UNDERSTANDING AND ATTITUDE OF CHEMISTRY TEACHERS TO ICT TOOLS FOR TEACHING AND LEARNING OF CHEMISTRY IN IMO STATE

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Abstract
This study evaluated the understanding and attitude of chemistry teachers toward the use of ICT tools for teaching and learning chemistry in secondary schools in Imo State. Using a descriptive survey research design from a population of 250 chemistry teachers, a sample of 100, consisting of 50 males and 50 female teachers, was randomly selected to form the sample group. Five research questions and two null hypotheses guided the study. A structured questionnaire that was titled "Understanding and Attitude of Chemistry Teacher on ICT Tools" (UACTICT) was used for data collection. The instrument adopted a 4-point Likert scale and was validated by three education experts from the Department of Science and Environmental Education at the University of Abuja. The instrument reliability coefficient was 0.81 for understanding and 0.72 for attitude, which was established using the Cronbach alpha reliability coefficient correlation. A face-to-face administration of the instrument was used by the researchers to ensure a 100% return. The data obtained were analyzed using mean and standard deviation to answer the research questions, while the null hypothesis was tested using a t-test at the 0.05 level of significance. The results showed, among others, that chemistry teachers have low understanding of ICT tools and there is no significant gender difference between male and female chemistry teachers' attitudes towards ICT integration in chemistry teaching. Therefore, it was recommended based on the findings that the government and stakeholders in education should integrate ICT into the curriculum and organize training/workshops for teachers for effective utilization of ICT tools for chemistry teaching.
Keywords: Chemistry Education, Understanding, Attitude, Information Communication and Technology

Introduction

Information Communication and Technology (ICT) education provides students with the basic knowledge and skills required for computing, use of communication devices, software that operates them, applications that run on them, and systems that are built with them (Ezeliora, 2019; Muhammed, 2021). According to Chen and Kee (2005), as cited in Olugbemi, Idowu, and Popoola (2018), Information and Communication Technology (ICT) is the backbone of the knowledge economy and in recent years has been recognized as an effective tool for promoting economic growth and sustainable development. Attitude is a predisposition or a tendency to respond positively or negatively towards an activity. Attitude is concerned with choice or preference for a particular type of activity to the other (Peter & Abot 2021). According to Bola (2008) in Peter and Abot (2021), right attitude toward an activity or subject can be sustained depending on what the individual whose interest is engaged stand to gain or lose by so doing. When teachers and students have the right attitude toward teaching and learning, they would spend their free time studying the subject. But researchers over the year observed that when teachers have negative attitude to teaching, they will lack motivation for instruction but positive attitude means motivation for work. Some examples of ICT usage include sending and receiving email, writing and publishing blogs, watching videos online, evaluating the credibility of a source and searching for information on a given topic of interest. According to Rao (2000) cited in Olotu (2016), the needed skills for effective use of ICT tools include having a working knowl

edge of computer, good classroom management skills relating to control and use of equipment, competence in using computer hardware and software and ability to select suitable software. Sc ience teachers' understanding of ICT tools can be applied in the use of power point for teaching, obtaining information from the internet, use of digital tools like word drive, kielikompassi, AI c hatbots/Al based personalization, gamified platforms, e-portfolios, speech recognition and use of computer software in many science topics.

In order to improve the quality of science and technology education in Nigeria, there is need for total reform in area of method of teaching. The integration of ICT in teaching and learning will enhance the quality of learning in science, change the pedagogical approach of teaching and im prove learners' learning outcome. Hence, teachers' understanding of digital literacy in the 21st c entury cannot be overlooked in order to improve the performance and achievement of science st udents at senior secondary educational level. Tedla (2021) inves tigated on ICT based learning schools to assess the challenges on implementation of functional and effective ICT learning. Author reported that ICT based learning significantly changed the r ole of teachers from transferring knowledge to facilitation of learning and equally from that of main resource person to that of manger of learning. In a similar study by Olugbemi, Idowu and Popoola (2018) to assess the attitude of students toward ICT integration in science education an d its economic challenges in FCT College of Education Zuba, the researchers reported that stud ents had positive attitude towards the use of ICT tools in science education. The finding also ide ntified cost of access and lack of technical knowledge among others as the economic challenges facing the use of ICT in FCT College of Education Zuba-Abuja. The authors reported that there was no significant difference between male and female students' attitude towards ICT integrati on in science education. Therefore, it is imperative to assess this study in line with teachers' und erstanding, utilization and attitude to the use of ICT.

The study of Daura (2020), on effects of using computers for data collection and analysis by chemistry teachers showed that there was a significant differ ence in academic achievement and attitude. Rivers and Vockel (2019), also reported in their stu dy that teachers use of Computer Assisted Learning (CAL) enhanced students' active involvem ent in the learning process and facilitated their practice and mastery of concepts and principles i n chemistry, which implies that use of computer helped students to meet their learning objective s.

Statement of the Problem

The self arner centered teaching approach can be integrated with Information, Communication and Tech nology (ICT) to inculcate the science process skills to the learners and help to modernize scienc e education through digital technology. Unfortunately, many science teachers adopt the convent ional teacher centered method which has resulted in poor students' performance. The role of IC T in science education cannot be overemphasized. The integration of ICT will promote digital li teracy and learner center teaching. This will be possible when schools are equipped with digital classrooms, interactive whiteboards, e-learning facilities and high-speed internet.

Despite the relevance of science subjects in national develop ment, the performance of students in external examination has not improved. It has been observ ed that one of the causes of poor performances in science subjects is lack of use of new technolo gical teaching strategies in learning (Okoroafor, 2020; Njoku & Emeh, 2020; Emmanuel, Chiak a & Edna 2024). The task of choosing appropriate teaching method in combination with adequa te and compatible teaching aid has always remained a challenging task even to the most skillful teacher. This task has always made the teaching of chemistry to be teacher centered as against t he learner centered approach.

However, there are inherent problems militating against the effective utilizati on of ICT in teaching and learning. There is the problem of teacher's incompetence in the use of

ICT facilities and lack of digital literacy. ICT resources cannot operate without constant power supply. Inadequate funding for ICT development by stakeholders is another problem. The curri culum is another challenge because chemistry curricula content does not accommodate global b est practices on integration of ICT into science teaching. The lack of readily available and functi onal e-learning facilities hampers the efficient process of science education among teachers and students. Therefore, in order to adopt science and technology as the bedrock for national develo pment, there is need to examine the level of understanding and attitude of chemistry teachers in Imo state on the use of ICT tools for effective chemistry teaching and learning.

Purpose of the Study This study is to evaluate the teachers' level of understanding and utilization of ICT tools in Imo State for teaching and learning of chemistry. In addition, it will offer insight into whether the use of I CT tools is effective in enhancing the attitude of teachers towards chemistry teaching. It aimed at achieving the following objectives;

i. To determine the level of understanding of teachers on ICT tools and its utilization for e ffective chemistry teaching in Imo state.
ii. To find out the attitude of chemistry teachers toward the use of ICT tools in teaching and learning of chemistry in Imo state
iii. To determine the challenges in using ICT tools for effective chemistry teaching In Imo State.
iv. To find out the difference between male and female chemistry teachers' understanding on the use of ICT in teaching and learning of chemistry in Imo state
v. To examine the difference between male and female chemistry teachers' attitude toward the use of ICT in teaching and learning of chemistry in Imo state.

Research questions The following research questions guided the study,

1) What is the level of chemistry teachers' understanding and utilization of ICT tools in chemis try teaching in Imo state?
2) What is the attitude of chemistry teachers toward the use of ICT in teaching and learning of chemistry in Imo state?
3) What are the challenges in using ICT tools for effective chemistry teaching?
4) What is the mean difference between male and female chemistry teachers' understanding o n the use of ICT in teaching and learning of chemistry in Imo state?
5) Is there any difference between male and female chemistry teachers' attitude on the use of I CT tools in teaching and learning of chemistry in Imo state?

Hypotheses

Two null hypotheses were used to provide answers at significance level of 0.05;

HO_1: There is no significant difference in the mean understanding rating of male and female ch emistry teachers on the use of ICT for chemistry teaching and learning

HO_2: There is no statistically significant difference in mean attitude rating of male and female c hemistry teachers on the use of ICT in chemistry teaching and learning.

Methodology

A descriptive survey research design was used for the study. This study was carried out in Imo state. The population covered the entire 250 public secondary schools in five educational zones.

Fifty (50) secondary schools were selected through stratified random sampling technique and 100 chemistry teachers from the selected schools consisting of 50 males and 50 females were via simple random sampling technique picked to form the respondents.
The instrument for data collection was structured questionnaire adopted on a 4-point Likert type scale which was weighted as follows: Strongly agreed (SA) =4, Agree (A) =3, Disagree (D) =2, Strongly disagree (SD) =1. The questionnaire was developed by the researchers and tilt ed "Understanding and Attitude of Chemistry Teachers on ICT tools (UACTICT)". The questio nnaire had three sections. Section one sought information on biodata of the respondents like sex rank, years of experience. Section two consisted of seven (7) items on level of understanding of Information, Communication and Technology (ICT) and its usage in chemistry teaching, while section three comprised of 7 items on the attitude of chemistry teachers toward ICT for teaching and learning of chemistry. The Instrument was validated for face and content reliability by two science educators and one specialist in measurement and evaluation from Imo State University Owerri. The comments and suggestions of the experts were incorporated in building up the final draft of the instrument. The instrument was trial tested on thirty-five (35) chemistry teachers fro m seven secondary schools in FCT Abuja. The results were used to determine the reliability of t he instrument using Spearman Brown correlation coefficient, which gave a reliability index of 0.81 for understanding test and 0.72 for attitude scale respectively. These values were consider ed reasonably high, hence indicating that the questionnaire was adequate and reliable for the stu dy. The developed questionnaire was administered and collected from respondents with 100% r etrieval via face-to-face method at WASCE 2024 marking centers. Data collected were analyze d in line with the research questions formulated to guide the study. Mean and standard deviation were used to provide answers to the research questions. The criterion mean value of 2.50 and ab ove were regarded as acceptance or agreement while, mean values less than 2.50 were regarded as rejection or disagreement. The null hypotheses were tested using t-test at 0.05 statistical level of significance.

Results

Research question one: What is the level of chemistry teachers' understanding and utilization of ICT tools in chemistry teaching in Imo state?

Table 1: The mean and standard deviation of chemistry teachers' level of understanding a nd utilization of ICT tools.

S/N	ITEM STATEMENTS	MEAN	SD	DECISION
1	I effectively use Internet for browsing/networking.	1.90	0.72	Disagree
2	I can use google to search for information.	1.60	0.64	Disagree
3	I use students' email to send assignment to them.	1.30	0.50	Disagree
4	Use power point slide, multimedia, interactive white boards during chemistry teaching.	1.20	0.44	Disagree
5	Manage students' assessment reports using micro so ft word processor.	3.50	1.66	Agree
6	Prepare students exam scores using excel spread she et.	3.60	1.98	Agree
7	Organize chemistry practical via CAL and AI tools.	1.40	0.56	Disagree

Average mean	**2.07**		**Disagree**

Table 1 presents the mean response on level of understanding and utilization of ICT tools by ch emistry teachers. From the Table most of the teachers' responses were low on items 1, 2, 3, 4 an d 7 on their level of ICT understanding and utilization, while item 5 and 6 was high. However, t he grand mean of 2.07 revealed that chemistry teachers' understanding level and utilization of I CT tools was low. This means many do not use internet, microsoft applications, google to searc h for information, email/Facebook, zoom/telegram and do not organize chemistry practical via computer assisted lesson and artificial intelligence.

Research question two: What is the attitude of chemistry teachers toward the use of ICT tools i n teaching and learning of chemistry in Imo state?

Table 2: Mean and standard deviation of chemistry teachers' attitude toward the use of I CT tools.

S/N	ITEM STATEMENTS	MEAN	SD	DECISION
1	Am willing to use ICT facilities and modern instructional material if available.	2.80	1.89	Agreed
2	Acquisition of computer/laptop for teaching if given subs idy.	2.70	1.86	Agreed
3	Am willing to attend digital pedagogy workshop for smar t school teacher.	2.90	1.88	Agreed
4	I use communication tools like smart phone in lesson pre paration.	2.60	1.81	Agreed
5	I will love to have a hand-on training at the digital resour ce center (DRC).	2.75	1.80	Agreed
6	I usually upload students results and assignment with m y personal computer	2.79	1.85	Agreed
7	With access to connectivity, I will use internet search too ls to get resource materials for teaching.	3.34	1.39	Agreed
	Average mean	**2.84**		**Agreed**

From Table 2 all the items on attitude of teachers toward the use of ICT had mean scores above 2.50. This means that chemistry teachers in Imo State had positive attitudes toward the use of IC T tools in chemistry teaching and learning since the overall mean of 2.84 was above the criterio n mean of 2.50.

Research question three: What are the challenges in using ICT tools for effective chemistry te aching?

Table 3: The mean and standard deviation of challenges in using ICT tools for effective ch emistry teaching

S/N	ITEM STATEMENTS	MEAN	SD	DECISION

1	Lack of technical skills for digital literacy.	3.28	0.90	Agreed
2	Internet facilities are available in my school.	1.47	0.51	Disagreed
3	High cost/funding issues and lack of affordable ICT tool s.	3.35	0.60	Agreed
4	Poor electricity supply.	3.48	0.85	Agreed
5	There is an equipped ICT laboratory in my school.	1.44	0.50	Disagreed
6	Poor school management /organization on ICT tools.	3.82	0.76	Agreed
	Average	**2.81**		**Agreed**

Table 3 shows that item statements numbers 1, 3, 4 and 6 on challenges facing the use of ICT to ols in teaching had a mean greater than the decision mean of 2.50. Since the Table mean of 2.81 is greater than 2.50, it can be concluded that the respondents are in agreement with the items on the challenges listed above. However, items number 2 and 5 mean rating was below 2.50 meani ng disagreement. This revealed that chemistry teachers in Imo state are faced with the above ch allenges in the utilization of ICT facilities for effective chemistry teaching.

Research question four: What is the difference between male and female chemistry teachers' understanding on the use of ICT tools in teaching and learning of chemistry in Imo state?

Table 4: Overall mean and standard deviation of male and female chemistry teachers' un derstanding on the use of ICT tools in teaching and learning of chemistry in Imo state

Gender	N	Mean	SD	Mean Difference
Male	50	2.20	0.75	0.13
Female	50	2.33	0.60	

From Table 4, the understanding on the use of ICT by male teachers had a mean of 2.20 with sta ndard deviation of 0.75, while female teachers had a mean value of 2.33 with standard deviation of 0.60. This gave a mean difference of 0.13 showing that there is no gender disparity on the un derstanding and utilization of ICT tools in chemistry teaching.

Research question five: Is there any difference between male and female chemistry teachers' a ttitude on the use of ICT tools in teaching and learning of chemistry in Imo state?

Table 5: Overall mean and standard deviation of male and female chemistry teachers' atti tude on the use of ICT tools in teaching and learning of chemistry in Imo state

Gender	N	Mean	SD	Mean Difference
Male	50	2.90	0.76	0.12
Female	50	2.78	0.81	

The result from Table 5 on chemistry teachers' attitude toward the use of ICT tools revealed that male teachers had a mean attitude value of 2.90 and standard deviation of 0.76. Female teachers

had mean value of 2.78 with standard deviation of 0.81. The mean attitude difference was 0.12 indicating equality relative to gender toward ICT though in the positive direction.

Hypotheses Testing

HO_1: There is no significant difference between male and female chemistry teachers' understanding on the use of ICT for chemistry teaching and learning

Table 6: T-test analysis of male and female chemistry teachers' understanding on the use of ICT for chemistry teaching and learning.

Source of variation	N	Mean	SD	Df	t-calculated	t-critical	Decision
Male	50	2.20	0.75	98	0.94	1.98	Not Significant
Female	50	2.33	0.60				

The analysis on Table 6 was carried out to determine whether male and female chemistry teachers differed significantly in their level of understanding on the use of ICT for chemistry teaching and learning. From the Table the calculated t-test value of 0.94 was less than the critical t-value of 1.98 at 0.05 level of significance hence, the hypothesis was accepted. This implies that there was no significant difference between male and female teachers' level of understanding on the use of ICT in chemistry teaching and learning in Imo state. Both genders had equal low understanding on the use of ICT tools in science education. This is in line with the findings of Osakwe (2020) who reported no significant difference in the perception and utilization of male and female teachers on use of ICT in education.

HO_2: There is no statistically significant difference in mean attitude rating between male and female chemistry teachers toward the use of ICT in chemistry teaching and learning in Imo state.

Table 7: T-test analysis of male and female chemistry teachers' attitude toward the use of ICT for chemistry teaching and learning.

Source of variation	N	Mean	SD	Df	t-calculated	t-critical	Decision
Male	50	2.90	0.76	98	0.64	1.98	Not Significant
Female	50	2.78	0.81				

Table 7 shows the t-test analysis of male and female teachers' attitude toward the use of ICT for chemistry teaching and learning. The Table shows that the calculated t-test value of 0.64 was less than the critical t-value of 1.98 at 0.05 level of significance hence, the hypothesis was accepted. This is indicative of the fact that, there was no significant difference between male and female teachers' attitude toward the use of ICT in chemistry teaching and learning in Imo state. This is in line with the findings of Olugbemi *et al.,* (2018) who reported no significant difference in the attitude of male and female students on the use of ICT in education.

Discussion of Findings

The findings in Table 1 revealed a low-level understanding as well as utilization of ICT by chemistry teachers in Imo state. The cumulative mean of 2.07 is low and further analysis of the results shows that teachers do not use internet resources especially internet browsing and google. This might be due to inability to update their knowledge and acquire necessary skills relevant for d

igital competence and poor exposure of chemistry teachers to the use of internet, Microsoft appl ications, google and email for chemistry teaching and learning. This is contrary to Muhammed (2021) findings, who reported constant use of ICT software in private secondary schools in Imo state which enhanced the ICT understanding of the science teachers. However, there is a hi gh level of ICT understanding and utilization by chemistry teachers in the use of micro soft proc essor to manage students' assessment reports and prepare students' exam scores via excel sprea d sheet. This is attributed to the fact that both students and parent assess feedback on their ward performance via online. This finding is in agreement with that of Nwagu (2023) who reported th at constant use of ICT facilities and exposure to digital gadgets will enhance science teachers' l evel of utilization of digital tools for meaningful learning.

The results in Table 2 showed an average mean r ating of 2.84 which is an indication of agreement. This implies that chemistry teachers in Imo st ate have positive attitude toward the use of ICT tools in chemistry teaching. This could be attrib uted to their realization that digital tool like ICT has the powder to revolutionize science educati on and is a key to national development. This finding agrees with that of Oku (2022) and Ugwua nyi (2021) who separately reported that ICT usage can improve performance and development of relevant skills for digital preparedness of science teachers due the positive attitude of teacher to their utilization. This study is also related to that of Ugwu (2021) which reported that science teachers' utilization of the numerous technological strategies through research information hav e improvement on teaching and learning process. Table three r evealed that chemistry teachers are faced with several challenges in the use of ICT for effective chemistry teaching. The cumulative mean of 2.84 recorded is high, which shows that most of th e identified items are the challenges facing the use of ICT in science teaching. This corroborated with the findings of Akuwudike (2022), that lack of access to network connectivity, poor infrast ructural facilities and unqualified manpower are barriers to the use of ICT in chemistry teaching In like manner, Liverpool (2022), reported that the use of Information Communication and Tec hnology (ICT) approach in science teaching is an illusion because of shortage of expertise by te achers, overcrowded classrooms, teachers' lack of interest in adapting to new innovative strateg ies and insufficient supply of ICT facilities.

Summary of Findings

The summaries of the findings from this study are as follows:

1. Secondary school Chemistry teachers in Imo State have low understanding on the use of ICT tools for effective chemistry teaching and learning.
2. Chemistry teachers at secondary school level have positive attitude on the use of ICT to ols for effective chemistry teaching and learning.
3. There are a lot of factors challenging the use of ICT tools in chemistry teaching and lear ning.
4. There is no significant difference on the mean level of understanding between male and female chemistry teachers toward the use of ICT tools in chemistry teaching and learnin g.
5. There is no significant difference on the mean attitude rating between male and female c hemistry teachers toward the use of ICT tools in chemistry teaching and learning.

Conclusion

This study was carried out with the sole objective to investigate the understanding and attitude o f teachers toward the use of ICT in chemistry teaching and learning in Imo state. The world has become a global village and educational systems has undergone tremendous changes such that t eachers in Imo State should not lack behind. If ICT integration and utilization in teaching and le

arning activities is to be made enjoyable, chemistry teachers should be willing to upgrade their c omputer competency/digital literacy through training and retraining.
Therefore, it is imperative and incumbent on science teachers to not only adopt ICT but to ensur e the proper use of its facilities. Teachers of chemistry should ensure that they acquire the neces sary ICT competency skills that will foster their teaching of science and expose them to the glob al trend in scientific innovations. Finally, the researchers discovered that teachers in Imo state h ad positive attitudes toward the use of ICT in chemistry teaching and learning.

Recommendations

Instructional packages should be designed and developed to stimulate teachers' understanding and attitude on the use of ICT in science teaching and learning. The following recommendation s are hereby made based on the findings of this study.

1. Government should endeavor to equip all secondary school teacher with laptops and some of the ICT materials at subsidized rate.
2. School administrators should organize regular workshop for science teachers on computer appreciation and application to upgrade their ICT skills to be abreast with the world best p ractices.
3. There should be adequate infrastructure, constant supply of electricity, expand the access of schools to internet.
4. Science teachers should endeavor to improve themselves via training on digital pedagogy and instructional design.
5. Chemistry education curriculum planners should incorporate topics on the use of ICT to e nhance teachers' understanding to use of ICT in chemistry teaching and learning.

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