

Evaluation of ICT Competence among Secondary School Biology Teachers: Implication for the 21ST Century Teacher Educators

Mary Imo Inyang*, and Henrietta Osayi Uchegbue²

¹Institute of Education, University of Calabar, Calabar, Cross River State, Nigeria.

²Department of Educational Foundations, University of Calabar, Calabar, Cross River State, Nigeria.

*Corresponding author email: inyangmary62@gmail.com

ABSTRACT

The study assessed the ICT competencies of biology teachers in Calabar Metropolis. The total population of 107 senior secondary school biology teachers in the 22 public schools formed the sample for the study. It was a census study. A 34 item questionnaire titled "Biology Teachers Information and Communication Technology Competency Status" (BTICTCS) was developed, and used to collect data from the respondents. The questionnaire had 5 sections. The instrument was face and content validated by 2 lecturers in Tests and Measurement Department, University of Calabar. The questionnaire was administered to 59 biology teachers seen on ground; 57 were returned and 53 (M=9; F=44) found useable. Four research questions guided the study. The results showed that (1) 75.5% of biology teachers possessed high basic ICT competency skills (2) Only 13 (24.5%) possess the higher skills (3) only 13 (24%) show a high level of internet competency. (4) Less female biology teachers possess higher ICT or internet competencies. (5) There is very low (9 =16.98%) utilisation of computers in lesson delivery. Based on the results it was recommended that (1) biology teachers be re trained and encouraged to promote computer/ICT based lessons. (2) Schools also are encouraged to obtain some of these software which can be purchased off the shelf. (3) Teachers should also be encouraged to sharpen their internet skills by surfing the internet.

Keywords: Biology teachers, ICT, ICT Competence, internet skills

Article information

Received 17 June 2024

Accepted 13 August 2024

Published 30 August 2024

DOI: <https://doi.org/10.26765/DRJEVS789051349>

Citation: Inyang, M. I., and Uchegbue, H. O. (2024). Evaluation of ICT Competence among Secondary School Biology Teachers: Implication for the 21ST Century Teacher Educators. *Direct Research Journal of Education and Vocational Studies*. Vol. 6(2), Pp. 88-92. This article is published under the terms of the Creative Commons Attribution License 4.0.

INTRODUCTION

The great strides witnessed within the past 20 years in the area of information and communications technology (ICT) has influenced the delivery of education in many nations. Over the years, various technologies have been introduced to assist teachers effectively pass on required knowledge to students. Some of them include the radio, television, photographic slides, audio tapes, overhead transparencies, motion pictures, computer etc. These instructional technologies and other ICT facilities now available, very often demand some form of technological expertise or knowledge to efficiently operate or

manipulate them so that the goals of utilization for knowledge dissemination is fulfilled. Information and Communication Technology (ICT) tools are information handling tools used to process, store, produce, exchange and distribute information and its utilization demands some level of competence by its users (Okoye & Ofili, 2015). Since the year 2000 the use of ICTs for educational purposes has greatly increased both among teachers and learners. Particularly with teachers, it is a tool for collaboration, not only with students or fellow teachers, but also with experts in various fields.

Current teaching methods in our science classrooms fall short particularly in view of the fact that science teaching should equip the students with critical thinking, problem solving and team work skills. ICT competencies among teachers will facilitate collaboration, interaction and communication. Most importantly ICT competencies by science teachers will generally aid self and ubiquitous learning. The world of science is constantly evolving with new breakthroughs and skills. Therefore, appropriate ICT competency skills will enhance the teacher's ability to keep abreast current events and information which can be shared to educate, challenge and inspire learners in the classroom.

In Nigeria today and in Cross River State in particular, the primary method of teaching is still the conventional lecture method where the teacher remains the sole dispenser of knowledge and the student the passive listener with little or no activity to spur them (Okoye, 2012). Even though many countries have shifted focus from this mode of instruction, Nigeria is yet to grasp this change. This dominant method is teacher centred and gives limited room for teacher – student interaction and team work. According to Ibe (2015), the lecture method is preferred because “educational systems are hard to change and the lecture model of lesson presentation demands less discipline and pedagogical expertise from the teachers.” Nigeria not only desires good pass levels from her science students, but also desires that more students study the sciences. This can be achieved through teachers that not only have the needed content knowledge and pedagogical skills, but also the technological expertise to effectively use available ICTs tools and software for enhanced lesson interaction and delivery and in so doing attract more students into studying science subjects. Biology is an interesting subject providing students with an avenue to know more about their body and body functions. It also explains the various physical and physiological changes observed in the living things. Also, biology as a subject is very important because it offers opportunities to students in careers such as botany, agriculture, medicine, pharmacy, etc. this importance underscores the need for strategies that enhance interests and active participation in the subject. ICT therefore in biology teaching will help in transforming teacher centred and text bound classroom into a rich student focused interactive environment (Inyang & Umoinyang, 2019). In addition, Yusuf (2016) asserted that students broaden their knowledge and that investigation and inquiry skills are deepened when teachers use ICT in lesson delivery. Despite the numerous benefits of ICT in helping communication, collaboration, resource location, developing interesting lessons, enhancing team work and effective lesson delivery, research consistently shows that many teachers only possess basic ICT literacy particularly in the developing countries. This is probably why some teachers

find it difficult to use some educational programmes like computer aided instruction (CAI), science modules and ICT related resources (Gusen, 2014; Okoroafor, Okoroafor and Ike, 2012). Ezenduka and Achufusi (2013) in their study of biology teachers in parts of Enugu state concluded that irrespective of location, biology teachers had a low level of ICT literacy and poor utilisation skills. Also, Ememe and Modebelu (2019) reported that students studied lacked the internet and digital skills to maximally access internet based resources and utilize them for their full benefits. The reports are different with chemistry teachers who exhibited high internet literacy but low internet access and fewer still had knowledge of internet educational tools (Inyang, Udoh & Ajah; 2024). Abubakar, Abubakar and Cholom (2017) in their study, found that teachers' computer literacy was moderate as only 19.9% was high while 59.3% was medium. However, Alufohai (2020) investigated the computer literacy competency of English language teachers in Benin metropolis and the results showed that computer literacy and computer usage level of English language teachers were low and that there was no difference in the level of Computer literacy between the male and female English language teachers in the metropolis. Akubuiro, Inyang and Ekpa (2014) and Ogunbodele, Wiche and Uchendu (2022) observed that there was a significant difference in higher ICT competencies between the male and female in favour of the male teachers and that the male teachers make greater use of the internet and ICT facilities more than their female counterparts. The impact of technology in the field of education, teaching and learning demands that teachers not only possess content knowledge and pedagogical skills but also technological skills to complement and aid efficient use of technology for effective lesson delivery. This is what the technological pedagogical content knowledge theory expounded by Koehler and Mishra (2006) tries to assert. The theory holds that the use of a technology to deliver a lesson must be backed up by adequate knowledge and ability to use that technology in such a way that the lessons intended to be passed to the learners are not lost or hampered in the use of technology. To this end, this study sought to find out the ICT competencies among biology teachers in Calabar Metropolis of Cross River state, Nigeria. The following research questions guided the study.

1. What is the level of Basic Computer competencies among biology teachers in Calabar Metropolis?
2. What is the level of higher Computer competencies among biology teachers in Calabar Metropolis?
3. What is the level of internet competencies among biology teachers in Calabar Metropolis?
4. To what extent do biology teachers in Calabar Metropolis utilize computers in lesson delivery?

METHODOLOGY

The study assessed the ICT competencies of biology teachers in Calabar metropolis. The total population of 107 senior secondary school biology teachers in the 22 public schools formed the sample for the study. The metropolis comprised Calabar Municipality and Calabar South Local Government Area. It was a census study. A 34 item questionnaire titled "Biology Teachers Information and Communication Technology Competency Status" (BTICTCS) was developed, and used to collect data from the respondents. The questionnaire had 5 sections. Section A collected bio-data of respondent, section B with 11 items, gathered data assessing respondents basic computer competencies, like powering on a computer system, opening any package from the start button, moving, minimizing and restoring the window, using simple word processing package, using editing features e.g. bold, copy and paste, and saving files etc. Section C had 9 items and assessed biology teacher's higher computer competency level e.g. ability to write files on compact disk (CD), scan disks for viruses, create simple presentation using power point, use keyboard shortcuts, search for files, rename files and ability to print a document using a printer. Section D measured their internet competencies with 9 items. The items assessed their ability to send and receive e-mails, download files, video, etc. from the internet, upload files/pictures, send attachment with their files, receive attachment through e-mails, and use video conferencing tools. Section E elicited response concerning utilization of computer in teaching. It utilized a 'yes' or 'no' response type and only one data item measured this. The instrument was face and content validated by 2 lecturers in tests and measurement department, university of Calabar. The questionnaire was administered to 59 biology teachers seen on ground; 57 were returned and 53 (M=9; F=44) found useable.

Respondent's basic, higher and internet competencies were categorized into 3 levels namely high, moderate and low. This was done using the formula mean plus or minus standard deviation ($X \pm 1SD$). Those who scored above the mean plus standard deviation were categorized as high. Those who scored below the mean minus standard deviation were classified as being low while those who scored around the mean were classified as being moderate. The results are here presented and discussed.

RESULTS

Research question 1: What is the level of basic ICT competency among biology teachers in Calabar Metropolis and Cross River State?

Result from (Table 1) shows a very high level of basic

ICT competency among biology teachers in Calabar Metropolis. Result shows that only 3(5.7%) exhibit low basic ICT competency skills while at least 75% demonstrate high ICT competency with regards to basic skills in computer operation.

Research question 2: What is the level of higher ICT competency among biology teachers in Calabar Metropolis of Cross River State?

Results from the findings show that lower number of teachers exhibit higher ICT competency skills (Table 2). In fact, only 11 (20.8%) agree to having ability to demonstrate higher competency skills, 20 (37.7%) show moderate ability while 22 (41.5%) demonstrate very low higher ICT competency skills.

Research question 3: what is the level of internet competency among biology teachers in Calabar Metropolis of Cross River State?

The result from (Table 3) reveals that only 13 (24.5%) of the biology teachers have high internet competency. A higher number of teachers 21 (39.6%) show moderate competency while 19 (35.8%) show low level of internet competency.

Research question 4: To what extent do biology teachers utilize computers in lesson delivery?

DISCUSSION

Results from the study revealed that a high percentage (75.5%) of biology teachers possessed high basic ICT competency skills meaning that they can perform basic ICT operations. While many teachers possess basic skills, they are significantly lacking in higher ICT and internet skills. Only 13 (24.5%) possess the higher skills which include the skills needed to create simple power point. Higher ICT competencies are required to efficiently design interesting slides, adopt or modify downloaded materials, use science modules tools and manipulate any scientific tools especially in research laboratories. This agrees with Ezenduka and Achufusi (2013) who found the biology teachers had a low level of ICT literacy and poor utilization skills. Also less female biology teachers possess higher ICT or internet competencies. Akubuiro, Inyang and Ekpa (2014) also obtained a similar result when they reported significant differences in male and female ICT capabilities and usage with respect to internet skills and access. It also agrees with the study of Ogunbodele, Wiche & Uchendu, (2022)

Generally, the result showed that the higher the competency or skills required, the less number of biology teachers that possess them, e.g. only 13 (24%) show a high level of internet competency. The absence of higher competency skills may probably account for the very low

Table 1: Basic ICT competency levels of biology teachers in Calabar metropolis of Cross River State.

		BASIC ICT COMPETENCY			
		HIGH LEVEL	MODERATE LEVEL	LOW LEVEL	TOTAL
Gender	Male	9 (17.0%)	0 (0.0%)	0 (0.0%)	9 (17.0%)
	Female	31 (58.5%)	10 (18.9%)	3 (5.7%)	44 (83.0%)
% of Total		40 (75.5%)	10 (18.9%)	3 (5.7%)	53 (100.0%)

N=53

Table 2: Higher ICT competency levels of biology teachers in Calabar metropolis of Cross River State.

		BASIC ICT COMPETENCY			
		HIGH LEVEL	MODERATE LEVEL	LOW LEVEL	TOTAL
Gender	Male	5 (9.4%)	0 (0.0%)	4 (7.5%)	9 (17.0%)
	Female	6 (11.3%)	20 (37.7%)	18 (34.0%)	44 (83.0%)
% of Total		11 (20.8%)	20 (37.7%)	22 (41.5%)	53 (100.0%)

N=53

Table 3: Internet competency levels of biology teachers in Calabar metropolis of Cross River State

		INTERNET COMPETENCY LEVEL			
		HIGH LEVEL	MODERATE LEVEL	LOW LEVEL	TOTAL
Gender	Male	5 (9.4%)	0 (0.0%)	4 (7.5%)	9 (17.0%)
	Female	6 (11.3%)	20 (37.7%)	18 (34.0%)	44 (83.0%)
% of Total		11 (20.8%)	20 (37.7%)	22 (41.5%)	53 (100.0%)

N=53

Table 4: Use of computers in classroom lessons delivery among biology teachers in Calabar metropolis of Cross River State.

		Do you use computer in teaching?		
		Yes	No	TOTAL
Gender	Male	5 (9.43%)	4 (7.55%)	9 (16.98%)
	Female	4 (7.55%)	40 (75.47%)	44 (83.02%)
% of Total		9 (16.98%)	44 (83.02%)	53 (100.0%)

N=53

utilization of computers in the lesson delivery as observed in (Table 4). This was also the case in Ememe and Modebelu (2019) reported the lack of internet and digital skills to maximally access internet based resources and utilize them for their full benefits. This simply means a non-effective utilization of the technology despite the efforts made to put them in place. Although the use of ICT is teaching, despite various efforts, is still a struggle in our nation and Cross River State in particular, it offers the potential of meeting the learning and self-developmental needs of both teachers and students. In other words, apart from providing learning materials, it also promotes collaboration and interdependence among learners (Yusuf (2016). ICT skills empower the science teacher to fulfil his or her role as a knowledge facilitator and not just as a knowledge dispenser which the lecture model imposes on the teacher. There are various science software's which can be used to stimulate and arouse interests of students when treating certain topics. The absence of the needed skills will hamper any biology teacher from utilizing this software whenever needed. It is therefore pertinent that science teacher educators

expose teacher trainees to computer application packages that will sharpen their computer skills and equip them for higher more technical skills. It is therefore vital that science teachers not only be computer literate but also possess secondary skills that will aid computer application in science education. Also, it is necessary that biology teachers accept the new technologies, learn more about them and treat them with a positive attitude.

Conclusion and Recommendations

This study investigated the ICT competencies of biology teachers in Calabar Metropolis and the general observation was that although at least 75% of the teachers possessed the basic ICT skills needed for efficient ICT integration into classroom teaching, the study also revealed significant differences between male and female ICT competencies in favour of the very few male biology teachers. It must be noted that biology is a fundamental course which leads to further studies in other science related courses and which could also enhance self-sustaining profession like horticulture.

In this age of global competitiveness when nations are striving to produce science students with both content knowledge and skills to efficiently function and effectively compete in the global market, it is necessary that the science teachers (trainees and educators) themselves are equipped with the very skills they are trying to impart to the students. Apart from this, science teachers (educators and trainees) lacking in higher computer and internet skills will be completely unable to collaborate with experts outside their current domain and will also be unable to tap from the varied and elaborate free educational resources that litter the internet. Biology teachers must be responsive to the fact that their challenge today's is not just to help the learners excel in external examinations, but to truly prepare them for a future by equipping them with the related competencies and skills. Cognitive sufficiency alone is not enough for the learners who must truly succeed in this 21st century technology driven world. It is therefore necessary that biology teachers change from their traditional teaching model to a more inspiring model by inculcating technology into their lesson preparation and presentation via the use of special science packages and modules. It is a truism that no one can successfully live in this modern age without science and technology, therefore biology teachers must acquire advanced skills to operate the technology. For these reasons, it is strongly recommended that biology teachers be re trained and encouraged to promote computer/ICT based lessons. Schools also should be encouraged to obtain some of these software which can be purchased off the shelf. Teachers should also be encouraged to sharpen their internet skills by surfing the internet to discover new sites, opportunities and partners for collaboration. All hands must be on deck to ensure that students' interest in biology is increased and sustained for a better tomorrow.

REFERENCES

- Abubakar, D., Abubakar, D. & Cholom, K. M. (2017). Relationship of user education, computer literacy and information and communication technology accessibility and use of e-resources by postgraduate students in Nigerian university libraries. *Library Philosophy and Practice*, 1555. <http://digitalcommons.unl.edu/libphilprac/1555>.
- Akuburo, I. M., Inyang, M. I. & Ekpa, U. O. (2014). Assessment of use of internet services in senior secondary schools in Cross River State, Nigeria. *International Journal of Research in Basic and Lifelong Education*, 4 (1 & 2), 18-26.
- Alufohai, P. (2020). Assessment of computer literacy among public secondary school English language teachers in Benin metropolis, Nigeria. *European Journal of Education Studies*, 7(9),141-151.
- Ememe, P. I. & Modebelu, O J. (2019). Challenges of accessibility and utilization of open education resources (OERS) in single and dual mode open education (ODE) institutions in Lagos. *International Journal of Educational Research*, 6 (1), 114-126.
- Ezenduka, C. U & Achufusi, J.N. (2013). Level of secondary school biology teachers ICT literacy and utilization in Anambra state: implication for the MDGs attainment. Proceedings of the 54th Annual Conference of the Science Teachers Association (STAN). Pg 323-331
- Gusen, J. N. (2014). Availability, accessibility and utilisation of e-learning resources for teaching and learning in faculties of education in Nigerian Federal Universities. Unpublished PhD Thesis. ATBU: Bauchi.
- Ibe, H. N. (2015). Integrating 21st century knowledge and skills in science education curriculum through 21st century pedagogies in faculties of education. *Journal of Educational Media and Technology*. 19(1), 103-111.
- Inyang M.I., Udoh, N.M, & Ajah, M.O. (2024) Educational Tools in the Clouds : Assessing Chemistry Teachers Level of Awareness. *Prestige Journal of Education* 7(1): 70-80.
- Inyang, M.I. & Umoinyang, I.E. (2019). Teacher quality and the implementation of STEM Curricular for modern society. *Interdisciplinary Journal of Science Education*, 1(1), 133-145. ISSN: 2695-2054 (PRINT); e-ISSN: 2659-1901 (Online)
- Mishra, P. & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teachers' knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Ogunbodele, K. F., Wiche, H. I. & Uchendu, B. O. (2022). Gender differences and use of digital resources in university libraries in Nigeria. *African Journals Online*. <https://www.ajol.info/index.php/ajlajs/article/view/236015>.
- Okoroafor, A. O., Okoroafor, P. N. & Ike, C. U. (2012). Enhancing human capacity building in open distance education through information technology in Nigeria. *Journal of Educational Technology and Media*. (16(2). 16-22.
- Okoye, A. C. (2012). Effects of computer assisted instruction on students' acquisition of science process skills and interest in biology. Unpublished PhD thesis. Nsukka: University of Nigeria.
- Okoye, A. C. & Ofili, G. O. (2015) Effects of computer assisted instruction on students' interest and achievement in Diffusion/Osmosis in Nsukka Local Government Area. *Journal of Educational Media and Technology*. 18(2), 14-21
- Yusuf, H. O. (2016). Effectiveness of using ICT in teaching reading comprehension in secondary schools in Kaduna. *Literacy Journal*, 38-45.