

Knowledge and Attitude of Chemistry Teachers to Information and Communication Technology (ICT) for Effective Teaching and Learning of Chemistry in Secondary Schools

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Abstract

The study investigated the knowledge and attitude of chemistry teachers to Information and Communication Technology (ICT) for effective teaching and learning of chemistry in secondary schools. Using a descriptive survey design, a sample of 105 chemistry teachers comprising 31 male and 74 female teachers which were randomly selected from 39 government-owned secondary schools in Anambra State, Nigeria were used. A validated questionnaire was used for data collection. Data collected were analyzed using both descriptive and inferential statistics. The result revealed that majority of the teachers have low knowledge of information and communication technology and there is no significant gender difference between male and female chemistry teachers attitude towards information and communication technology. Therefore, it is recommended that the government and the stakeholders in the field of education should integrate ICT into the curriculum and organize workshops and training for teachers to enhance the quality of teachers for realization of the Nation's Education vision.

Keywords: Knowledge, Attitude, Chemistry Teachers, ICT, Teaching and Learning, Chemistry.

Introduction

There is evidence that technology is no longer a thing of the-future in Nigeria but a part of the present. Technology has brought about quantitative and qualitative changes in the life of everyone in the society (Ebenezer, 2015; Wole, 2015). The use of information and communication technology (ICT) into the teaching and learning process within, and out of the school system has brought significant improvement not just in the rate of knowledge acquisition and dissemination but, also in the level of the quality of product (Audu, 2018; Abimbade, 2016). New technologies have brought about an increase and wide variation in access to information and means of communication. These technologies have considerable influence on education processes both in school and in the society as a whole (Audu, 2018, Abimbade, 2016). The integration of information and communication technology into Nigeria school curricula particularly in the secondary schools has been the topic much debated since 1988. The government has tried to implement series of measures aimed at ensuring that the secondary school teachers and students have adequate training to enhance their acquisition of minimal competencies in the pedagogical use of information (National Policy on Education, 2022). In other words, basic education is necessary for an individual to gain the capacity and capability to access and apply ICT to its daily use. Such ability and capacity will make them to find bearing in the use of ICT in global village.

Presently, there has been a considerable impact of ICT development on almost every aspect of society in such a way that there is hardly any area that the citizenry find themselves without the application of ICT (Ogunyemi and Adebajo, 2016). According to Ololube (2026) Information and Communication Technologies (ICTs) are indispensable and have been accepted as part of the contemporary world especially in the industrialized societies. The importance of ICT has brought about rapid changes in technology, social; political and global economic transformation. Information and communication technology have impacted on the quality and quantity of teaching, learning and

research education. ICT provides opportunities for students, teachers, academic and non-academic staff to communicate with one another more effectively during formal and informal teaching and learning.

Yusuf (2025) said that teachers need training in the application of various kinds of educational software in teaching and learning. They also need to learn how to integrate ICTs into the classroom activities and school structure. The need for quality teachers is known in virtually all spheres of life to be the key predictor of students learning. Therefore, teacher training is crucial in using ICTs because ICTs are tools that can facilitate knowledge by helping the teachers to take full advantage of the potentials of technology to enhance students learning (UNESCO, 2023). ICT have opened a new dimension in conventional methods of teaching and offering new teaching and learning experience to both teachers and students.

Enwereonye (2014) opined that education in whatever form it takes, is not complete without effective ICT. This means that ICT should be properly rooted in both primary, secondary and tertiary schools curriculum so that the level of literacy will be increased with regard to the use of ICT. Akubuilu and Ndubuisi (2023) viewed ICT as a process which provide link between levels of teachers and enable information instruction and decision to be conveyed from their point of origin to all those who need to be informed, that is, the students. To do this, the teacher has to exhibit the use of ICT so that they will have right attitude towards the use of ICT in teaching and learning of their subjects in the classroom. The use of ICT in education opens a new area of knowledge and offers a tool that has the potential to change some of the existing educational methods and classroom environment. The teacher is the key to the effective exploitation of this resource in the educational system, because the use of ICTs in educational system is like using instructional materials which brought about enrichment in the level of knowledge acquisition in classroom teaching (Olagunju, 2013). The use of ICT in teaching of school subjects will arouse the knowledge as well as the interest of the students, thereby, making learning more meaningful and real to the learners.

Attitude, according to Seifert (1991) is the acquisition of certain feeling about something or somebody, either positive or negative that influences his/her choice of action in a consistent way. In other words, attitude of chemistry teachers towards ICT could be seen as the way of thinking or behaving towards ICT. This may be as a result of the training they have acquired or exposed to from their institution of training. There has been a consistent effort in many countries to promote an ICT teachers/learners empowerment culture (Simpson; Munro and Hughes, 1999). In, Nigeria, studies have shown that many teachers are far from being literate in information and communication technology not to talk of enjoying the benefits offered by this modern technology. Akudolu (2022) said that over 85% of teachers in Nigeria are still illiterate in ICTs, it is obvious that such teachers will find it extremely difficult to deliver the appropriate education and training demanded by the information age of the 21st century for their students. Presently, computers are being introduced and supplied to most secondary schools to initialize the impression and expectation of the public about computer education with a great effort in the teaching and learning environment; it is a great task for chemistry teachers to have knowledge of ICT before they can teach in the classroom with these computers.

It is on this background, that the researcher deemed it necessary to investigate the knowledge and attitude of chemistry teachers to information and communication technology for effective teaching and learning of chemistry.

Research Questions

Four research questions guided the study:

1. What is the level of chemistry teachers' knowledge of information and communication

technology usage in education?

2. What is the general attitude of chemistry teachers to the use of information and communication technology in teaching and learning of chemistry?
3. Is there any difference between male and female chemistry teachers' knowledge on the use of Information and Communication Technology in education?
4. What is the difference between male and female chemistry teachers attitude to the use of information and communication technology in teaching and learning of chemistry.

Hypotheses

Two null hypotheses were tested at significance level of 0.05.

Ho₁: There is no significant difference between male and female chemistry teachers knowledge on the use of information and communication technology.

Ho₂: Male and female chemistry teachers attitude do not differ significantly to the use of information and communication technology.

Method

A descriptive survey research design was adopted. All the two hundred and fifty eight (258) government-owned secondary schools in six education zones of Anambra State formed the population of the study. Thirty nine (39) secondary schools were selected through stratified random sampling. One hundred and five (105) chemistry teachers from the selected secondary schools which comprised of 31 male and 74 female teachers formed the sample. A questionnaire tagged (KACTITO) designed by the researchers which had three sections was used to collect data. The validated 30-item questionnaire was administered to the chemistry teachers. Section A, sought information on personal data of the respondents which include, sex, school, rank and education zone.

Section B consisted of twenty (20) items on knowledge about information and communication technology and its usage in teaching, while section C consisted often (10) multiple choice items which dwelt on the attitude of chemistry teachers towards information and communication technology for teaching and learning of chemistry. 4 - Point scale ranging from Strongly agree (SA), Agree (A), Disagree (D) and Strongly disagree (SD) indicated the teachers level of agreement on section C. In section B teachers that scores between 0-10 marks are graded low and 11-20 marks are graded high. These scores were converted to percentages.

Kuder - Richardson's 20 formular for reliability coefficient was used to find out the reliability of the instrument and a coefficient of 0.92 and 0.82 were obtained for knowledge test and attitude scale respectively. Percentage frequency, mean, standard deviations and z-test were used for data analysis.

The results were presented according to research questions in tables 1, 2, 3 and 5 while hypotheses were presented in tables 4 and 6.

Results

Table 1: Chemistry teachers' knowledge level of information and communication technology usage in education

Score Range	Number of Subjects	Percentage (%)
0-10	81	77.1
11-20	24	22.9

Table 1 reveal that eighty one (81) chemistry teachers representing 77.1% of the teachers scored between "Zero to ten" (0 - 10) on questions for chemistry teachers' knowledge of information

and communication technology.

This indicates that the senior secondary school chemistry teachers have very low knowledge of information and communication technology, while twenty four (24) chemistry teachers' representing 22.9% scored between eleven and twenty (11 - 20) were rated high in knowledge of information and communication technology. The implication is that the majority of chemistry teachers in senior secondary schools (Anambra State) have little knowledge of information and communication technology (ICT).

Table 2: Mean Rating of Chemistry Teachers' Attitude to the use of Information and Communication Technology (ICT).

Attitude Scale	Number of Subjects	Mean	Standard deviation
Positive	87	13.76	4.07
Negative	18	4.73	1.21

The result in table 2 reveal that majority of the chemistry teachers with a mean of 13.76 and standard deviation of 4.07 falls within the positive attitude to the use of ICT on attitudinal scale, while others with mean 4.73 and standard deviation of 1.21 fall within the negative attitude to the use of ICT on attitudinal scale. This implies that the sampled chemistry teachers generally have positive attitude to the use of ICT- in teaching and learning of chemistry.

Table 3: Overall mean and standard deviation scores of male and female chemistry teachers' knowledge of the use of ICT in education

Gender	Number of Subjects	Mean	Standard Deviation
Male	31	27.22	12.24
Female	74	16.56	12.56

From table 3, the knowledge of the use of ICT in education of male chemistry teachers' is high compared to that of the females. With a mean score of 27.22 and standard deviation of 12.24, the males out performed the females who had a mean score of 16.56 with standard deviation of 12.56. The finding indicates that the low knowledge level on the use of ICT of the chemistry teachers may have been greatly influenced by the female chemistry teachers'.

Table 4: Z - Test on Comparison of Mean scores of male and female chemistry teachers' knowledge of the use of ICT in education

Gender Categories	Number of Subjects	Mean Score	SD	df	Z-cal	Z-Crit	Alpha
Male	31	27.22	12.24	103	2.076	1.960	0.05
Female	74	16.56	12.56				

From table 4, the comparison of male and female chemistry teachers knowledge of the use of ICT in education mean score reveal that male teachers have higher knowledge of the use of ICT in education (27.22) than their female counterparts who has a mean of 16.56. z-calculated value is higher than the z-critical at 0.05 level of significance, hence, the null hypothesis was rejected. This is in agreement with the findings of Olagunju (2013); Igboegwu (2010) who reported that male subjects showed greater knowledge of information and communication technology.

Table 5: Overall Mean and Standard deviation scores of Male and Female Chemistry Teachers' Attitude to the use of ICT in Teaching and Learning of Chemistry

Gender	Number of Subjects	Mean	Standard Deviation
Male	31	23.14	11.06
Female	74	22.58	9.15

Table 5, reveal that the male chemistry teachers' attitude to the use of ICT in teaching and learning of chemistry had a mean score of 23.14 with SD score of 11.06 while female chemistry teachers had a mean score of 22.58 with SD score of 9.15.

Table 6: Z-test on Comparison of Mean scores of Male and Female Chemistry teachers' Attitude to the use of ICT in teaching and learning of chemistry

Gender Categories	Nember of Subjects	Mean Score	SD	df	Z-cal	Z-Crit	Alpha
Male	31	23.14	11.06	103	0.123	1.960	0.05
Female	74	22.58	9.15				

From table 6, the Z-calculated is less than z-critical, hence, the null hypothesis of no significance difference between the mean scores of male and female chemistry teachers' attitude to the use of ICT in teaching and learning of chemistry is accepted. Therefore, there is no significant difference between male and female chemistry teachers' attitude to the use of ICT in teaching and learning of chemistry.

Discussion

The major focus of this study is to assess the knowledge and attitude of chemistry teachers to information and communication technology for effective teaching and learning of chemistry in senior secondary schools. From the findings of the study, it was observed that generally chemistry teachers' knowledge of ICT is very low, although they have a positive attitude towards the use of ICT in teaching and learning of chemistry. From this, it is obvious that if chemistry teachers are equipped with ICT materials they will probably have a high knowledge of ICT for teaching and learning activities.

The findings of this study is however in support with the findings of Akudolu (2022) and Yusuf (2025), that most school teachers lack the skills and literacy to fully utilize the ICT and other common softwares. It is also in line with the findings of Newhouse (2022), that most teachers irrespective of the level of education have minimal ICT literacy.

The findings of this study on positive attitude to the use of ICT in teaching and learning is in line with the finding of Adebayo (2019) and Yusuf (2015) that teachers exhibited great enthusiasm on positive attitude towards the use of ICT in teaching and learning and also that teachers are favourably disposed of using ICT in classroom instruction.

The findings of this study on gender attitude to the use of ICT in teaching and learning disagrees with the findings of Olalere (2015) who indicated that large number of male teachers are seriously concerned about the integration of ICT into the instructional process, but in agreement with the findings of Ololube (2026) who found no significant difference between the mean attitude of male and female teachers towards the use of ICT in teaching.

Conclusion

It was concluded that most senior secondary schools chemistry teachers in Anambra State were not using information and communication technology (ICT) facilities for their teaching and learning. Therefore, majority of these schools do not integrate information and communication technology (ICT) programmes into their teaching and learning process irrespective of the fact that computer systems have been supplied to most of these schools. This shows that the teachers have little or no knowledge of ICT, even though they show positive attitude to ICT and good interest in it.

Recommendations

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

1. Government and other stakeholders in the field of education should organize training, seminars, conferences and workshops to boost the knowledge of ICT in order to equip these teachers.
2. Government and other stakeholders in the field of education should make ICT facilities available to chemistry teachers to use for instructional purposes. Since teachers are interested in ICT.
3. Government should endeavour to equip all secondary school teachers with laptop and some of the ICT materials at subsidized rate, to enhance their teaching in the classroom. It is expected that this will later help in boosting the standard of education.

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