100	100.0
4.	Interactive white board	0	0.0	0	0.0	100	100.0
5.	LCD projector	11	11.0	8	8.0	81	81.0
6.	Computers	12	12.0	11	11.0	77	77.0
7.	Printers	23	23.0	9	9.0	68	68.0
8.	Television	0	0.0	0	0.0	100	100.0
9.	Internet	3	3.0	9	9.0	88	88.0
10.	CDROM	0	0.0	0	0.0	100	100.0
11.	Instructional Software	0	0.0	0	0.0	100	100.0
12.	Smart/White Board	61	61.0	8	8.0	31	31.0
13.	Photocopy Machines	68	68.0	10	10.0	22	22.0
14.	i-pad	0	0.0	0	0.0	100	100.0
15.	School dedicated website	0	0.0	0	0.0	100	100.0
16.	Projected video package	0	0.0	0	0.0	100	100.0
17.	Laptops	32	32.0	18	18.0	50	50.0
18.	External storage facilities	0	0.0	0	0.0	100	100.0
19.	Electronic messaging	0	0.0	0	0.0	100	100.0
20.	Handsets	9	9.0	4	4.0	87	87.0

Table 3 revealed the extent of utilization of information and communication technology facilities for teaching and learning Biology in Emure – Ekiti. The table revealed that white board and photocopy machine are the information and communication technology facilities fully utilized by over 50% of the sampled schools as other facilities are not fully utilized by majority of the sampled schools. The table also revealed that the highest fully utilized facility by the sampled schools is photocopy machines with 68.0% of the sampled schools fully utilized it.

The table above revealed that most of the teachers did not utilize the information and communication technology facilities as recommended by Federal Ministry of Education (2014) for the teaching and learning of Biology.

Hypotheses Testing

Hypothesis 1: Availability of information and communication technology for teaching and learning Biology in secondary schools will not significantly predict students' performance in Biology.

Table 4: Simple regression analysis between availability of information and communication technology facilities and academic performance of students in Biology

Variables	Unstandardized Coefficients		Stand. Coefficients	t- Stat.	R	R ²	F
	(B)	Std Error	(Beta)				
Constant	-0.481	0.813	-	-0.592	0.382	0.146	7.191*
Availability of Information and communication technology Facilities	0.506	0.099	0.382	5.111			

*P<0.05

In table 4, the calculated F-value of 7.191 is significant at P<0.05, therefore the null hypothesis is rejected. It implies that availability of information and communication technology for teaching and learning Biology in secondary schools significantly predicted students' performance in Biology. The result of the analysis shown in Table 4 indicated the predictors accounted for 14.6 percent of the students' performance in Biology (R² = 0.146). It contributed 14.6% to the criterion variable in predicting students' academic performance in Biology.

The regression equation derivable from table 4 is $Y = -0.481 + 0.506X$

where:

Y = Students' academic performance in Biology

X = Availability of Information and communication technology facilities

Hypothesis 2: Utilization of information and communication technology for teaching and learning Biology in secondary schools will not significantly predict students' performance in Biology.

Table 5: Simple regression analysis between utilisation of information and communication technology facilities and academic performance of students in Biology

Variables	Unstandardized Coefficients		Stand. Coefficients	t- Stat.	R	R ²	F
	(B)	Std Error	(Beta)				
Constant	0.483	0.702	-	0.688	0.611	0.373	17.110 *
Utilisation of Information and communication technology Facilities	0.791	0.078	0.573	10.141			

*P<0.05

In table 5, the calculated F-value of 17.110 is significant at P<0.05, therefore the null hypothesis is rejected. It implies that utilisation of information and communication technology for teaching and learning Biology in secondary schools significantly predicted students' performance in Biology. The result of the analysis shown in Table 5 indicated the predictors accounted for 37.3 percent of the students' performance in Biology (R² = 0.373). It contributed 37.3% to the criterion variable in predicting students' academic performance in Biology.

The regression equation derivable from table 5 is $Y = 0.483 + 0.791X$

where:

Y = Students' academic performance in Biology

X = Utilisation of information and communication technology facilities

DISCUSSION

The findings of the result revealed that most of the students had grade C in Biology in secondary schools in Emure – Ekiti, Ekiti State. This might be as a result of non-utilization of information and communication technology as it was revealed in this study that there was poor utilization of information technology.

This study also showed that that none of the schools have all the recommended information and communication technology facilities as they all fall below the recommendation standard by Federal Ministry of Education (2014). It was revealed that the highest adequately available information and communication technology facilities are the LCD projectors, printers and photocopy machines. This implies that information and communication technology facilities were not adequate for the teaching and learning of Biology. Information and communication technology facilities were not adequate in most of our secondary schools, thereby affecting the performance of secondary school students. Most Biology teachers have been teaching Biology without the necessary information and communication technology facilities. This present finding is in consonance with the findings of Adeuya

(2020) who concluded that there is lack of adequate and appropriate information and communication technology facilities for effective teaching of Biology in schools.

The study also revealed that most of the teachers did not utilize the available information and communication technology facilities for teaching and learning of Biology. This implies that the available information and communication technology facilities are lowly utilized by Biology teachers. This finding agreed with the conclusion of Okebukola (2004) who concluded that the poor state of facilities and inadequate use of facilities has affected the teaching and learning of Biology.

The study further revealed that availability of information and communication technology for teaching and learning Biology in Ekiti State secondary schools significantly predicted students' performance in Biology. Information technology help improve the skills of students to think scientifically, observe, collect data, analyse, and interpret the results of experimentation. In support of this finding, Okoye (2016) reveals that facilities influence students' performance in Science. A survey research conducted by Okoye (2016) on the effects of information and communication technology approach on academic achievement of biology students concluded that information and communication technology facilities have significant effect on students' performance in Biology.

It was revealed that utilisation of information and communication technology facilities for teaching and learning Biology in Ekiti State secondary schools significantly predicted students' performance in Biology. Okoye (2016) and Adeuya (2020) in support of this finding also concluded that adequate utilisation of facilities contributed to students' performance in Biology.

Conclusion

Sequel to the findings of this study, it was concluded that the level of availability, level of adequacy and extent of utilization of information and communication technology facilities in secondary schools in Emure-Ekiti, Ekiti State are low. Also, it is concluded that the level of students' performance in Biology in public secondary schools in Ekiti State is moderate. Furthermore, availability and extent of utilization of information and communication technology facilities have influence on students' performance in Biology.

Recommendations

Based on the findings of this study, the following recommendations were made.

1. The government should provide information and communication technology facilities in secondary schools.
2. The government through inspectorate department should ensure that schools with information and communication technology facilities should put it into use in teaching and learning of school subjects especially Biology.
3. Biology teachers should adequately put into use information and communication technology facilities in teaching Biology in the classroom

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