

Utilization of ICT Resources in Teaching Chemistry in Senior Secondary Schools in Kwara State, Nigeria**'Abdullateef Olayinka Hamza, 'Akindeyi Luwoye, 'Bilkisu Aliyu Suleiman, 'Adekunle Solomon Olorundare**['University of Ilorin, Nigeria](https://www.unilorin.edu.ng/)**Research Article****Citation Information:**

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ABSTRACT

Chemistry deals with the composition, properties, and uses of matter, the interaction between different matter, and the relationship between matter and energy. The utilization of Information and communication technologies in educational institutions globally has facilitated the streamlining of instructional processes, thereby fostering national stability and economic sustainability. This study investigated teachers' utilization of ICT resources in teaching chemistry in senior secondary schools based on teachers' gender, educational qualification, and teaching experience. The study was a descriptive research of a survey type. A purposive sampling technique was used to select 250 chemistry teachers from Kwara state, Nigeria. Five research questions were generated and answered using frequency count, percentage, mean, and standard deviation. Three hypotheses were formulated and tested using t-test and ANOVA at 0.05 level of significance. The instrument for data collection is a researcher-designed questionnaire titled Questionnaire on Utilization of ICT Resources (QUICT). Findings revealed that the available ICT resources were rarely utilized among chemistry teachers while most of the chemistry teachers do not utilize ICT resources for teaching chemistry. The study concludes that teachers' gender, educational qualification, and teaching experience significantly influence the level of utilization of ICT resources in teaching senior school chemistry. The study recommended that the Government should ensure adequate funding to provide ICT resources in senior secondary schools as contained in the national policy on education. Chemistry teachers should endeavor to attend seminars, conferences, and workshops to update themselves on global best practices on the utilization of Information and Communication Technology resources in teaching chemistry.

Keywords: Availability, Utilization, Chemistry teachers, ICT, Gender

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Corresponding Author:

Abdullateef Olayinka Hamza

[University of Ilorin, Nigeria](https://www.unilorin.edu.ng/)

1515, P.M.B, Ilorin, Nigeria

Email: princeadelekm@gmail.com**INTRODUCTION**

Science has evolved to become a very important aspect of our everyday life, especially with the advancement of technology. The three major science subjects taught at the Senior Secondary School level in the Nigerian education system include; biology, chemistry, and physics. Owoyemi and Adesoji (2012) described Chemistry as a key science subject that explains the workings of the universe through an understanding of the properties and interactions of substances that make up matter. Chemistry is the study of matter, what it is made up of, how it behaves, its properties, and how it changes during Chemistry reactions (Ababio, 2011). Chemistry deals with the composition, properties, and uses of matter, the interaction between different matter, and the relationship between matter and energy. Chemistry has its main objectives, the determination of the nature and properties of the non-living matter, which surrounds us as well as the preparation of new substances, scientifically interesting or generally useful from the materials which nature has offered. The study of Chemistry makes it possible for us to acquire knowledge about matter. Being an experimental science, experiments are carried out, observations are recorded, and intelligent inferences are made

Chemistry is a human endeavor that relies on basic qualities like activity, weight, recording, and skills. The subject is commonly viewed as the "Central Science" as mastery of its concepts regarding the structure of matter is a prerequisite to further study in all sciences. In essence, Chemistry performs the function of gatekeeper for the future study of both pure and applied science, Medicine, Pharmacy, Engineering, Agriculture, Nursing, and Food Technology. Chemistry has helped greatly in providing our basic needs and enhancing the quality of our lives. For instance, the effects of Chemistry are felt in the provision of medicine, potable water, improved food technology, household equipment, modern buildings, textiles, and so on. Despite the importance

of chemistry, students' performance in both external and internal examinations has not correlated with this importance. Many factors are responsible for this ugly performance, such factors include; Chemistry teachers' negative perception of their learners' abilities; inadequate use of resources in the teaching and learning process, and negative socio-cultural factors as well as an inappropriate learning environment and inappropriate use of ICTs were the main causes of the students' persistent poor performance in Chemistry (Ahmed et al., 2015).

There has been a tremendous transformation in the education sector as a result of rapid advances in Information and Communication Technology (ICT). Aduwa-Ogiegbaen and Iyamu (2015) affirmed that the role of technology in teaching and learning is rapidly becoming one of the most important and widely discussed issues in contemporary education policy. According to Nwafor et al (2022), the concept of information and communication technology encompasses a category of technological tools that facilitate various activities related to information, including the collection, manipulation, retention, and presentation of data. In an educational context, Information and Communication Technology (ICT) may be employed for several purposes, including the storage of data such as financial records and transactions, as well as for instructional delivery. Laabidi (2022) stated that ICT encompasses a range of technologies that facilitate the acquisition and dissemination of information through various communication devices, such as computers, scanners, printers, and internet connectivity. Similarly, Fidelis and Onyango (2021) suggest that Information and Communication Technology (ICT) encompasses several components such as internet connectivity, cable data transfer, and computer hardware. According to Fidelis and Onyango (2021), the term "technology" encompasses many communication devices and applications, such as cellular phones, television, radio, computers, and network hardware and software.

Correos (2014) submitted that Information and Communications Technology (ICT) is considered nowadays as a potential tool that provides educational opportunities in both formal and non-formal ways. In the teaching-learning process, ICTs can increase the learner's motivation and engagement in classroom learning. It equips learners with digital-age literacy, inventive thinking, higher-order thinking, sound reasoning, effective communication, and high productivity (Tinio, 2014). Information and Communication Technology (ICT) has significantly facilitated the field of education by leveraging electronic media, the Internet, and other related technologies. Advances in Information and Communication Technology are reshaping the socio-economic, political, and educational systems of society. Husain (2019) asserts that the utilization of calculators and computers in educational institutions globally has facilitated the streamlining of instructional processes, thereby fostering national stability and economic sustainability. That is why many schools are making frantic efforts to automate their operations. The use of Information and Communication Technologies (ICTs) in the classroom is becoming increasingly prominent because of the need for children to develop skills that will empower them for modern society and because of the potential value of such technologies as tools for learning. Nevertheless, the effective utilization of Information and Communication Technology (ICT) necessitates meticulous strategic planning and substantial government backing in terms of financial resources and policy formulation.

Many countries in the world are revising their educational system to be competitive. In Nigeria, teachers and other educators in higher institutions have been involved in some form of informal online communication and discussion process. All of these could be harnessed and used as a strength towards leveraging the conventional process of teaching and learning in schools. This will create a computer and internet-mediated environment where teaching and learning work are augmented. Utilization of ICT resources represents an innovative model and method on which modern science teaching is based. Simplification of rules, phenomena, laboratory procedures, and complex molecular structures is based on the simplicity in work, and the use and application of ICT. The means and equipment for conducting experiments, diaphotos, multi-layer pictures, models, graphoscopic and magnetic labels, and feature film pictures, are among the most commonly utilized teaching aids. For the sake of the successful practice of teaching (topics) units, the explanation of terminology and phenomena in the sciences, and the choice and use of teaching aids, only the most suitable, simplest, and most interesting are to be taken into consideration.

The textbook was, and has remained the central source of knowledge and a way of the enhancement of educational programs, which contains the summary of the basic and existing knowledge on phenomena. Precisely due to such treatment of phenomena, most textbooks fail to enrich teaching and teaching process didactically and methodically. Therefore, it is necessary to find an optimal didactic-methodical solution that provides the correspondence between the structure of real student activities in the teaching process and program objectives. Due to the advancement of new techniques and technologies, under the strong influence of the computer revolution during the last decade, the traditional source of knowledge, the textbook, is slowly being pushed behind. ICTs and modern teaching aids, have recently assumed their role in school teaching, thus pushing behind traditional teaching means used so far (Kostic et al, 2008). Nowadays, the use of computers in school teaching is of crucial importance. The main characteristic of the computer, as opposed to classic teaching aids, is the fact that it unites the following teaching the picture, sketch, photo, scheme, television, projectors, and films. Since it can easily reproduce several media simultaneously (sound, tone, and picture), it can justly be referred to as a multimedia means.

Dickson (2004) opined that the application of ICT in teaching chemistry in secondary schools is becoming indispensable for several reasons.

- a) Complex molecular structures can be displayed on the monitor, with the possibility of a 3D picture, for example, molecules of DNA (deoxyribonucleic acid), RNA (ribonucleic acid), and proteins, instead of the carotid (ball) and tetrahedron models.
- b) Multimedia programs in the field of chemistry, encyclopedia issues, scientific magazines, lexicons, and text-books on the CD, are the accompanying elements of the books and technical literature.
- c) Complex technological processes are shown as a whole their display is simplified, while drawing plants, machinery, and apparatuses are becoming a matter of routine. Schemes and sketches of technological processes and industrial plants may

successfully be reproduced on the computer. In addition, the chemical processes occurring within plants are vividly displayed by interrupted lines, often in red or green. The movement of raw materials and half-products is shown by vertical blinking blue lines. This creates an impression of the raw materials moving within plants.

- d) The Internet may be regarded as a lucrative and inexhaustible source of information. It also represents a powerful system of communication among people throughout the world. It enables fast, effective, and cheap exchange of information.

Nowadays, ICTs are used by millions of users, with a tendency of constant growth. The number of users in the world doubles every three months. The new aspect of the utilization of ICTs in the teaching of the sciences is a result of the long-lasting work and the conducted practice in the field of Computer Science and Sciences. The innovative methods of the utilization of ICTs in the teaching of the sciences are based on the advantages of the use of the computer. They also facilitate and advance the work of the teacher and the student in both theoretical and practical aspects. The computer offers plenty of possibilities in the theoretical aspect of teaching, as a result of which students are shown various chemical processes, and natural phenomena on the computer, and vividly presented with principal chemical laws as well. The structure of molecules, atoms, and crystal systems (cubic system of sodium chloride (NaCl)) is much clearer if shown in 3D on the monitor of the computer instead of a two-dimensional diagram.

Practical work with the help of ICTs represents a simplification of procedures when applying chemicals and laboratory equipment during experiments. Arranging the apparatus when conducting experiments becomes easier when performed with the help of the computer. The position and order of the laboratory equipment are displayed on the monitor, the only task of the student is to follow the instructions on the monitor, which leads not only to independence while experimenting but also to enable students to conduct various more complex experiments. In addition, students may revise and practice certain quantitative analysis methods several times, by the use of a so-called computer virtual laboratory to optimize caution and precision in work and reduce the number of possible injuries when conducting experiments and using toxic substances. The computer can be placed on the teacher's working desk in the cabinet, in the facility for experiment preparation, but certainly not in the laboratory. Not only does it occupy space, but it may also be partly damaged due to the presence of a large number of students and working in groups, mainly lack of caution, and the impact of evaporating and corrosive substances (acids, bases, and solvents).

Moreover, ICTs may be used by the teacher to serve as a database. In this way, traditional files for storing student records, test scores, and seminar papers are not necessary. Lists of laboratory equipment and substances, and teaching aids are constantly available to the teacher (Sotheeswaran, 2004). Computers are also used for testing and evaluating students' knowledge (mainly of separate units) by the use of tests, composing standard tests, as well as creating procedures when conducting experiments, and organizing school quizzes, debates, and competitions. Ahmed et al (2017) investigated the extent of biology teachers' utilization of communication technology materials and resources in the teaching of biology in the Ilorin metropolis. The result revealed that schools are not scientifically developed as they do not have readily available communication technology instructional materials, however, biology teachers have a positive attitude towards the utilization of communication technology materials. Teachers' characteristics such as age, gender, educational qualifications, teaching experience, and experience with the computer for educational purposes can influence the utilization of innovation (Schiller, 2013). Onasanya, Shehu, Ogunlade, and Adefuye (2011) in their study of teachers' awareness and extent of utilization of information communication technologies for effective science and health education in Oyo state, Nigeria. Their findings show that the level of their utilization of ICT resources for teaching science and health education was found to be very low and there exists a significant difference between the male and female science teachers in their level of utilization of ICTs, with the male outperforming their female counterparts with higher mean scores. This implies that there is low utilization of ICT resources for teaching science and health education in Oyo state, Nigeria.

There is a prevailing concept that women are at a disadvantage in terms of their use of information and communication technology (ICT) (Alao & Brink, 2020). According to Mfaume (2019), a study revealed that male teachers had a higher frequency of utilizing ICT facilities in comparison to their female colleagues. In a study conducted by Okkan and Aydin (2022), it was discovered that gender has a notable impact on the extent to which teachers utilize ICT facilities. In contrast, Okocha (2021) observed that gender did not provide any statistically significant impact on teachers' utilization of information and communication technology (ICT) facilities. Rahimi and Yadollahi (2010) reported that there is no relationship between ICT utilization and gender. Petriell (2009) found that while females used e-mails more than their male counterparts, the latter used the Web more. He further found significant gender differences in the way females and males rated themselves in their ability to master technology skills, though both genders were positive about their technological ability. Males rated themselves higher than females.

Teachers' qualification is another factor to be considered when it comes to effective teaching. Omosewo (2008) commented that the efficiency of any institution depends to a large extent on the academic competence of the teaching staff, as no educational system can grow above the qualities of its teachers. The availability of adequate and qualified science teachers can therefore not be neglected for the success of any science program. A study by Olagunju and Abiona (2008) revealed that qualified teachers' perception of the utilization of ICT in teaching is higher than that of the less qualified teachers. The study conducted by Okocha (2021) revealed that academic qualification serves as a significant predictor of the utilization of information and communication technology (ICT) in the context of education. In a similar vein, Aina (2022) discovered that teachers with a first degree had a more favourable disposition towards the utilization of information and communication technology (ICT) compared to those with advanced degrees. In contrast, the study conducted by Owan and Offu (2021)

revealed that there was no statistically significant disparity in the integration of information and communication technology (ICT) based on teachers' qualifications.

Teaching experience has not been widely investigated about ICT utilization by teachers. Teaching experience is vital in a teaching and learning situation. Experience can be said to be those attitudes, skills, or knowledge acquired by the teacher through his participation in instructional programs. The experience of the teacher may help to model the way teachers think and adapt to changes in educational programs. The findings of a study done by Aina (2022) identified a notable disparity between teachers with less experience and those with more experience. However, it was observed that teachers with less experience showed greater proficiency in the utilization of information and communication technology (ICT) for educational objectives. According to the findings of Okkan and Aydin (2022), there exists an inverse relationship between teachers' years of experience and their understanding and levels of utilization of information and communication technology (ICT). The phenomenon described has been ascribed to the passion and receptiveness of young individuals towards technology, as evidenced by the works of Adhya and Panda (2022) and Okkan and Aydin (2022). Abdul-Salaam (2010) found that teachers' experience has a significant positive influence on their level of utilization of ICT for teaching as most of the experienced teachers do not know how to integrate ICT into their classroom activities since experienced teachers resort to the use of traditional chalk-talk methods. Also, Baek et al (2008) claimed that experienced teachers are less ready to integrate ICT into their teaching.

Despite all the efforts made to ensure effective teaching and learning of chemistry at the secondary school level in Nigeria, the problem of students' poor achievement in chemistry in internal and external examinations has remained unsolved (Olorundare, 2014). This high failure rate has been attributed to many factors including non-availability and non-utilization of proper instructional resources such as ICTs in teaching and learning science subjects especially chemistry in secondary schools in Nigeria. Adeyemo (2010) stressed that the method of teaching has gone beyond traditional methods and this makes the utilization of information technologies very important in science class. Information technology has broken the monopoly and provided a variety of teaching-learning situations in chemistry. This means that information technology should be properly rooted in the senior secondary school curriculum so that the level of literacy will be increased about the use of information technology in teaching chemistry. Despite the wide recognition and acceptance accorded to the role of ICT in teaching and learning chemistry at the Senior Secondary School level, there seem to be problems in the utilization of ICT in teaching and learning chemistry. How to sensitize chemistry teachers on the need to effectively utilize ICT facilities in teaching chemistry and also make the government committed to providing the necessary environment for ICT instruction in our Senior Secondary Schools remains daunting. The overall expectation is that chemistry teachers' participation by eliciting their perceptions on the factors affecting the effective utilization of ICT in teaching chemistry would reawaken them to be more committed to the use of ICT in teaching chemistry as well as making them serve as agents in the spread of the effective use of ICT for teaching and learning chemistry.

It is consequently of great advantage to find out if the use and application of ICT in the teaching and learning of chemistry will improve students' performance. Therefore, the study examined the influence of teachers' gender, teaching experience, and qualification on ICT Utilization in teaching chemistry in senior secondary schools in Ilorin Metropolis, Nigeria.

Research Questions

1. What are the ICT resources available for teaching chemistry in senior secondary schools?
2. What is the level of utilization of ICT resources among senior secondary school chemistry teachers?
3. Is there any difference between male and female chemistry teachers' level of utilization of ICTs for teaching Chemistry;
4. What is the difference between qualified and unqualified chemistry teachers' level of utilization of ICTs for teaching Chemistry;
5. What is the difference between highly experienced, moderately experienced, and low experienced chemistry teachers' level of utilization of ICTs for teaching Chemistry?

Research Hypothesis

Ho₁: There is no significant difference between male and female chemistry teachers' level of utilization of ICTs for teaching Chemistry;

Ho₂: There is no significant difference between qualified and unqualified chemistry teachers' level of utilization of ICTs for teaching Chemistry;

Ho₃: There is no significant difference between highly experienced, moderately experienced, and low experienced chemistry teachers' level of utilization of ICTs for teaching Chemistry.

METHOD

This study is a descriptive research of a survey type. This type of research involves collecting data based on the opinions, views, available resources, personnel involved, and decisions of the respondents based on their gender, academic qualification, and experience. The population for this research was all chemistry teachers in Nigeria while the target population for this study was all chemistry teachers in Kwara state. The researcher employed the use of a purposive sampling technique. Also, qualified, unqualified, experienced, and inexperienced chemistry teachers were sampled for the study. The instrument used for this research is a researcher-designed questionnaire based on the utilization of ICT for teaching chemistry in Senior Secondary Schools (QUICT).

The questionnaire consists of two sections; A and B. Section A deals with the respondent's personal information such as name of school, gender, academic qualification, and teaching experience. Section B deals with the Availability and Utilization of ICT

resources in teaching chemistry. This section contains two items on the frequency the usage of the available ICTs in teaching chemistry and response mode was available and not available while three items on the frequency of the utilization of ICTs in teaching chemistry and response mode was frequently used, rarely used, and not used. The face and content validity of the instrument was done with the help of three experts in the Department of Science Education, University of Ilorin. In establishing the reliability of the research instrument, a pilot study was conducted with 30 chemistry teachers from different schools at an interval of two weeks using the test-retest method, and Cronbach alpha was used to find out the reliability index of 0.86. Descriptive statistics was used to answer the research questions. Research questions were answered using Mean, Standard Deviation, Frequency, and Percentage. Research hypotheses were tested with t-test and ANOVA at 0.05 level of significance

RESULTS AND DISCUSSIONS

Research Question 1: What are the available ICT resources for teaching chemistry in senior secondary schools?

Table 1 revealed the Frequency and percentage of availability of ICT resources for teaching chemistry in senior secondary schools in Kwara state. The table shows that out of 25 ICT resources identified for teaching chemistry, 14 were available while 11 were not available. That is, items 3, 4, 5, 7, 10, 12, 16, 17, 19, and 21 were ICT resources not available in the sampled area.

Table 1. Frequency and percentage of availability of ICT resources for teaching chemistry

S/N	ICT Resources	Available	%	Not Available	%	Remarks
1.	Internet/web services	128	51.2	122	48.8	Available
2.	e-mail	210	84.0	40	16.0	Available
3.	Multimedia projector	53	21.2	197	78.8	Not Available
4.	Interactive radio	21	8.4	229	91.6	Not Available
5.	Tablet	109	43.6	141	56.4	Not Available
6.	Audiotapes	133	53.2	117	46.8	Available
7.	Fax machines	107	42.8	143	57.2	Not Available
8.	Computers	187	74.8	63	23.2	Available
9.	Photocopy machines	172	68.8	78	32.2	Available
10.	Electronic cameras	13	5.2	237	94.8	Not Available
11.	Computer laboratories	136	54.4	114	45.6	Available
12.	e-Learning applications	112	44.8	138	55.2	Not Available
13.	LAN/ WLAN	128	51.2	122	48.8	Available
14.	WebQuest	139	55.6	111	44.4	Available
15.	Computer Assisted Learning (CAL)	176	70.4	74	29.6	Available
16.	Video conferencing	23	9.2	227	90.8	Not Available
17.	Chartroom	7	2.8	243	97.2	Not Available
18.	Spreadsheets (Excel, Access, etc.)	187	74.8	63	25.2	Available
19.	Google talk	81	32.4	169	67.6	Not Available
20.	Microsoft Word	187	74.8	63	25.2	Available
21.	Discovery Channel	15	6.0	235	94.0	Not Available
22.	Search engines	128	51.2	122	48.8	Available
23.	Whatsapp	226	90.7	24	9.3	Available
24.	Youtube	117	46.8	133	53.2	Not Available
25.	Smartphones	226	90.4	24	9.6	Available

Research Question 2: What is the level of utilization of ICT resources among senior secondary school chemistry teachers?

Table 2 revealed the frequency, percentages, and mean of chemistry teachers' level of utilization of ICT resources. The table revealed that many of the available ICT resources were rarely utilized among chemistry teachers while most of the chemistry do not utilize ICT resources for teaching chemistry.

Table 2. Frequency, percentages and mean of chemistry teachers' level of utilization of ICT resources

S/N	ICT Resources	Frequently Used (%)	Rarely Used (%)	Not Used (%)	Mean
1.	Internet/web services	54(21.6)	108(43.2)	88(35.2)	2.81
2.	e-mail	85(34.0)	125(50.0)	40(26.0)	2.42
3.	Multimedia projector	2(0.8)	51(20.4)	197(78.8)	1.89
4.	Interactive radio	3(1.2)	18(7.2)	229(91.6)	1.68
5.	Tablet	48(19.2)	61(24.4)	141(56.4)	1.54
6.	Audiotapes	32(12.8)	127(50.8)	111(44.4)	2.01
7.	Fax machines	57(22.8)	103(41.2)	90(36.0)	2.31
8.	Computers	107(42.8)	80(32.0)	63(23.2)	2.14
9.	Photocopy machines	112(44.8)	63(25.2)	75(30.0)	2.19
10.	Electronic cameras	1(0.4)	12(4.8)	237(94.8)	1.91

11.	Computer laboratories	50(20.0)	86(34.4)	114(45.6)	1.73
12.	e-Learning applications	42(16.8)	70(28.0)	138(55.2)	1.83
13.	LAN/ WLAN	29(11.6)	99(39.6)	122(48.8)	1.94
14.	WebQuest	58(23.2)	103(41.2)	89(35.6)	2.03
15.	Computer Assisted Learning (CAL)	86(34.4)	93(37.2)	71(28.4)	2.06
16.	Video conferencing	4(1.6)	53(21.2)	193(77.2)	1.95
17.	Chartroom	4(1.6)	53(21.2)	193(77.2)	1.76
18.	Spreadsheets (Excel, Access, etc.)	80(32.0)	107(42.8)	63(25.2)	2.41
19.	Google talk	52(20.8)	69(27.6)	169(67.6)	1.98
20.	Microsoft Word	90(36.0)	97(38.8)	63(25.2)	2.05
21.	Discovery Channel	5(2.0)	10(4.0)	235(94.0)	1.82
22.	Search engines	29(11.6)	124(49.6)	97(48.8)	2.45
23.	Whatsapp	144(57.6)	25(10.0)	81(33.4)	2.31
24.	Youtube	25(10.0)	92(36.8)	133(53.2)	1.89
25.	Smartphones	145(58.0)	24(9.6)	81(33.4)	2.09

Research Question 3: Is there any difference between male and female chemistry teachers' level of utilization of ICTs for teaching Chemistry;

The results in Table 3 show that male chemistry teachers have an overall mean of 3.43 while female chemistry teachers have an overall mean of 2.89. Therefore, male teachers' mean utilization of ICT in teaching chemistry is higher than their female counterparts. The mean ratings showed that there is a difference between male and female chemistry teachers' level of utilization of ICTs for teaching Chemistry in favor of male chemistry teachers.

Ho₁: There is no significant difference between male and female teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara State, Nigeria.

Table 3. Independent t-test Comparing Male and Female Respondents' utilization of ICT resources in Teaching Senior School Chemistry

Gender	N	Mean	SD	Df	Cal. t	p-value	Remark
Male	183	3.43	0.89	248	1.05*	0.005	Sig.
Female	67	2.89	1.21				

* Sig. at $p < 0.05$

Table 3 presents the independent t-test results on the difference between male and female teachers' level of utilization of ICT resources in teaching senior school chemistry. The Table shows that at a Degree of Freedom (df) of 248, the hypothesis is statistically significant (Cal. $t = 1.05$; $p = 0.005 < 0.05$); hence, the hypothesis is rejected. Therefore, there is a significant difference between male and female teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara State, Nigeria.

Research Question 4: What is the difference between qualified and unqualified chemistry teachers' level of utilization of ICTs for teaching Chemistry;

The results in Table 4 show that qualified chemistry teachers have an overall mean of 3.21 while unqualified chemistry teachers have an overall mean of 1.89. Therefore, qualified chemistry teachers' mean utilization of ICT in teaching chemistry is higher than their unqualified counterparts. This means that teachers' qualification has some difference in the mean ratings in favor of qualified chemistry teachers.

Ho₂: There is no significant difference between qualified and unqualified chemistry teachers' level of utilization of ICTs for teaching Chemistry;

Table 4. Independent t-test Comparing qualified and unqualified teachers' Responses on utilization of ICT resources in Teaching Senior School Chemistry

Gender	N	Mean	SD	Df	Cal. T	p-value	Remark
Qualified	199	3.21	1.02	248	0.43*	0.01	Sig.
Unqualified	51	1.89	0.96				

* Sig. at $p < 0.05$

Table 4 presents the independent t-test results on the difference between qualified and unqualified teachers' level of utilization of ICT resources in teaching senior school chemistry. The Table shows that at a Degree of Freedom (df) of 248, the hypothesis is statistically significant (Cal. $t = 0.43$; $p = 0.01 < 0.05$); hence, the hypothesis is rejected. Therefore, there is a significant difference between qualified and unqualified teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara State, Nigeria.

Research Question 5: There is no significant difference between high-experience, moderately experienced, and less-experienced teachers' level of utilization of ICT resources for teaching Chemistry.

Table 5 revealed the Mean and standard deviation of teachers' teaching experience influence on the utilization of ICT resources. The results in Table 7 show that less experienced chemistry teachers have an overall mean of 2.92, while moderately

experienced chemistry teachers have an overall mean of 2.84 and highly experienced chemistry teachers have an overall mean of 1.92. Therefore, less experienced chemistry teachers' mean utilization of ICT in teaching chemistry is higher than other levels of experienced teachers. This means to some extent that teachers' teaching experience has some influence on the mean rating in favour of less experienced chemistry teachers.

Table 5. The mean and standard deviation of teachers' teaching experience influence the utilization of ICT resources

Teachers Qualification	N	Mean	SD
Less Exp	91	2.92	0.95
Moderately Exp	116	2.84	1.01
Highly Exp	43	1.92	0.78

Ho₄: There is no significant difference among highly experienced, moderately experienced, and less experienced teachers' utilization of ICT resources in teaching senior school chemistry in Kwara State, Nigeria.

Table 6. One-Way ANOVA Comparing Respondents' level of utilization of ICT resources in Teaching Senior School chemistry Based on Teaching Experience

Sources	Sum of Squares	Df	Mean Square	Cal. F	p-value	Remark
Between Groups	291.720	2	145.860	1.67*	0.024	Sig.
Within Groups	6808.474	248	39.584			
Total	7100.194	250				

* Sig. at $p < 0.05$

Table 7 presents the ANOVA results on the difference among teachers' level of utilization of ICT resources in teaching senior school chemistry based on teaching experience. The Table shows that at Degrees of Freedom (df) of 2 against 248, the hypothesis is statistically significant (Cal. F = 1.67; $p = 0.024 < 0.05$); hence, the hypothesis is rejected. Therefore, there is a significant difference between highly experienced, moderately experienced, and less experienced teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara state, Nigeria. The Sheffe posthoc test is thus performed (in Table 8) to determine the teachers' category of experience that contributes to the difference observed in their perception of ICT integration in teaching Physics.

Table 7. Sheffe Post-Hoc to Determine the Respondents' Category of Teaching Experience that Contribute to the Observed Difference in their utilization of ICT resources in Teaching Senior School Chemistry

Teaching Experience	N	Subset for alpha = 0.05	
		1	2
11 years & above	43	1.92	
5-10 years	116	2.84	
0-4 years	91		2.92
Sig.		.134	.012

The Sheffe post hoc homogeneous subsets table shows which groups of the respondents' qualifications have the same mean and which ones have a different mean. Table 8 shows that the highly experienced (11 years and above) and moderately experienced (5-10 years) groups are in subset 1 and the less experienced (0-4 years) group is in subset 2. Within a subset there is no significant difference; while between subsets there is a significant difference. There is no significant difference between highly experienced and moderately experienced groups; while both of these groups are significantly different from the groups in subset 2. Hence, chemistry teachers with less teaching experience contributed to the observed difference in the respondents' level of utilization of ICT resources in teaching senior school chemistry.

Discussion

The result of the study revealed that out of 25 ICT resources identified for teaching chemistry, 14 were available while 11 were not available. The ICT resources that were available included; Audiotapes, computers, photocopy machines, WebQuest, Computer Assisted Learning (CAL), and Microsoft Office. While, the ICT resources not available were a Multimedia projector, Interactive radio, tablet, google Talk, video conferencing, and interactive whiteboard. The findings from the study conform with the findings of Ahmed, Abimbola, Omosewo, and Akanbi (2012), Ahmed et al (2017), and Okoye and Onwuachia (2012) who point out that ICT resources such as telephone, satellite, e-mail, Internet and world wide web are not available in the schools in reasonable numbers. The study also revealed that many of the available ICT resources were rarely utilized among chemistry teachers while most of the chemistry teachers do not utilize ICT resources for teaching chemistry. The finding from the study shows that the few available ICT resources are rarely utilized and this is in agreement with the findings of Onasanya, Shehu, Ogunlade, and Adefuye (2011); who reported that the extent of science teachers' utilization of ICT infrastructure is low in Oyo and Abia States respectively. Also, this work collaborates with the findings of Igboegwu, Egolum, and Nnoli (2011) who found out, that most senior secondary school chemistry teachers in Anambra State were not using ICT facilities for their teaching and learning chemistry.

The finding from the study revealed there is a significant difference between male and female teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara State. The finding disagreed with the study carried out by Fakomogbon, Olarewaju and Soetan (2015) which showed that there was no significant difference between the use of

instructional media between male and female teachers. There is a significant difference between qualified and unqualified teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara State. Teachers' academic qualification influences teachers' level of utilization of ICT resources in teaching chemistry in favor of qualified teachers. The finding agreed with Olagunju and Abiona (2008) revealed that qualified teachers' level of utilization of ICT in teaching is higher than that of the less qualified teachers.

Findings from the study also revealed that there is a significant difference between highly experienced, moderately experienced, and less experienced teachers' level of utilization of ICT resources in teaching senior school chemistry in Kwara state. The finding agreed with Findings on the relationship between teaching experience and ICT use which shows that teachers' years of teaching experience relate to ICT use in teaching (Tezci, 2009; Rahimi & Yadollahi, 2010). This implies that the higher the teacher's experience on the job, the lesser the use of ICT in teaching. Abdul-Salaam (2010) found that teachers' experience has a significant positive influence on their level of utilization of ICT for teaching as most of the experienced teachers do not know how to integrate ICT into their classroom activities, since experienced teachers resort to the use of the traditional chalk-talk method.

CONCLUSION

The study concluded that most of the ICT resources identified were not available in the sampled schools while only a few were rarely utilized. The study also concluded that teacher variables such as gender, academic qualification, and teaching experience significantly influence teachers' utilization of ICT resources for teaching chemistry in Kwara state, Nigeria. Based on the findings from the study, the following recommendations were made;

1. Government at various levels should ensure adequate funding to provide ICT resources in senior secondary schools and indeed, at the other levels of education as contained in the national policy on education.
2. Chemistry teachers should be more committed to their teaching job by utilizing the available ICT resources in teaching chemistry.
3. Chemistry teachers should endeavor to attend seminars, conferences, and workshops to update themselves on global best practices for effectively using Information and Communication Technology resources in teaching chemistry.
4. Teachers' variables such as gender, qualification, and teaching experience should be considered when sensitization is done on the need for utilization of ICT resources for teaching chemistry in secondary schools in Kwara state.

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Information about the authors

Abdullateef Olayinka Hamza – University Ilorin-Nigeria. E-mail: princeadelekm@gmail.com

Akindeyi Luwoye– University Ilorin-Nigeria.

Bilkisu Aliyu Suleiman – University Ilorin-Nigeria.

Adekunle Solomon Olorundare – University Ilorin-Nigeria.