

# Assessment of Science Teachers' Knowledge and Use of Information and Communications Technology for Teaching in Kwara State Secondary Schools

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## Abstract

*There is no doubt that emergence of Information and Communication Technology (ICT) has significant impact on education especially for teachers in the discharge of their teaching duties. In this contemporary era, ICT is being used as synchronous and asynchronous teaching and learning platform that caters for both teachers and learners' needs. The purpose of this study was to investigate science teachers' knowledge and use of Information and Communication Technology for teaching in Kwara State. The study was descriptive research of the survey method using random sampling techniques to draw a sample of 200 (130 males and 70 females) science teachers from ten secondary schools in Kwara State, Nigeria. The main research instrument employed for data collection was a researcher-designed questionnaire. The research question was answered using mean and standard deviation. Hypotheses one to three were tested using T-test statistics while hypothesis four was tested using Analysis of Variance (ANOVA). All hypotheses were tested at a 0.05 significant level, and the statistical tool used for analysis is Statistical Package for Social Science (SPSS) version 21. Findings from the study indicated that science teachers were competent to use ICT for teaching and all the teachers' variables considered in the study except years of teaching experience have no influence on science teachers' knowledge and use of ICT for teaching. Thus, it was recommended among others that more professional development-oriented policies should be encouraged and sponsored by the government to maintain teachers' ICT knowledge for teaching in the classroom.*

**Keywords:** Science Teachers, Level of Knowledge, ICT, Teaching

## INTRODUCTION

Information and Communication Technology (ICT) is a platform that meets the needs of both educators and learners, and it is vital to note that the teaching and learning processes can take place either synchronously or asynchronously on the platform. ICT has become an essential part that cannot be separated from the various aspect of human life, especially in education. As a result, implementing ICT usage in the educational context helps to improve teachers' and students' skills and understanding. ICT is an assuring technology designed to engage students in independent learning via media which uses electronic technologies for communication among students and

teachers (Silverthorne, & Wang, 2001; Beketova, Leontyeva, Zubanova, Gryaznukhin, & Movchun, 2020).

Changes in education requires some innovation to deal with it, and this requires more ICT knowledgeable graduates, both in quality and quantity. To attain this feet, Information and Communication Technology (ICT) plays important roles. Higher education institutions have earnest ICT through the introduction of e-learning which triggers a huge change on students' knowledge and skills, progress in education. According to Ali, Holder and Muhammad (2013), "in the new millennium, rapid development of computer utilities such as multimedia and the internet facilitate broader chances for teachers and students to operate, save, manipulate, gain information and boost an active and independent learning". Individual learning obligations such as long-distance learning motivate teachers and students to keep learning out of the school hours, planning and saving learning materials, designing and facilitating files sending. Several studies have highlighted the significance of Information Communication Technology (ICT) in the field of education. A quantitative methodology research by Ghavifekr and Rosdy (2015) on the teaching and learning with technology: effectiveness of ICT integration in school shows that technology-based teaching and learning process seems to be more effective than the traditional learning method. The study indicated that using ICT tools helps to create an active classroom learning environment that is more fascinating and effective for both students and teachers.

Aina (2013), explained that ICT utilities in science educations such as biology, chemistry and physics as thus: (a) Computer helps students to visualize tiny and invisible objects like human anatomy, internal structures of human and animals' cells. (b) Chemist educations where most of chemical substances and chemical reactions are dangerous for human body especially when they are not handled carefully. In most cases, chemical reactions are hard to understand by students without watching them directly. Generally, teachers explain the reaction abstractly and draw diagrams of molecules. For those purposes, ICT is crucial, as students can watch chemical reactions lively from computer software. Animation and videos of chemistry complex molecular structures are available for classroom learning for all groups of students. (c) Applications in physics educations; most people assumed that physics is an abstract subject, it might be caused by the way of teacher's teaching that bring about physics being challenging to understand. When concepts of physics are taught correctly with ICT' support, they would no longer be recognized as

abstract concepts (Adeyemo, 2010). Generally, Educational software can be used to teach difficult concepts or to learn challenging skills in most science subjects.

ICT is a tool that can be used across the curriculum or in separate subjects where the emphasis is on the development of ICT-related skills, knowledge and processes. It enhances students' learning outcomes within the limits of the existing curriculum. It is also a potential tool to transform the teacher-based classrooms into learner-focused, rich and interactive learning environments. Teachers constitute the key element in this transformation based on the adoption of ICT learning and teaching tools in schools. Integrating ICT in the curricula requires an investment both in these technologies and in trained personnel.

One of the factors that determine educational development and innovation in general is teacher being the ones to use the ICT investments for educational development. They are the primary changing agent to promote educational development in every country. Teacher's roles are vital; it incorporated all aspects of growth and development of teaching-learning and scientific development. For teachers, to be able to manage functions of this technology (ICT), the teachers' level of knowledge must be relatively good. As it is being observed by Gebhardt, Thomson, Ainley and Hillman (2019) that integration of ICT into teaching and learning depends so much on the teachers' knowledge of ICT for effective inclusion to take place.

Technology does not have an educational value in itself. It becomes important when teachers use it in learning-teaching process. Although there are some who claim that the presence of technology in the classroom creates a pressure and requires effective use (Kozma, 2003), research results show that these are also related to teachers' attitudes and levels of knowledge (Pelgrum, 2001; Garland & Noyes, 2004; Torkzadeh, Chang & Demirhan, 2006; Lim & Khine, 2006; Zhang, 2007; Paraskeva, Bouta & Papagianni, 2008) as well as other important factors such as their information about and experience with ICT (Hong & Koh, 2002) their experiences on how to use these technologies in classroom environment (Keong, Horani & Daniel, 2005), information and experiences concerning the types of applications based on ICT, age (Hartley & Bendixen, 2001), and self-confidence (Ertmer, 2006). Based on submission of these researchers it is necessary to put into consideration the teachers' variables such as gender, school type, qualification and years of teaching experience in order to investigate their influences on the teachers' knowledge of ICT.

## **Objectives of the Study**

The objectives of the study are as follows:

1. to determine science teachers' knowledge and use of ICT for teaching
2. to determine the influence of gender on the science teachers' knowledge and use of ICT for teaching
3. to find out whether school type influence science teachers' knowledge and use of ICT for teaching
4. to investigate influence of qualification on science teachers' knowledge and use of ICT for teaching
5. to find out if there is difference in the science teachers' knowledge and use of ICT for teaching based on their years of teaching experience.

### **Research Questions**

The following research questions are used to guide the study:

1. what is the science teachers' knowledge and use of ICT for teaching?
2. does gender influence science teachers' knowledge and use of ICT for teaching?
3. does school type influence science teachers' knowledge and use of ICT for teaching?
4. does qualification influence science teachers' knowledge and use of ICT for teaching?
5. What is the influence of years of teaching experience on science teachers' knowledge and use of ICT for teaching?

### **Research Hypotheses**

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

1. there is no significant difference in the male and female science teachers' knowledge and use of ICT for teaching
2. there is no significant difference in the public and private school science teachers' knowledge and of use of ICT for teaching
3. there is no significant difference in the qualified and unqualified science teachers' knowledge and use of ICT for teaching
4. there is no significant difference in the science teachers' level knowledge and use of ICT for teaching based on their years of teaching experience

## **METHODOLOGY**

This study adopted descriptive survey research design. The population for the study comprised all science teachers in Kwara State, Nigeria. The target population was all science teachers in selected public and private secondary schools in Kwara State, Nigeria. Stratified sampling technique was used to classify the secondary schools into Public and Private. From each stratum using year of establishment, five secondary schools were selected making a total of ten secondary schools (public and private) sampled.

However, 250 respondents were randomly sampled for the study to cater for attrition and experimental mortality using proportional sampling technique to allocate number of respondents to each secondary schools based on the numbers of science teachers and only 200 teachers adequately responded to the questionnaire items. The responses were analysed in the study. The research instrument that was used to obtain data for this study was a researcher designed questionnaire with two sections A and B. Section A contains respondents' demographic information such as: gender, school type, year of teaching experience and educational qualification; while section B sought information on Science Teachers' level of knowledge on the use of ICT for teaching containing 30 items that required respondents to tick appropriate option that best explain their opinion and was graded using Likert scale response modes of Strongly Disagree (SD); Disagree (D); Uncertain (U); Agree (A); and Strongly Agree (SA).

The validity of the instrument was ensured by two experts from the faculty of Communication and Information Science (CIS), University of Ilorin and three experts from the department of Computer Science, Kwara State College of Education (Technical), Lafiagi. The reviewers helped to review the questionnaire items to check the clarity of language and ensured it is relevant to the study. Their suggestions and corrections were noted and effected on the final draft of the instrument administered. The reliability of the research instrument was determined by administering thirty copies of the questionnaire to randomly selected secondary school science teachers in Edu Local Government area of Kwara State who did not take part in the study. After the administration and retrieval of the completed instrument, their responses to the items were subjected to statistical analysis using Cronbach alpha reliability statistics to check for the instrument's internal consistency. The reliability coefficient 0.73 was obtained which indicates that the instrument is reliable.

The copies of the research questionnaire were administered to the study samples through personal contact by the researchers to ensure the questionnaire items were properly filled without delay.

The completed copies of the questionnaire were collected, and data obtained from the questionnaire were analysed using mean and standard deviation for the research question 1, while independent t-test was used to test hypotheses 1 to 3 because they consist of one independent variable each, which occurred at two levels and one dependent variable. Hypothesis 4 was tested using ANOVA since it consists of an independent variable that exist at three levels and one dependent variable.

## RESULTS

### Research Question 1: What is science teachers’ knowledge and use of ICT for teaching?

The science teachers are knowledgeable/ competent in their use of ICT for teaching

**Table 1:** Science teachers’ knowledge and use of ICT for Teaching

S/N	Items	Std.	
		Mean	Deviation
1	Using internet to search/surf for relevant science information and resource	3.47	.729
2	Using word processor (e.g. Microsoft word) to create, edit and produce a document for specific purposes	3.25	.768
3	Using of spread sheet software	2.86	.919
4	Using of animation software to create animation	2.71	.954
5	Using presentation software (e.g. Microsoft Power Point) to deliver science lesson	3.08	.926
6	Using ICT tools to create data base	2.96	.873
7	Using ICT tools to create presentation with animations	2.72	.952
8	Using tutorial software package on CD-ROMS to present science lesson	2.87	.947
9	Using ICT facilities to conduct test/exam	2.99	.924
10	Using ICT facilities to mark test/exam	2.69	.989

The science teachers’ knowledge and use of ICT for teaching can be said to be competent based on the findings in Table 1. The mean values of the knowledge of the teachers in the use of ICT for teaching are all greater than 3.0 which is the average mean value of teachers’ knowledge to use ICT. This means that any mean value greater than or equals to 3.0 is equivalent to being knowledgeable/competent as regard the use of the ICT by the teachers. Whereas any mean value less than 3.0 translate to not knowledgeable/competent as regard the use of the ICT. Since all the mean values of the items presented to the teachers as regard their knowledge/competency of use of ICT for teaching are greater than 3.0 it means the teachers are knowledgeable/competent in the use of ICT for teaching.

### Research Question 2: Does gender influence the science teachers’ knowledge and of ICT for teaching?

Gender did not influence the science teachers’ knowledge and use of ICT for teaching

**H0<sub>1</sub>:** there is no significant difference in the male and female science teachers’ knowledge and use of ICT for teaching

**Table 2:** Gender Influence on Science Teachers’ knowledge and use of ICT for teaching

Gender	N	Mean	Std	t	df	Sig	Decision
Male	130	29.65	5.73	0.144	198	0.886	Not Significant
Female	70	29.51	6.96				

It is shown in Table 2 that there is no significant difference in the knowledge of male and female science teachers’ use of ICT for teaching. This is because Male (M= 29.65, SD=5.73) and Female (M=29.51, SD=6.96),  $t(198) = 0.144$ ,  $p = 0.886$ . Since the p-value is greater than 0.05, this means that the null hypothesis formulated is not rejected.

**Research Question 3:** What is the influence of school type on the science teachers’ knowledge and use of ICT for teaching?

School type had no influence on science teachers’ knowledge and use of ICT for teaching.

**H0<sub>2</sub>:** there is no significant difference in the public and private school science teachers’ knowledge and use of ICT for teaching

**Table 3:** Science Teachers’ Knowledge and Use of ICT for Teaching Based on School Type

School Type	N	Mean	Std. Dev.	t	df	p	Decision
Public	128	29.06	6.03	-1.648	198	0.101	Not significant
Private	72	30.56	6.35				

Table 3 reveals that there is no significant difference in the knowledge and use of ICT for teaching between public school science teachers (M= 29.06, SD=6.03) and Private school science teachers (M=30.56, SD=6.35),  $t(198) = -1.648$ ,  $p = 0.101$ . This is because the p-value is greater than 0.05. It means that the null hypothesis formulated is not rejected

**Research Question 4:** What is the influence of science teachers’ teaching qualification on their knowledge and use of ICT for teaching Science subjects?

Science teachers’ academic qualification did not influence their knowledge and use of ICT for teaching.

**H0<sub>3</sub>:** there is no significant difference in the qualified and unqualified science teachers’ knowledge and use of ICT for teaching.

**Table 4:** Science Teachers’ Knowledge and Use of ICT for Teaching Based on their Academic Qualification

Academic Qualification	N	Mean	Std. Dev.	t	df	p	Decision
Unqualified	130	29.62	6.24	0.048	198	0.982	Not significant
Qualified	70	29.57	6.09				

Table 4 shows that there is no significant difference in the knowledge and use of ICT for learning between unqualified science teachers (M= 29.62, SD=6.24) and qualified science teachers (M=29.57, SD=6.09),  $t(198) = 0.048$ ,  $p = 0.982$ . This is because the p-value is greater than 0.05. It means that the null hypothesis formulated is not rejected

**Research Question 5:** What is the influence of years of teaching experience of science teachers’ knowledge and use of ICT for teaching?

Science teachers’ years of teaching experience did not influence their knowledge and use of ICT for teaching.

**H04:** there is no significant difference in the science teachers’ knowledge and use of ICT for teaching based on their years of teaching experience.

**Table 5:** Descriptive Analysis of Science Teachers’ Knowledge and use of ICT for Teaching Based on their Years of Teaching Experience

Years of Teaching	N	Mean	Std. Dev.
0-5	52	27.31	7.43
6-11	84	30.36	4.92
12 and above	64	30.47	6.15

**Table 6:** ANOVA of Science Teachers’ Level Knowledge and use of ICT for Teaching Based on Years of Teaching Experience

Years	Sum of Squares	df	Mean Square	F	P
Between Groups	369.700	2	184.850	5.045	0.007
Within Groups	7218.300	197	36.641		
Total	7588.000	199			

It can be deduced from Table 5 and 6 that there is significant difference in the science teachers’ knowledge and use of ICT for teaching based on their years of teaching experience. 0-5 years (M= 27.31, SD=7.43), 6-11 years (M= 30.36, SD=4.92) and 12 years and above (M= 30.47, SD=6.15),  $F(2, 197) = 5.045$ ,  $P = 0.007$ . Since the p-value of 0.007 is less 0.05, it means that there is significant difference in the mean values of the three set of years of teaching experience of the teachers and as a result, there is need to carry out post-hoc test in order to determine where the difference lies among the three set of years.

**Table 7:** Multiple comparison of knowledge and use of ICT for teaching by science teachers based on years of teaching experience

(I) Teaching Experience	(J) Teaching Experience	Mean Difference (I-J)	Sig.
0-5 Years	6-11 Years	-3.04945*	.013
	12 Years and Above	-3.16106*	.016
6-11 Years	0-5 Years	3.04945*	.013
	12 Years and Above	-.11161	.993
12 Years and Above	0-5 Years	3.16106*	.016
	6-11 Years	.11161	.993

Table 7 reveals that the significant difference among the three set of years is between 0-5 years and 6-11 years as well as between 0-5 years and 12 years and above, this is so because, their p-values of 0.013, 0.016 and 0.993 respectively are both greater than 0.05 and the differences in these values are in favour of 6-11 years and 12 years and above respectively. This means that the science teachers with 6 and above years of teaching experience were more knowledgeable and competent more than those with lesser years of teaching experience. Hence, the null hypothesis formulated in this regard is rejected. It means that, there is significant difference in the knowledge and use of ICT for teaching by science teachers based on their years of teaching experience.

## DISCUSSION

The first finding from the study revealed that the science teachers sampled had adequate knowledge of the use of ICT for teaching like for browsing for materials used in teaching students, Microsoft word processing, setting of questions for students, etc. This finding is in agreement with that of Kozma (2003), who reported that the teachers' level of ICT knowledge is generally good, and that they were excellent when it comes to utilising mundane application such as word processing, spreadsheets, power point, e-mailing and internet browsing which are the most widely and often used in the teaching profession. The finding also agreed with that of Silver. (2022), who found those teachers are able to impact the knowledge of ICT they acquired in the classroom while teaching. However, findings of this study and finding disagreed with that of Garland and Noyes (2004). They found most teachers do not know how to use the Internet, email, word processing, graphics and presentation software. The low levels of knowledge on ICT might be attributed to the fact that these technologies require technical knowledge.

The study also revealed that gender as male or female has no significant difference in the knowledge and use of ICT for teaching. The finding is in agreement with that of Danladi (2016); Gebhardt, Thomson, Ainley and Hillman (2019) whose findings revealed that gender did not influence ICT competence of teachers. However, the finding is at variance with that of Manyilizu and Gilbert (2015) as well as Nizoloman (2019). They reported gender differences in their studies in favour of male teachers. It was also found in the present study that the difference in the knowledge of ICT for teaching by both private and public-school teachers was not significant. This means that school type did not influence the knowledge of ICT of the teachers.

The study showed that there was no significant difference in the knowledge and use of ICT for teaching by qualified and unqualified science teachers, that is, those who are having teaching qualification and those who do not have. The finding disagreed with that of Adedaja (2016) and Danladi (2016) who both reported that qualification significantly influenced the teachers' perceptions of integration of ICT and teachers' knowledge of ICT respectively. Finally, another finding from this study showed that significant difference occurred based on years of teaching experience of the science teachers as regard their knowledge and use of ICT for teaching which was in favour of the teachers with higher years of teaching experience from 6 years and above. The finding disagreed with that of Lim and Khine (2006) who reported that teachers' levels of knowledge use of ICT and attitudes towards the Internet and computers show the same difference according to years of experience. But the finding agreed with that of Manyilizu and Gilbert (2015) as well as Keong, Horani, & Daniel (2005). Although, while the difference in years of teaching experience is in favour of the experienced teachers just like that of Manyilizu and Gilbert (2015), it is different from that of Keong, Horani, & Daniel (2005), which the difference in years of teaching experience was in favour of the less experienced teachers.

## **CONCLUSION AND RECOMMENDATIONS**

It can be concluded from the study that the science teachers are ready to make use of ICT for teaching since they possessed the knowledge and competency to use ICT for teaching. It can also be deduced from the study that gender, school type and academic qualification did not influence the science teachers' knowledge of use of ICT for teaching, so all these variables need not to be prioritized while teaching using ICT. However, the years of teaching experience seems to influence the knowledge of use of ICT of the science teachers. As it can be seen that those having teaching experience starting from six years and above possessed the knowledge of use of ICT for teaching

than those with years of teaching experience of five years and below. This therefore may be because those with lesser years of teaching experience are new to the use of ICT for teaching.

Derived from the findings of the study, the following are thus recommended:

- i. Government and other stake holders should make provisions for ICT like computers with related software in the right numbers in secondary schools to facilitate its use for teaching science subjects.
- ii. Referral training program should be put in place periodically to update both male and female teachers on contemporary skills of ICT use in science teaching.
- iii. School heads and quality assurance officials should ensure the usage of ICT for teaching in both public and private schools.
- iv. Regardless of the qualifications of science teachers, they should all be encouraged to be skilful in the use of ICT for teaching science subjects.
- v. A step-down of ICT skills system should be instituted in schools and at education zones to enable less experience one's benefit from the mastery of the highly skilful science teachers in secondary schools.

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