Information and Communication Technology Competences Possessed by Biology Teachers in Secondary Schools in Anambra State

Ugbaja, J. N.
Biology Education Department, School of Sciences, Federal College of Education (Technical), Umunze, Anambra State, Nigeria
&
Okeke, S. O. C.
Department of Science Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria
soc.okeke@unizik.edu.ng

Abstract

The new requirement for working and living in the 21st century is the ability of individuals to be technologically compliant. There is always need for teachers to possess the right competences to operate Information and Communication Technology (ICT) facilities available in the schools. This necessitated the study on the ICT competences possessed by secondary school biology teachers in Anambra State. Two research questions and two hypotheses guided the study. The study adopted descriptive survey research design. The population of the study comprised 288 biology teachers in all government owned secondary schools in the state. The sample for the study comprised 99 biology teachers drawn from six education zones in the state using a purposive sampling technique. The instruments for data collection were biology teachers' ICT competence questionnaire (BTICTCQ) and biology teachers' ICT competence practical test (BTICTCPT). Three experts validated the instruments. They were trial tested to ascertain its reliability using Cronbach Alpha, BTICTCQ gave a reliability coefficient value of 0.83 while BTICTCPT gave a reliability coefficient value of 0.88. The instruments were administered through direct delivery approach by the researchers and six research assistants. The data collected were analysed using mean and standard deviation to answer the research questions and t-test to test the null hypotheses at 0.05 alpha levels. The study revealed among others that there is a significant difference between the assumed and actual mean ICT competences of biology teachers in demonstrating basic ICT tasks and age is a significant factor on actual mean ICT competence of secondary school biology teachers. The study concluded that secondary school biology teachers in Anambra do not possess the required ICT competence to use ICT facilities to teach biology concepts. The study recommended among others that practicing biology teachers should enrol in in-service training programme on ICT to update their competences in its use in teaching and the education/teacher training institutions should make sure that pre-service biology teachers possess the required competency before graduation.

Keywords: ICT competence, Biology teachers, Secondary school, Anambra state

Introduction

Biology is a science subject offered in Senior Secondary School in Nigeria which attracts the greatest patronage of both science and art-oriented students (Nwosu, 2012). It addresses the needs of students through its relevance and functionality in content, practice and

application (Chioma, 2005). Thus, biology teaching needs teachers that are well grounded not only in subject matter but also in the skills and competences needed to impart such knowledge to bring about meaningful learning in the students. One of the competences needed by biology teachers is Information and Communication Technology (ICT) competence.

Margaret (2005) defined ICT as an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software and satellite systems, the various services and applications associated with them such as videoconferencing and distance learning. In the context of this study, ICT are those devices that help the teacher to facilitate and enhance learning. However, the study focuses on competences possessed by biology teachers is the use of computer system to teach biology concepts.

Ojiegbe (2010) defined competence as the acquisition of knowledge, skills and abilities at a level of expertise sufficient to be able to perform a given task in a work place appropriately. Competence is a specific practical ability possessed by someone to do a given task. ICT competency, according to Dike (2014), is the ability to effectively demonstrate practical use of ICT facilities to teach desired contents. ICT competences are set of technology standards that define proficiency in using computer technology in the classroom (www.google.com , 2017).

United Nations Educational, Scientific and Cultural Organization (UNESCO, 2011) outlined ICT competence for teachers to includes the use of ICT to form teaching pedagogy, incorporation of ICT activities and skills into lesson plans to support students acquisition of school subject matter. Use of presentation software and digital resources to support instruction, ability to demonstrate and describe the use of common hardware technologies and basic tasks in use of ICT and the use of input devices for word processors such as text entering, editing, formatting and printing. Ability to describe the purpose and function of graphic software, to describe the internet and World Wide Web, elaborate on their uses and how a browser works.

Ability to create an e-mail account and use it for a sustained series of e-mail correspondence, to integrate the use of computer laboratory into ongoing teaching activity, and to use of ICT resources to support students' acquisition of subject matter and pedagogical knowledge. The competence covered in this study is the ability to demonstrate basic tasks in the use of ICT. Mastery of these abilities means mastery on how to use ICT to perform basic task in teaching biology contents. It is quite pertinent to note that the competence discussed cover practical and functional skills the teacher needs to demonstrate if he/she had the ability to effectively teach biology using ICT facilities.

ICT competences of teachers could be determined by a number of factors such as teacher's qualification, year of experience, age, gender and location among others. This study considered age to be of great interest. Age is the number of years someone has lived or something has existed. Dike (2014) reported that older teachers find it difficult to adapt to the present form of teaching with ICT while young teachers feel more comfortable working with computers. Jegede (2009) reported that age is not a factor when considering the competence. There is therefore need to ascertain whether age bracket of biology teachers impede their ICT competences. It should be noted that education industry has become ICT driven in recent time. The evolving global digital society is an indication that the next generation of students will not likely make use of paper and pencil. More also, students' nowadays are more curious about what happens around them using ICT. They are no longer interested in teacher's old methods of instruction. The new requirement for working and living in the 21st century is the ability of individuals to become technologically compliant. Educators have recognized that there is need to equip learners with the necessary skills and experiences that will enable them to become contributing members of the global community.

Therefore, uncertainty exists about whether biology teachers possess the right competences to operate ICT facilities effectively. Where they lack the needed ICT competences, it means that their students' would probably be cut off from the rest of the world in terms of globalization. A times teachers assumed that they possess the ability to use ICT but in actual sense that might not be true. This is why Anih (2013) observed that ICT skills computer science teachers claim they possessed were far below what they actually possessed. On the basis of this, the study compared the ratings of secondary school biology teachers on their possessed ICT competences with their actual ICT competences through a practical test to determine their ICT competences.

Purpose of the Study

The purpose of this study was to determine the ICT competences possessed by secondary school biology teachers in Anambra State. Specifically, the study determined the:

1. ICT competences of secondary school biology teachers in Anambra State in demonstrating basic ICT tasks.
2. ICT competences of secondary school biology teachers in Anambra State in demonstrating basic ICT tasks based on their age.

Research Questions

1. What are the assumed and actual mean ICT competences of secondary school biology teachers in Anambra State in demonstrating basic ICT tasks?
2. What is the influence of age on the actual mean ICT competence of secondary school biology teachers in Anambra State in demonstrating basic ICT tasks?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean scores on the assumed and actual ICT competences of secondary school biology teachers in demonstrating basic ICT tasks.
2. There is no significant difference between the actual mean ICT competences of young and old secondary school biology teachers in demonstrating basic ICT tasks.

Method

The study employed a descriptive survey research design. The area of the study is Anambra state. The population comprised 288 biology teachers (39 males and 249 females from all public secondary schools in the six Education Zones of the State. The choice of public secondary schools is because the state government has supplied each one of them with ICT facilities/ computers. A sample size of 99 (15 males and 84 females) biology teachers was drawn from 10 schools in each education zone using purposive sampling technique based on schools that have functional computer laboratories, biology teachers, and ICT personnel.

The instruments used for data collected were Biology Teachers ICT Competency Questionnaire (BTICTCQ) and Biology Teachers' ICT Competency Practical Test (BTICTCPT) developed by the researchers. BTICTCQ comprised two sections A and B. Section A contained the biodata of the respondent, while section B contained five items that assumed Biology Teachers ICT Competences. The items were adapted from the objectives identified by United Nations Educational Scientific and Cultural Organization Information and Communication Technology Competency Framework for Teachers (UNESCO ICT CFT, 2011). The respondents have allowed to rate their specific ICT competences which enable them to teach biology effectively. The second instrument (BTICTCPT) was developed from the first instrument and is also a 5-item practical test on ICT competences the biology teachers

actually possessed. The BTICTCPT lasted for 40 minutes for each teacher. The researchers score the actual ICT competences possessed by the biology teachers based on a four-point rating scale of Very High Competence (VHC), High Competence (HC), Moderate Competence (MC) and Low Competence (LC).

The instruments were validated by three experts from Faculty of Education, Nnamdi Azikiwe University, Awka. To establish the reliability of the instruments, trial testing was carried out on 10 secondary school biology teachers from Imo State who were not part of the population of the study and their internal consistency were established using Cronbach Alpha which yielded reliability coefficient value of 0.83 and 0.88 respectively. Data were collected by the researchers with the help of six research assistants who are computer compliant and trained for two days.

Ninety-nine (99) copies each of BTICTCQ and BTICTCPT were produced and administered to the teachers. Each biology teacher was given the BTICTCQ to fill first (responses on BTICTCQ is called assumed competence), the reason is to entice the teacher to take the BTICTCPT. After, the BTICTCQ was collected; the teacher was given laptop to carry out the practical exercises (i.e. BTICTCPT with response called actual competence). This is to enable the researchers' match their assumed competences of BTICTCQ with their actual competences got from the BTICTCPT. The exercise was not carried out collectively for the whole teachers at a spot in one day, but it was done individually, school by school. After administering, 88 instruments were recovered and used for analysis.

Data collected were analysed using mean and standard deviation to answer the research questions while t-test was used to test the null hypotheses at 0.05 alpha level. Decision on the research questions were based on the average on a 4-point scale. For hypothesis testing, accept H_o if p-value > 0.05, otherwise reject H_0 if p-value < 0.05.

Results

Table 1: Mean and standard deviation of respondents on the assumed and actual ICT competences of Biology teachers in demonstrating basic ICT tasks

S/N	Ability to demonstrate basic ICT tasks Ability to	Assumed (n=88) Mean	SD	Decision	Actual (n=88) Mean	SD	Decision
1	Set up and boot a computer system without making a mistake.	3.66	0.64	Very High Competence	2.43	0.76	Moderate Competence
2	Locate and activate the Microsoft word icon on the desktop and key in data into system.	3.46	0.66	High Competence	2.18	0.88	Moderate Competence
3	Format page into paragraphs, do alignment, bold, italicize, underline and save document	2.86	0.85	High Competence	1.61	0.69	Moderate Competence
4	Select the command a printer from the options, number of pages and print.	2.74	0.86	High Competence	1.33	0.56	Low Competence
5	Shut down a computer system by selecting the appropriate commands from the desktop	3.72	0.61	Very High Competence	2.25	0.76	Moderate Competence
	Average Mean	**3.29**	**0.57**	**High Competence**	**1.96**	**0.64**	**Moderate Competence**

Table 1 shows the assumed ICT competence of biology teachers has an average mean score of 3.29 which is high competence while their actual ICT competence has an average mean score of 1.96 which is moderate competence. This indicates that there is difference between the assumed and actual ICT competences of biology teachers in demonstrating basic ICT tasks.

Table 2: Mean and standard deviation of the respondents on the influence of age on actual ICT competences of Biology teachers in demonstrating basic ICT tasks.

		Young (n=38)			Old (n=50)		
S/N	**Ability to demonstrate basic ICT tasks**	**Mean**	**SD**	**Decision**	**Mean**	**SD**	**Decision**
	Ability to						
1	Set up and boot a computer system without making a mistake.	2.63	0.79	High Competence	2.28	0.70	Moderate Competence
2	Locate and activate the Microsoft word icon on the desktop and key in data into system.	2.50	0.86	High Competence	1.94	0.82	Moderate Competence
3	Format page into paragraphs, do alignment, bold, italicize, underline and save document	1.84	0.72	Moderate Competence	1.44	0.61	Low Competence
4	Select the command a printer from the options, number of pages and print.	1.50	0.65	High Competence	1.20	0.45	Low Competence
5	Shut down a computer system by selecting the appropriate commands from the desktop.	2.53	0.80	High Competence	2.04	0.67	Moderate Competence
	Average Mean	**2.20**	**0.66**	**Moderate Competence**	**1.78**	**0.55**	**Moderate Competence**

Table 2 shows that the average mean ICT competence score of young biology teachers in demonstrating basic ICT tasks was 2.20 while that of old teachers was 1.78 with a mean difference of 0.42 in favour of young teachers. This indicates that age influences ICT competence of biology teachers in demonstrating basic ICT tasks.

Table 3: t- Test analysis of the assumed and actual ICT competences of biology teachers in demonstrating basic ICT tasks.

Sources of Variation	**N**	**Mean**	**SD**	**Df**	**t-cal.**	**p-value**	**Remark**
Assumed	88	3.29	0.56	174	14.58	0.000	S
Actual	88	1.96	0.64				

S-Significant, NS- Not Significant

Table 3 shows that there is a significant difference between the assumed and actual mean ICT competences of secondary school biology teachers in demonstrating basic ICT tasks.

This is indicated by the calculated t-value (14.58) and the corresponding *P*-value (0.000) which is less than the stipulated 0.05 level of significance. The null hypothesis was therefore rejected

Table 4: t- Test analysis of young and old biology teachers' actual mean competence in demonstrating basic ICT tasks

Sources of Variation	N	Mean	SD	Df	t-cal.	p-value	Decision
Young	38	2.20	0.66	86	3.24	0.002	S
Old	50	1.78	0.55				

S-Significant

Table 4 shows that the calculated t-value is 3.24 with p-value of 0.002 which is less than the p-value of 0.05. This means that there is significant difference between the actual mean ICT competence of young and old secondary school biology teachers in demonstrating basic ICT tasks. Therefore, the null hypothesis of no significant difference between the two groups is rejected.

Discussion

The study showed that there was a significant difference between the assumed and actual ICT competences of biology teachers in demonstrating basic ICT tasks. This was shown on the assumed and actual mean ICT competences of biology teachers whereby the assumed mean ICT competences were greater than actual mean ICT competences. It shows that the ICT competence the biology teachers actually possessed is far below what they assumed they have. This result is in agreement with the findings of Anih (2013) who reported a difference between claimed and actual ICT skills possessed by computer science teachers. The study further showed that there is significant difference between the assumed mean ICT competence of secondary school biology teachers and what they actually possessed.

Similarly, the findings of the study revealed that actual mean ICT competence possessed by young biology teachers is greater than that of the older ones. This means that age

has influence on actual mean ICT competence of secondary school biology teachers in demonstrating basic ICT tasks. This study is in line Anih (2013) and Dike (2014) who reported that age is a factor in ICT competence possession, that younger teachers possessed ICT competences more than older teachers. However, the findings contradict Jegede (2009) who revealed that age is not a factor when considering ICT competences.

Conclusion

The study concluded that secondary school biology teachers in Anambra state have not possessed the required ICT competence to use ICT facilities to teach biology concepts. Therefore, secondary school biology teachers need to improve in their ICT competences through the use of ICT facilities for effective service delivery.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Practicing Biology teachers should enrol in in-service training programme on ICT so as to update their competences in the use of ICT in teaching.
2. The teacher training institutions should make sure that pre-service biology teachers possess the required competence before certification.
3. Ministry of Education should encourage biology teachers to procure personal computers by supplying and subsidizing the cost for them so as to practice the necessary skills and become competent in the use of ICT for teaching.

References

Anih, A. A. (2013). *Assessment of ICT proficiency level of computer science teachers in secondary schools in Agbani Education zone of Enugu State.* Unpublished M Sc. Ed Thesis Nnamdi Azikiwe University, Awka.

Chioma, U. (2005). Science curriculum trends implications. *Journal of Professional Teachers, 1 (1)*, 172-180.

Dike, F. O. (2014). *Assessment of economics teachers' perception of their information and communication technology competencies using UNESCO ICT competency framework for teachers.* Unpublished M.Ed. Thesis University of Nigeria, Nsukka.

Jegede, P. O. (2009). Age and ICT-related behaviours of higher education teachers in Nigeria. Issues in Informing Science and Information Technology 6, *jegede@oauife.edu.ng.*

Margaret, N. T. (2005). *Teacher training in technology-pedagogy integration; experts meeting on teachers facilitators training in technology-pedagogy integration.* Bangkok: Drenver Publishing.

Nwosu, A. A. (2012). Inquiry skill acquisition for enhancing women's participation in sustainable development: Implication for science education. *The 43rd Annual Conference Proceedings of STAN,* 98-101.

Ojiegbe, N. (2010). *ICT competencies of library staff at the University of Abuja, FCT and University of Jos, Plateau State.* Unpublished master's thesis. University of Nigeria, Nsukka.

UNESCO (2011). ICT competency standards for teachers' implementation guidelines Version 1. Retrieved from: http://www.unesco.org/new/en/communication-and-information/resources/publications-and-communication-materials/publications/full-list/ict-competency-standards-for-teachers-implementation-guidelines-version-10/