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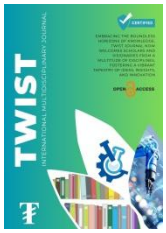

Instructional Materials and Information Communication Technology (ICT) as Prediction of Academic Performance of Biology Students in Secondary Schools in Oyo East Local Government Area, Oyo State

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Abstract
This study investigates the impact of instructional materials and Information Communication Technology (ICT) on the academic performance of biology students in secondary schools within Oyo East Local Government Area, Oyo State. The research aims to determine the extent to which these educational resources serve as predictors of student achievement in biology. A quantitative approach was employed, utilizing a structured questionnaire to collect data from a sample of 100 students across two randomly selected secondary schools. The data were analysed using descriptive and inferential statistics, including regression analysis. Results indicate a significant positive correlation between the availability and utilization of instructional materials and ICT resources and the academic performance of students. The findings suggest that enhancing the quality and accessibility of these educational tools can substantially improve learning outcomes in biology. The study concludes with recommendations for educational stakeholders to invest in and prioritize the integration of modern instructional materials and ICT in the teaching of biology to foster improved academic achievement.

Keywords
Instructional Technology, Biology Education, Information Technology

INTRODUCTION

Background to the study

Advancements in science and technology, and by implication, scientific literacy, are crucial to any country's economic growth and social progress. Biology is a vital scientific course provided in secondary schools in Nigeria. For the Federal Republic of Nigeria (FRN), it falls under the domain of mathematics and science (2014, p. 19). As a scientific discipline, biology seeks to teach students to think scientifically, to be competent scientists, and to be able to apply scientific knowledge to any problem they may face in life. According to Isma'il and Lukman (2022), the goal of the biology curriculum in secondary schools is to teach pupils to think and act in a scientific way. Almost every student majoring in the arts or sciences opts for biology in their final year of high school, according to research by Ogbuze and Okoli (2020). For starters, a lot of careers and academic paths necessitate a biology major or minor (Adesola, Olorode & Aranmolate, 2022). This includes medicine, biochemistry, microbiology, nursing, pharmacy, and a host of other related topics. So, it's a boon to the country's progress.

According to Adalikwu and Iorkpilgh (2013) and Olasehinde and Olatoye (2014), student performance is the main indicator used to measure scientific growth through education. The degree to which an educational institution, a student body, or both has succeeded in meeting its immediate and distant objectives is known as its academic performance. A broader definition could be that it is a gauge of how well a student will do in subsequent classes (Lei & Li, 2015). While course grade is the most common indicator of achievement, learning tests, co-curricular activities, and final grades are typically used to judge academic performance. Additionally, there are a number of characteristics that might be utilized to forecast how well a student would do in a given course; nevertheless, the most prevalent data utilized for this purpose is the student's performance in the course of interest, their level of engagement with the course of interest, and their success in prior courses (Hellas et al., 2018).

Nevertheless, it is worth noting that majority of students continue to perceive and study Biology as an abstract topic, and their performance in the subject remains discouraging, even though Biology is a relevant science subject

(Ezechi, 2014).According to Umar, Sani, and Isma'il (2020), students' performance on both internal and external exams in Biology has consistently been dismal. Many problems have been identified as contributing to this, including insufficient laboratory facilities, high class sizes, ineffective teaching methods, and an absence of qualified educators (Isma'il & Lukman, 2022). Research in science education in Nigeria has persisted in its pursuit of more effective methods of teaching biology considering the numerous complaints about students' lackluster performance on the subject and the need to determine the root causes of this problem, particularly at the secondary level. A large amount of time and energy has been devoted to studying how instructional materials and ICT might improve students' performance in the classroom as part of this effort.

Having high-quality instructional resources is crucial for both teachers and students when it comes to learning and teaching academic subjects. Learning becomes more engaging, applicable, realistic, and appealing with their help. Additionally, they facilitate effective and active participation in class from both instructors and students. In doing so, they pave the way for learning, growth, self-assurance, and fulfillment (Abdu-Raheem, 2016).

Educational resources are "designed to enrich the teaching and learning processes and hence contribute to better learning" (p. 15) per Akanbi (2018). Authentic learning experiences are given to students through instructional resources.Instead than just talking and using chalk, students are more engaged with hands-on activities (Olokooba, 2021). All products and services that facilitate communication and the dissemination of information are collectively referred to as information technology (IT) or information and communication technology (ICT) (Fomsi & Orduah, 2017). Among the many instruments available for digitization are a wide range of hardware components, software programs, and other non-physical elements. Computers, the Internet, radio, television, mobile phones, digital cameras, and software (like e-mail forums) all fall under this category of technology (Ong'amo, Ondigi & Maundu, 2015). Technology and lesson plans have a tremendous effect on biology classes. Biology classrooms cannot function without instructional materials that help students learn the scientific method and its many applications, including but not limited to observation, measurement, classification, recording, experimentation, analysis, inference, etc. According to Salaudin, Muhammed, and Jubrin (2020), most of the subjects covered in secondary biology classes that do not have adequate instructional resources do not get adequately covered. Since students' academic achievement is directly related to the instructional materials and ICT facilities utilized by their teachers, it is prudent to investigate the impact of these factors on learning.

Statement of the Problem

Despite the importance of biology in science, Nigerian secondary school pupils have performed poorly in biology exams. Inadequate lab equipment, student attitude, and teaching approaches are among the causes. Teacher incapacity to assist students understands science meaningfully causes most scientific teaching issues in Nigerian schools. As programme implementer, the teacher must ensure all pupils, regardless of sex or ability, have equitable access to science.

Some recent research has highlighted the value of instructional materials and ICT in improving Biology teaching and learning, although there is no consensus on their usefulness in predicting academic performance. Secondary schools lack adequate school infrastructure, including instructional materials and ICT facilities, and teachers rarely uses them for instruction, especially in biology classes. In addition to existing research, this study examines the use of instructional material and information and communication technology to improve biology students' academic performance in secondary schools in Oyo East Local Government Area.

Research Questions

1. What are the levels of availability, accessibility and utilization of instructional materials with respect to students in Biology class?
2. What are the levels of availability, accessibility and utilization of ICT facilities with respect to students in Biology class?
3. What is the performance level of students in Biology class?

Scope of the Study

The study is limited to senior secondary school 2 (SSS2) Biology students in Oyo east local government area, Oyo state. 2 public secondary schools that are easily accessible to the researcher were purposively selected to study. In the chosen schools, a total of 100 Biology students (50 students in each school) were randomly selected during a preliminary survey carried out. The students enumerated eventually constituted the population for the study. The whole population of SSS2 Biology students enumerated in the chosen schools was used for the study.

METHODOLOGY

The study adopted a survey research design. The data for the study was collected from both primary and secondary sources. The primary source of data collection was through structured questionnaire which was administered to the target population in the study area. The secondary sources of data collection included relevant textbooks, published and unpublished theses, journals, conference publications, internet materials, technical reports and other similar relevant sources. In the study, instructional materials and ICT constitute the independent variable while academic performance constitutes the dependent variable.

A structured questionnaire was designed by the researcher for data collection. The questionnaire titled "Instructional Materials and Information Communication Technology (ICT) as Prediction of Academic Performance of Biology Students in Secondary Schools in Oyo-East Local Government Area" comprises 4 sections. Section A was used to obtain information on the socioeconomic characteristics of the respondents such as age and gender. Variables in this section were coded categorically. Section B was used to obtain information on the availability, accessibility and utilization of instructional materials in Biology class. Variables in this section were coded categorically to indicate availability/ accessibility/utilization or otherwise.

A face and content validity of the instruments was done for the study, the draft copies were shown to experts in the field of Biology education at the Federal College of Education (Special), Oyo. All corrections and suggestions were strictly adhered to, and the final copies were used for data collection. Biology students in secondary school other than those chosen to study were involved. The instruments were administered to the students for a first time, and after 3 weeks, the instruments were re-administered to the same set of students. The data collected in the two administrations were analyzed using Pearson Product Moment Correlation Coefficient to ascertain the reliability of the instruments. A correlation coefficient of 0.73 adjudged acceptable was obtained. In addition, the estimation of internal consistency was determined using the Cronbach's Alpha Coefficient. The result yielded a reliability coefficient of 0.75 which is adjudged adequate.

The data obtained was analyzed using univariate statistics such as frequency, percentage, mean and standard deviation. Also, scores obtained from BAT as categorized thus: low (0-10), medium (11-20) and high (21-40).

RESULTS AND DISCUSSION

Socio economic Characteristics of Respondents

Sex of Respondents

Table 1 Sex of Respondents

Sex	Frequency	Percent
Male	42	42.0
Female	58	58.0
Total	**100**	**100.0**

Table 1 above shows that a higher number of respondents (58.0%) were females compared to the number of males (42.0%). This indicates that there were more females in Biology class than males, although the margin of difference is small (16.0%).

Age of Respondents

Table 2 Age of Respondents

Age	Frequency	Percent
11-15	28	28.0
16-20	70	70.0
21-25	1	1.0
26-30	1	1.0
Total	**100**	**100.0**

Table 2 above indicates that a larger part of the respondents fell within the age-range of 16-20 (70.0%), followed by those within the age-range of 11-15(26.0%) and the other two age categories possessing a value of 1% each. This clearly shows that most of the students were teenagers and within the recommended age grade for senior secondary education as stated by the FRN (2014).

Availability, Accessibility and Utilization of Instructional Materials in Biology Class

Table 3 (see Page 7) presents results on the availability, accessibility and utilization of instructional materials in Biology class. With regards to availability, only 3 of the 15 instructional materials examined were found not to be available. These include reagents (32.0%), model/mock-ups (33.0%) and Forceps (39.0%). In contrast, theother12 instructional materials were found to be available, although in varying degrees. These include real objects (73.0%), pictures/charts (76.0%), specimens of plants (79.0%), Bunsen burners/stoves (80.0%), thermometer (80.0%), microscopes (85.0%), specimens of animals (85.0%), conical flasks (85.0%), hand lens (86.0%), measuring cylinders (88.0%), test tubes (89.0%) and beakers (94.0%). Clearly, the results indicate that most of the instructional materials were available for learning in Biology class, with beakers being the most available and reagent being the least available.

Also, with regards to accessibility, findings show that only 3 of the 15 instructional materials examined were found not to be accessible. These include reagents (22.0%), model/mock-ups (29.0%) and Forceps (40.0%). In contrast, the other 12 instructional materials were found to be accessible, although to different degrees.

Table 3 Availability, Accessibility and Utilization of Instructional Materials in Biology Class

Instructional Materials	Availability		Accessibility		Utilization	
	Avail (%)	Not Avail (%)	Access (%)	Not Access (%)	Utiliz (%)	Not Utiliz (%)
Real Objects	73 (73.0)	27 (27.0)	55 (55.0)	45 (45.0)	66 (66.0)	34 (34.0)
Model/ Mock-ups	33 (33.0)	67 (67.0)	29 (29.0)	71 (71.0)	25 (25.0)	75 (75.0)
Pictures/ Charts	76 (76.0)	24 (24.0)	64 (64.0)	36 (36.0)	65 (65.0)	35 (35.0)
Microscopes	85 (85.0)	15 (15.0)	75 (75.0)	25 (25.0)	58 (58.0)	42 (42.0)
Handlens	86 (86.0)	14 (14.0)	62 (62.0)	38 (38.0)	70 (70.0)	30 (30.0)
Forceps	39 (39.0)	61 (61.0)	40 (40.0)	60 (60.0)	34 (34.0)	66 (66.0)
Specimensof Plants	79 (79.0)	21 (21.0)	59 (59.0)	41 (41.0)	68 (68.0)	32 (32.0)
Specimens of Animals	85 (85.0)	15 (15.0)	69 (69.0)	31 (31.0)	71 (71.0)	29 (29.0)
Bunsen Burner/Stove	80 (80.0)	20 (20.0)	63 (63.0)	37 (37.0)	66 (66.0)	34 (34.0)
Beakers	94 (94.0)	6 (6.0)	76 (76.0)	24 (24.0)	82 (82.0)	18 (18.0)
Measuring Cylinders	88 (88.0)	12 (12.0)	68 (68.0)	32 (32.0)	71 (71.0)	29 (29.0)
Reagents	32 (32.0)	68 (68.0)	22 (22.0)	78 (78.0)	22 (22.0)	78 (78.0)
Thermometer	80 (80.0)	20 (20.0)	64 (64.0)	36 (36.0)	63 (63.0)	37 (37.0)
Conical Flask	85 (85.0)	15 (15.0)	65 (65.0)	35 (35.0)	66 (66.0)	34 (34.0)
Test Tubes	89 (89.0)	11 (11.0)	71 (71.0)	29 (29.0)	73 (73.0)	27 (27.0)

These instructional materials include real objects (66.0%), specimens of plants (59.0%), hand lens (62.0%), bunsen burner/stove (63.0%), pictures/charts (64.0%), thermometer (64.0%), conical flask (65.0%), measuring cylinders (68.0%), specimens of animals (69.0%), test tubes (71.0%), microscopes (75.0%) and beakers (76.0%). Vividly, the results indicate that most of the instructional materials were accessible for learning in Biology class, with beakers being the most accessible and reagents being the least accessible.

Additionally, with regards to utilization, results show that only 3 of the 15 instructional materials examined were found not to be utilized. These include reagents (22.0%), model/mock-ups (25.0%) and Forceps (34.0%). In contrast, the other 12 instructional materials were found to be utilized, although in different degrees. These include real objects (55.0%), thermometer (63.0%), pictures/charts (65.0%), microscopes (65.0%), bunsen burners/stoves (66.0%), conical flasks (66.0%), specimens of plants (68.0%), hand lens (70.0%), measuring cylinders (71.0%), specimens of animals (71.0%), test tubes (73.0%) and beakers (82.0%). Clearly, the findings indicate that most of the instructional materials were utilized for learning in Biology class, with beakers being the most utilized and reagents being the least utilized.

Availability, Accessibility and Utilization of ICT Facilities in Biology Class

In the results presented in Table 4 (seePage10), the availability, accessibility and utilization of ICT facilities in Biology class were documented.

Table 4 Availability, Accessibility and Utilization of ICT Facilities in Biology Class

ICT Facilities	Availability		Accessibility		Utilization	
	Avail (%)	Not Avail (%)	Access (%)	NotAccess (%)	Utiliz (%)	Not Utiliz (%)
Televisions	5 (5.0)	95 (95.0)	4 (4.0)	96 (96.0)	5 (5.0)	95 (95.0)
Projectors	3 (3.0)	97 (97.0)	2 (2.0)	98 (98.0)	3 (3.0)	97 (97.0)
Audio tapes	4 (4.0)	96 (96.0)	3 (3.0)	97 (97.0)	4 (4.0)	96 (96.0)
Computers	61 (61.0)	39 (39.0)	33 (33.0)	67 (67.0)	26 (26.0)	74 (74.0)
Tablets	2 (2.0)	98 (98.0)	1 (1.0)	99 (99.0)	2 (2.0)	98 (98.0)

With regards to the availability of ICT facilities, only computers (61.0%) were found to be available. The other ICT facilities, which include tablets (2.0%), projectors (3.0%), audio tapes (4.0%) and televisions (5.0%) were found not to be available. Also, with regards to the accessibility of ICT facilities, all including tablets (1.0%), projectors (2.0%), audio tapes (3.0%), televisions (4.0%) and computers (33.0%) were found not to be accessible. Similarly, with regards to utilization of ICT facilities, all including tablets (2.0%), projectors (3.0%), audio tapes (4.0%), televisions (5.0%) and computers (26.0%) were found not to be utilized. Performance Levels of Students in Biology Class

Table 5 Performance Levels of Respondents in Biology Class

Performance Level	Frequency	Percent
Low(0-10)	72	72.0
Medium(11-20)	13	13.0
High(21-40)	15	15.0
Total	**100**	**100.0**

Table 6 Performance Scores of Respondents in Biology Class

	Mean	Median	Mode	SD	Variance	Range	Min	Max
Biology Achievement Test Score	8.29	8.00	6	2.982	8.895	24	2	26

Tables 5 and 6 indicate the performance levels and scores of respondents in Biology class. The results show that 15% of the respondents were of high performance, while 13% and 73% were of medium and low performance respectively. Also, the mean performance score was about average (M = 8.29; SD = 2.982); and the minimum and maximum performance scores were 2 and 26 respectively. The findings show that the performance level of students in Biology class is low and requires significant improvement.

DISCUSSION OF FINDINGS

The poll indicated that most Biology class attendees were female and aged 16–20. This shows strong enrolment, especially among girls, in an important scientific field like biology. Most students were also the right age for senior high school. According to the results, secondary schools had most biology teaching resources. Most course materials were available and used, to varying degrees. Ajemba et al. (2021) and Isma'il & Lukman (2022) noted that publicly available educational resources may improve student performance. This is consistent with Olokooba (2015) and Olokooba (2021) findings that secondary school social studies classrooms rarely employed instructional resources. The study's findings contradict Isma'il and Lukman (2022), who found that high school biology teachers rarely used educational resources. Schools must buy the reagent, although it is the least available, accessible, and used educational resource.Due to reagent shortages, schools are struggling financially. According to Onche (2014), Olokooba (2021), and Isma'il and Lukman (2022), limited funding prevents secondary schools from delivering high-quality biology instructional tools. Except for PCs, secondary schools have no ICT resources for biology. Biology class did not use any of the evaluated ICT resources. In terms of improving post-basic education in the country, FRN(2014) notes that the government has failed to provide sufficient infrastructure and build capacity for effective ICT use in secondary schools. Ong'amo et al. (2015) and Mwanda et al. (2017) argue that secondary school biology curricula don't meet the needs of today's pupils, who need to know how to use computers, the internet, and other media to compete for global jobs. Mwanda et al. (2017) also found that most secondary schools in Rachuonyo South Sub-County, Kenya had few computers and that biology teachers rarely used them. Study results support this. The findings also support Isma'il and Lukman (2022), who found no televisions, projectors, or audio cassettes for biology lessons in secondary schools. The study's findings partially support Ong'amo et al. (2015), who found that while secondary school biology classes use ICT, most teachers don't use it.Ige (2013), Gambari et al. (2014), Elom (2014), Osuji (2016), and Takwate (2018) found that many Nigerian secondary schools have enough resources, including ICT, for instruction. According to Onche (2014), Ong'amo et al. (2015), and Tety (2016), these amenities may not be provided due to their high cost and the government's inadequate execution. Nearly 75% of students failed Biology class. Umar et al. (2020), Ezeh et al. (2021), and Matazu (2022) have noted that biology student performance has been poor for some time. Biology students may do poorly because educational materials are scarce, difficult to utilise, or not used well.Because Huetal. (2018) found a link between ICT use and academic success. Also, Ong'amoetal (2015), Mwandaetal (2017), and Isma'il and Lukman (2022) have acknowledged that ICT can greatly affect academic achievement, notably in Biology class.

CONCLUSION

The study examined how instructional materials and ICT predict secondary biology students' academic success. Biology lesson materials were readily available and used. These include genuine objects, pictures/charts, microscopes, hand lenses, plant and animal specimens, bunsen burner/stove, beakers, measuring cylinders, thermometer, conical flasks and test tubes. However, reagents, models/mock-ups, and forceps were unavailable. ICT facilities including tablets, projectors, audio tapes, and TVs were unavailable in Biology class. Computers were widely available but unusable. About three-quarters of the students performed poorly, while the remaining quarter performed moderately or well. Given the

positive influence of ICT use on academic achievement, the high number of Biology students with low performance may be linked to the lack of ICT facilities.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made: The school administrators and teachers should ensure the availability, accessibility and utilization of instructional materials in Biology class.

i. The teachers should endeavour to improvise instructional materials especially model/mock-ups that are not available for learning in Biology class.
ii. The government and school administrators should facilitate the provision, accessibility and utilization of ICT facilities in Biology class.
iii. The teachers and school administrators should enhance the academic performance of students in Biology class by utilizing available ICT facilities for instructional purposes.

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