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INFORMATION AND COMMUNICATION TECHNOLOGY COMPETENCIES POSSESSED BY BIOLOGY TEACHERS' IN PUBLIC SECONDARY SCHOOLS IN ENUGU NORTH LOCAL GOVERNMENT AREA

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ABSTRACT

The study was undertaken to determine ICT competencies of Biology teachers in secondary schools in Enugu North Local Government Area of Enugu state Nigeria. Two research questions guided the study and two null hypotheses were tested. Survey design was adopted and the population consisted of 33 Biology teachers in secondary schools in the area. The entire population was used for the study. The instrument used was questionnaire with a 5 point rating scale containing 24 items in two sections. The instrument was validated by three experts, two in measurement and evaluation and one in Biology. The reliability of the instrument was determined using Cronbach Alpha reliability formula for internal consistency and reliability. Coefficients of 0.76 and 0.85 were obtained for the two sections. Data in respect of a research questions were analysed using mean and standard deviation while the hypotheses were tested using independent t-test (I tail, p-val = 0.05) on SPSS software. The two research questions showed that the ICT competency of teachers were moderate. All the two hypotheses tested showed that there were significant differences between the mean responses of the teachers (mean = 0.05), hence all the null hypotheses were rejected. The study revealed that teachers were not highly competent in ICT to enhance their teachings. Based on the finding of the study, it was recommended that government should organize workshops, seminars and conferences for secondary school teachers to enhance their ICT competencies and also grant study leave with pay to teachers to enable them embark on ICT training programmes.

Keywords: Information and communication technology, competency, biology teachers

Introduction

Education is the bedrock of any society, and a more effective and efficient educational system will give rise to a better society. For teaching to be effective, teachers must employ several approaches. Taking into considerations teaching methodology and instruments that can help to make the teaching and learning process more interesting and robust. Various tools and mechanisms can help to improve the efficiency of any system, Information and Communication Technology (ICT) is one of them. Information and communications technology refer to information-handling tools used to generate, store, process, spread and share information (United Nation Development Programme [UNDP], 2011).

With ICT making the world a global village, it is now more pertinent for us to realize that the products of teachers, school system, curriculum and society must be abreast with global standards if they are to contribute meaningfully to the immediate environment and the global communities at large. As stated by the Federal Republic of Nigerian (FRN, 2013) in the National Policy on Education "Our covenant with every Nigerian Child, therefore, is access to quality education relevant to the need of the Nigerian economy. We will nurture the mind to create a good society that can compete globally. Yes, we can."

From observation, one can see that the world is moving rapidly toward a 'technological culture and indoctrination' and there cannot talk about competing globally without the acculturation of information and communication technology into the educational system, at all levels. That means to start with, these ICT facilities, equipment and tools must be available for use and poorly utilized to achieve maximum results. Just like ICT, the usefulness of science cannot be under-rated. There are many areas of life that science has contributed such as in medicine, geophysics, hydrology, agriculture, communication, technology, education, transportation, healthcare to mention a few. Science has led to breakthrough in medical care. Diagnostic machine for checking different ailments and diseases are now controlled and diseases cured through science. The usefulness of science to humanity cannot be over emphasized.

Biology is the study of living things, including plants and animals. It is classified as one of the sciences. This intriguing field of study covers everything from tiny, cellular molecules to the biosphere, which is the surface of the earth and all of its living things (Enebechi, 2021). All secondary schools in Nigeria are required to teach biology as a core subject because it is a prerequisite for many humanities-related courses, such as the following: Medicine, Pharmacy, Molecular biology, evolutionary biology, genetics, population dynamics, medicine, pharmacy, biochemistry, agriculture, anatomy, physiology, botany, zoology, microbiology, cell biology, ecology, entomology, and immunology, among other subjects. ICT resources are a convenient way to teach biology. It is evident that the majority of secondary schools do not have ICT laboratories, and those that do often have outdated or insufficient equipment. Because biology is so important, it must be taught using ICT tools in order to spark students' interest. According to Umar et al. (2014), there is a problem with abstract teaching in which neither teachers nor students use ICT resources. According to reports, the majority of secondary schools lack ICT labs, and even the schools that have, have turned into classrooms to accommodate the large number of students arising from the Universal Basic Education (UBE) and Universal Primary Education (UPE). As a result of WAEC specification on SSCE examination, some schools resorts to multipurpose laboratory. Certain competencies must be possessed by Biology teachers for effective teaching of business studies in schools. Such competencies include technical and methodology competencies. Technical competencies

enable the teacher to apply technology wisely, logically and effectively while methodology competencies are skills and abilities applied in teaching and learning process. According to Enguage (2012), technical skills include scientific literacy, manipulative skills and technological skills. Technological skills involve the ability to solve problems with ICT tools which according to the author include functional efficiency (which enables users to familiarize with the workings dos and don'ts of the technological tools), visual arts, cultural art and communication art which contribute to effective research and learning in the ICT environment. Technological skills also include maintenance literacy which means the ability to handle the servicing and safe keeping of ICT tools and equipment in such a manner that shall ensure the maximum efficiency and long life. According to UNESCO (2012), learning, in its methods and nature has changed. With ICT in place, each learner can establish contact with learning resources on the internet and the libraries as well as the teacher at his own time, either through the phone or e - mail. Individual learning affords learners to combine work and study. The students now have the role of deciding their speed and pace of work as well as what to learn depending on their dispositions to the subject matter, provided that they remain within tolerance. According to School Net (2007), the method that teachers should adopt is to access and use electronic and communication resources such as the internet and e - mail for the benefit of educators and learners.

Earlier researches on the use of ICT in teaching indicate varied results. For instance, Richard and Augustine (2011) carried out a study on teacher competence in ICT in Zimbabwean secondary schools. Their result showed that teachers were knowledgeable and skilled in computer aided instructions and they had knowledge of the word processing software but they lacked knowledge and skills of presentation software. Tariq, Ayed and Tayseer (2017) had a study on teacher adoption of ICT in Jordanian schools and the study revealed that teachers moderately possess the ICT skills. In education, the teacher is the change agent between the learner and technology and plays a critical role in the process of teaching and learning. Therefore, it is necessary for teachers to stay abreast of changing technology and current opportunities in order to assure their place of leadership in instructional technology. Sadly, a lot of teachers don't seem to have the skills necessary to use ICT for teaching and learning. It is necessary to determine the ICT technical and methodological competencies of biology teachers in order to either help them develop the ones they already have or help them acquire the ones they lack, as many do not seem to have the competencies necessary for the effective application of ICT in the majority of Nigerian educational institutions. The UNESCO ICT Competency Standards for Teachers (ICT-CST) view the professional teacher as a "model learner," according to an addendum. Other factors can also affect teachers use and competence of ICT e.g. gender and academic qualification. Gender disparity has been seen in various fields such as business and politics, Education is not any better (Fomsi & Ordua, 2017). While the most study on ICT on

gender difference has been focused mainly on pupils/student, female students are reported to have less confidence on using computers than males' (Mandari, 2018). The effectiveness of teaching and learning using ICTs may lead to different educational outcomes for men and women based on their gender (Manyilizu & Gilbert 2015). At a different level of a teacher's journey, it is expected that they possess a certain level of competency required to function optimally. The demand for a teacher with a Nigeria Certificate of Education (NCE) should differ from that of a Graduate teacher or even a Doctorate teacher based on specific competence. As such, academic qualifications may also reflect on their use and competence of ICT for classroom teaching. Therefore, the researcher sets to investigate the ICT competencies possessed by Biology teachers in teaching and learning of Biology in Enugu North Local Government Area, Enugu.

Statement of the Problem

The significant impact of ICT in Biology teaching when properly engaged cannot be left to mere propaganda in a world where its absence can mean doom to the society today and generation yet unborn at a global scale, considering the ripple effect that it can have from teachers to learners and the economy at large. The issue of ICT integration in Science instruction most especially pedagogical instruction cannot be over flogged and by now should be a core part of the approach to learning most especially in Biology considering its paramount role for the development of the nation. Whether these ICT facilities/tools are readily available for use especially in the classroom where teaching and learning primarily take place is a thing of concern and in cases where they are available, they may experience little or no use. When ICT facilities are not available for use, the possibility of conducting a poor-quality education is imminent. There are different road blocks inherent in the use of ICT in teaching and learning, as in cases where it is used the teacher may not have the prerequisite knowledge and experience to properly apply ICT in realizing the instructional objective which borders around competence. The competent use of ICT at every level of academic qualification places a new demand on teachers, some graduate teachers may not be able to computerize most of their classroom activities even though they are expected to. Even some teachers with higher degrees may not be able to interact with the international communities in carrying out academic research. This will impact negatively the educational system. This research is therefore aimed at finding out the ICT competencies possessed by Biology teachers for classroom instruction in senior secondary schools in Enugu North Local Government Area, Enugu State.

Purpose of the study

The purpose of the study was to determine the ICT competencies possessed by Biology teachers in public secondary schools in Enugu North Local Government Area of Enugu state. Specifically the study determined:

1. the level of ICT technical competencies possessed by Biology teachers in public

secondary schools in Enugu North LGA

2. the level of ICT methodology competencies possessed by Biology teachers in public secondary schools in Enugu North LGA.

Research Questions

The following research questions guided the study:

1. To what level do Biology teachers in secondary schools possess ICT technical competencies for effective teaching of Biology?
2. To what level do Biology teachers in secondary schools possess ICT methodology competencies?

Hypotheses

The study was guided by the following null-hypotheses:

H_{01} There is no significant difference between the mean responses of male and female Biology teachers regarding the level of ICT technical competencies they possessed for effective teaching of Biology.

H_{02} There is no significant difference between the mean responses of urban and rural Biology teachers regarding the level of ICT methodology competencies possessed for effective teaching of Biology in senior secondary schools in Enugu North

Research Method

The research design employed in this study is descriptive survey. This was chosen because according to Nworgu (2015), descriptive survey is a type of survey in which a large group is studied by collecting and analyzing data from only a few people or items, considered to be a representative of the entire group. The study was carried out in all public secondary schools in Enugu North Local Government of Enugu State. The population of the study comprised all the thirty-three (33) Biology teachers in 9 public secondary schools in Enugu North Local Government Area ((Post Primary School Management Board, 2023, (PPSMB) Zonal Office Statistics and Record Office). The teachers consisted of 18 females and 15 males. The teachers were considered appropriate for use in this study because they are the people that possess the ICT competency and could provide information on the information needed. There was no sampling. No sampling was conducted since the population was manageable for the study. The instrument used in gathering data for this study was a structured questionnaire titled "Information and Communication Technology Competencies Possessed by Biology Teachers" (ICTCPBT). The questionnaire was structured on 5-point rating scale of Very Highly Competent (VHC), Highly Competent (HC), Moderately Competent (MC), Fairly Competent (FC), and Incompetent (IC) with the corresponding values of 5, 4, 3, 2, and 1 respectively. The instrument was validated by three experts from the Faculty of Education of Godfrey Okoye University, Enugu. Two of the experts were from Science Education department and One from Measurement and Evaluation department. Their comments and suggestions were infused into the final draft of the

instrument. The instrument was given to 15 teachers from Enugu East Local government Area. The data obtained was tested for reliability using Cronbach Alpha method. The reliability co-efficient of 0.89 was obtained which indicates that the instrument was reliable and therefore considered appropriate for use. Data collected was analysed using mean and standard deviation to answer the research questions while Independent t-test was used to test the hypotheses at 0.05 level of significance. The decision rule on the mean was based on the upper and lower limit of scale values as follows: 4.50 - 5.00 (Very Highly competent); 3.50 - 4.49 (Highly Competent); 2.50 - 3.49 (Moderately Competent); 1.50 - 2.49 (Fairly competent); 0.50 - 1.49 (Incompetent). In the case of hypotheses testing, the null hypothesis was rejected where p-value was less than 0.05 ($p< 0.05$) otherwise the hypothesis was accepted

Presentation of Results

Research Question 1: To what level do Biology teachers in secondary schools possess ICT technical competencies for effective teaching of Biology??

Table 1: Level of technical competencies possessed by Biology teachers

S/N	ITEM STATEMENT	$\bar{X}$	S.D	Remark
1	Ability to select learning experience and present lessons electronically	2.36	1.41	FC
2	Ability to use a browser	2.71	1.65	MC
3	Ability to type work in fast pace	2.13	1.30	FC
4	Ability to apply set induction in electronic form	2.44	1.58	FC
5	Ability to connect computer terminals	2.04	1.13	FC
6	Ability to cite an electronic references to information used	2.71	1.57	MC
7	Ability to use spell checks	2.56	1.51	MC
8	Ability to generate appropriate graph eg bar, column, line	2.49	1.50	FC
9	Ability to interpret data from an existing spreadsheet	2.12	1.58	FC
10	Ability to enter data	2.31	1.37	FC
11	Ability to apply word processing to produce present and evaluate lesson	2.71	1.51	MC
12	Ability to apply software programmes to produce, present and evaluate lessons	2.65	1.60	MC
13	Ability to use excel in ICT base lessons	2.38	1.43	FC
14	Ability to apply Corel Draw to produce present and evaluate lessons	2.56	1.71	MC

Keys: FC: fairly competent; MC: Moderately competent

According to Table 1, those who answered six questions said they had a moderate level of technical competency for teaching biology in secondary schools in the Enugu North Local Government Area. The remaining items, which were 2, 3, 4, 8, 9, 10, 11, and 13, demonstrated that the biology teachers in Enugu North's secondary schools possessed a reasonable level of technical competency for instructing biology. This suggests that the biology teachers reported having a fair level of technical competency in 82.35% of the items, while they reported having a moderate level of technical competency in the remaining 18% of the items.

Research Question 2: To what level do Biology teachers in secondary schools possess ICT methodology competencies?

Table 2: Level of methodology competencies possessed by Biology teachers

S/N	ITEM STATEMENT	$\bar{X}$	S.D	Remark
15	Ability to source information from the internet for ICT based Lesson	3.20	1.50	MC
16	Ability to formulate lesson objectives using ICT facility	2.66	1.67	MC
17	Ability to apply illustration in lesson plan in electronic form	2.38	1.45	FC
18	Ability to apply set induction in lesson plan electronically	2.27	1.80	FC
19	Ability to use e-mail to communicate with the students	2.73	1.62	MC
20	Ability to identify issues, analyze root causes, and devise appropriate solutions.	2.63	1.61	MC
21	Ability to conduct exams and assessments with ICT facilities	2.14	1.54	FC
22	Ability to use examples in electronic based lesson plan	2.20	1.20	FC
23	Ability to use scanner	2.65	1.67	MC
24	Ability to use opaque projector in the classroom	2.69	1.53	MC

Keys: FC: Fairly competent; MC: Moderately competent

Table 2 showed that the respondents were moderately competent in the use of ICT to enhance teaching methods in 60% of the items tested while they are fairly competent in the remaining 40% of the items.

Hypothesis 1: There is no significant difference between the mean responses of male and female Biology teachers regarding the level of ICT technical competencies they possessed for effective teaching of Biology. The data analysis with respect to hypothesis 1 is presented in Table 3.

Table 3: Mean Responses of Male and Female on ICT Technical Competencies possessed by Biology teachers

Item	Gender	N	Mean	Std. Deviation	Std. Error mean
ICT Methodology competency	Male	15	48.40	25.05	2.12
	Female	18	43.24	23.49	1.73

		Levene's t-test for Equality of Equality of Variances							
		F	Sig	t	df	Sig. (1-tallied)	Mean Dif.	Std. Error. Dif	Alpha-level
Technical competencies skills	Equal variances assumed	.10	.73	1.90	322	.03	5.15244	2.71	.05
	Equal variances not assumed			1.80	286	.03	5.15244	2.74	.05

The null hypothesis was tested with independent (1-tailed) t-test. The p-value of .03, implies that the difference in mean values is statistically significant at the .05 alpha level. The null hypothesis which states that there is no significant difference between the mean responses of male and female Biology teachers regarding the level of ICT

technical competency possessed by the teachers for effective teaching of Biology is rejected.

Hypothesis Two: There is no significant difference between the mean responses of rural and urban Biology teachers regarding the level of ICT methodology competencies possessed for effective teaching of Biology in senior secondary schools in Enugu North

The result of the test of hypothesis 2 was presented in Table 4.

Table 4: Mean Responses of Rural and Urban Teachers on Level of ICT Methodology Competency possessed by Biology teachers

Item	Location	N	Mean	Std. Deviation	Std. Error mean
ICT Methodology competency	Rural	19	28.28	13.55	1.13
	Urban	14	23.68	13.90	1.04

		Levene's t-test for Equality of Equality of Variances							
		F	Sig	t	df	Sig. (1-tallied)	Mean Dif.	Std. Error. Dif	Alpha-level
Technical competencies skills	Equal variances assumed	.03	.87	2.99	321	.02	4.60	1.54	.05
	Equal variances not assumed			2.99	307 .97	.02	4.60	1.54	.05

The independent 1-tailed t-test was used to test the null hypothesis. At the.05 alpha level, the p-value of.02 indicates that there is a statistically significant difference between the mean values of the two groups. The null hypothesis is rejected, indicating a significant difference in the mean response between biology teachers in rural and urban areas with respect to their level of ICT methodology competency skills for effective biology instruction

Discussion of Findings

The analysis's findings demonstrated that biology teachers in secondary schools in Enugu North had a reasonable level of ICT technical and methodology competencies for biology instruction. The results also show that, when it comes to the level of ICT technical competencies that male and female biology teachers possess in order to effectively teach biology, there is a statistically significant difference in their mean responses. It was found that male teachers are more competent than female teachers. There is also statistically significant difference between the mean responses of Biology teachers in urban and rural schools regarding the methodology competencies possessed by them for effective teaching of Biology. It was further found out that Biology teachers in urban school are more ICT competent than their counterparts in rural schools. The findings were in agreement with the findings of Richard and Augustine (2011) which showed that teachers in rural secondary schools lacked the necessary skills and knowledge of computers and related

technology. They were equally in agreement with the findings of Tariq, Ayed and Tayseer (2017); Egboka (2012) and Abdul-Salaam (2012) which indicated that vocational teachers in urban schools moderately possessed the listed ICT skills necessary for their teaching.

Conclusion

From the findings of the research, the researcher concluded that Biology teachers in Enugu North do not possess enough ICT competencies for effective teaching. Therefore, if nothing is done to enhance their ICT competencies, they will produce half-baked students that cannot compete globally. This will affect the development of the state because children are the future hope and leaders of tomorrow.

Recommendations

The under listed recommendations were made with regards to the finding of the study.

1. Government should organise workshops, seminars and conferences for secondary school biology teachers to enhance their ICT competencies.
2. Government should also grant study leave with pay to Biology teachers to enable them embark on ICT refresher programmes.
3. The secondary school management should ensure that the secondary schools in the state have effective computer laboratories. The management would further ensure that the laboratories are supplied with steady electricity for effective use of the laboratories whether in rural or urban location.
4. The post-secondary school management board should use the extent of ICT competency level of teaching as a means for their promotion. This step would spur the teachers for greater achievement in ICT competency acquisition.

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