

EFFECTS OF INTEGRATION OF ICT IN THE TEACHING AND LEARNING OF
CHEMISTRY IN SOME SELECTED SECONDARY SCHOOLS IN CHANCHAGA LOCAL
GOVERNMENT AREA OF NIGER STATE.

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Abstract

We are living in the digital age and hardly can any aspect of human endeavour be effectively carried on without Information communication technologies (ICTs), education inclusive. ICTs are now at the center of education reform in line with the technological development of the 21st century. ICT-supported education can promote the acquisition of the knowledge and skills that will empower students for lifelong learning. The study was done in some selected Secondary Schools in Chanchaga Local Government Area of Niger State to assess the ICT facilities and infrastructure, to determine the Teacher's knowledge and skills in ICT and its application to establish how the schools get the ICT technical support that influences the use of ICT in teaching and learning of chemistry. Non-experimental descriptive survey design was used to establish the factors that influence the integration and the use of ICTs in teaching and learning chemistry. The target Schools were five (5) Secondary Schools. Stratified random sampling was used to allow full participation of the Schools. Twenty five (25) teachers in the Secondary Schools made up the target population. Five chemistry Teachers were randomly selected in each sample School to fill the questionnaire and four Principals were interviewed to represent each category of schools. Questionnaires, observation schedule and interview enabled the researcher collect data. The data collected was analyzed using statistical package for social sciences (SPSS). The study findings revealed that inadequate ICT infrastructure, limited ICT skills and training, limited access to technical support, lack of ICT policies in schools and budget constraints hinder the integration of ICT in teaching and learning chemistry in Secondary Schools. The Researcher recommends that the school administration should familiarize themselves with the national ICT policy so that they can develop School ICT policies of how to efficiently integrate ICTs in teaching and learning chemistry. The Government should also intensify ICT funding in Schools to help subsidize the high ICT costs and increase the number of computers in Schools.

Keywords: Teaching, learning, chemistry, information communication technology, integration

Introduction

Information and Communication Technologies (ICT) are electronic technologies used for information storage and retrieval. Development is partly determined by the ability to establish a synergistic interaction between technological innovation and human values. The rapid rate at which ICTs have evolved since the mid-20th century, the convergence and pervasiveness of ICTs, give them a strong role in development and globalization (Nwagwu, 2006). ICTs have a significant impact on all areas of human activity (Brakel and Chisenga, 2003).

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning, and research (Yusuf, 2005). A great deal of research has proven the benefits to the quality of education (Al-Ansari, 2006). ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; cited by Yusuf, 2005).

In a rapidly changing world, basic education is essential for an individual to be able to access and apply information. Such ability must include ICTs in the global village. The Economic Commission for Africa has indicated that the ability to access and use information is no longer a luxury, but a necessity for development. Unfortunately, many developing countries, especially in Africa, are still low in ICT application and use (Aduwa-Ogiegbean and Iyamu, 2005).

There are several topics in chemistry which required computational technique to learn and use of ICT enhance learning capacity of learner as well as facilitator. The present research deals with the use of ICT in some of the topics of chemistry. We tried to overcome from routine chalk and talk method to understand the several topics viz. stereochemistry, IUPAC naming and other organic chemistry topics. Although chalk and talk method has gained attention of the students but it has been found that using ICT to teach such topic of chemistry helps teacher to overcome from class room difficulty like presenting 3D structure of molecule with model. The objective is .to reveal teachers' ICT experiences and views on ICT integration into teaching-learning process as well as uncover the perceived obstacles to the integration process (Ojha and Punjab, 2016).

Teachers require continuous support and training to effectively integrate technology initiatives. Successful technology integration involves the allocation of time for teachers to experiment with new technologies, collaborate with peers, and the provision of professional development opportunities. As teachers collaborate and plan lessons that integrate technology, they reframe their perceptions towards innovative technology implementation and, ultimately, student achievement (Ojha and Punjab, 2016).

Statement of Problem

Computers are spreading rapidly in schools not just in wealthy countries, but increasingly in developing ones as well. However, although schools have had computers for almost two decades, ways to use them effectively have evolved slowly and patchily. Research findings across the country have revealed that there are ICT facilities in the secondary schools such as computers, computer laboratories, internet connections, alongside the traditional methods of

telecommunication. Further research has revealed that teachers do not make real use of ICTs at their disposal hence weak integration and usage in classroom activities of teaching and learning. In addition, most Secondary Schools in Niger face a number of challenges including; frequent power disruptions, inadequate connectivity and network infrastructure. This study sought to address and establish the factors that affect the integration and use of ICTs in teaching and learning chemistry in secondary schools.

Objectives of the Study

The purpose of the study was to establish the factors that influence and affect the efficient use of ICT in teaching and learning chemistry in some selected Secondary Schools in Chanchaga Local Government Area of Niger State.

Research Questions

This study sought to answer the following questions:

- Does level of accessibility and cost of ICT equipment affect the use of ICT in teaching and learning of chemistry?
- Does level of ICT training for teachers affect the use of ICT in teaching and learning chemistry?
- Does Teachers' and Students' attitude towards chemistry affect the use of ICT in teaching and learning chemistry?
- Does level of parent and community support affect the use of ICT in teaching and learning chemistry?
- To what extent does the use of ICT affect teaching and learning of chemistry in Chanchaga Local Government Area (LGA)?

Significance of the Study

The findings of the study would help the stakeholders in education to understand the factors that affect the use of ICT in teaching and learning chemistry and make relevant decisions. The Ministry of Education (MOE) would use the findings to formulate the appropriate ICT policies in line with the National ICT Policy. The School administrators would use the findings in making decisions on the type of ICT infrastructure to acquire as well as the technical support necessary. The curriculum developers would find the result of the study important in developing ICT curriculum that would maximize the potential of ICT in teaching and learning chemistry.

Limitation of the Study

The data collected were from some selected secondary schools in Chanchaga Local Government Area of Niger State. The schools are;

- Government Secondary School, Bosso road, Minna.
- Day Secondary School, Maitumbi, Minna.
- Day Secondary School, Chanchaga, Minna.
- Government Day Secondary School, Bosso road, Minna.

- Government Day Girls Secondary School, Bosso road, Minna.

Digital Revolution

Interactions that provide learners with immediate performance feedback will engage and hence motivate students. Visualizations and animations go well beyond what has been possible in the past. As new apps and sensors become available, changes are easy to make. Technology does not make education better but what is provided is the platform for making education more meaningful for the learners involved (Schoenfeld-Tacher *et al.*, 2001).

Integrating ICT into Education

Several theories have been advanced to describe teacher training in Information Communication Technology (ICT) integration and its implementation in education. According to a report from UNESCO (2002) there is need to develop a resource text that addresses the inherent challenges of teaching teachers, how it should be planned and organized and technologies to be applied. A separate report from UNESCO (2013) on teacher training on ICT use in education, sought to establish informative inventory of professional development and teacher training programs on ICT integration focusing on ICT related curriculum courses. The objective was to synthesize topics of curricula for training teachers on ICT use in education; but failed to address the issue of content development that should be pegged to the environment of application for its relevance to the users. An earlier study by Fouts (2000) asserts familiarity with common software and other basic operations are important skills for teachers to possess.

ICT enhanced Teachers Development Model

Working on a curriculum for schools and program of teacher development, another report from UNESCO (2004) sought to offer support to educators in better ways of integrating ICT in the process of training and knowledge sharing in the field of education. The objective was to outline a professional development program to support teachers in implementation of ICT educational program for secondary school teaching that responds to current international trends.

ICT Integration in Chemistry

While researching on pedagogical principles and theories of ICT integration in chemistry at the African Virtual University in South Africa, Educators like Onwu and Ngamo (2016) and Ngamo (2006) asserted that teachers must also have certain competencies and abilities in order to support student learning with ICT. The studies link to the current one as skills entail competencies and abilities. However, they ignore the fact that prerequisite skill in the subject matter is also a useful ingredient in integration.

ICT Tools in Chemistry

There is huge amount of chemistry software available which can be readily used as an ICT tools to learn chemistry in better way. Some of them are freely available while some of them have commercial values. Drawing of molecule can be done by (Chemsketch) and (Marvin Sketch). These tools provide additional information along with the object. Software for drawing and

visualizing 3D chemistry structure, predicting NMR, IR and other spectroscopic techniques, periodic table and organic chemistry other topics.

Stereochemistry

An important branch of stereochemistry is the study of chiral molecules (March, 1985). Stereochemistry is also known as 3D chemistry because the prefix "stereo-" means "three-dimensionality". Teaching stereochemistry with chalk and talk method is always a tedious job for teacher because it requires a lot of 3D structure of molecule and drawing 3D object on black board is not possible. There is several drawing tools available free on internet in which 3 D object can easily draw and several other information viz. bond angle, angle strain, chiral carbon etc. can easily calculate.

Periodic Table

Concept of periodic table used in every aspect of chemistry, whether it is organic, inorganic and physical chemistry or pharma, drug, and medicinal chemistry. But it is always a challenge to remember all the properties of periodic table. With the help of this tool we can teach periodic table in more effective manner.

IUPAC Naming

In chemical nomenclature, the IUPAC nomenclature of organic chemistry is a systematic method of naming organic chemical compounds as recommended (The Commission on the Nomenclature of Organic Chemistry, 1971) by the International Union of Pure and Applied Chemistry (IUPAC).

Research Methodology

Research Design

Descriptive survey design was used to establish the factors that influenced the integration and the use of ICTs in teaching and learning chemistry in some selected Secondary Schools in Chanchaga Local Government. The questionnaires, observation and interview schedules enabled the Researcher to collect primary data.

Target Population

The total population of this study comprised of twenty five (25) chemistry Teachers and five principals in five selected Secondary School in Chanchaga Local Government Area.

Sample Design and Sampling Procedure

Stratified random sampling was used to allow full participation of the schools. Five Schools made the sample size representing 80% of the total population. Five Teachers were randomly selected to be the respondents in each sample School and five Principals were interviewed to represent each category of Schools.

Research Instruments

The questionnaire was used to collect data from chemistry Teachers while the Principals were interviewed; Observation helped the Researcher to gather crucial information that could not be obtained through interviews and questionnaires.

Validity of the Instrument

Validity is the degree to which results obtained actually represent the phenomenon under investigation. Validity was established through close consultation with Experts in Measurement and Evaluation.

Data Analysis and Presentation

Descriptive statistics was used to present the results of the study and the general trends which involve tabulating, graphing and describing data.

Data Presentation and Analysis

TABLE 4.1: Schools with Computers

Schools	Number	Percentage (%)
School with computers	4	80
School without computers	1	20
Total	5	100

TABLE 4.2: Location of Computers in the Computers Schools

Computer location	Number	Percentage (%)
Offices	4	16
Staffroom	5	20
Computer Lab	15	60
Other Places	1	4
Total	25	100

TABLE 4.3: How often Teachers access the Computers

How often the computers are accessed	Number	Percentage (%)
No response	1	4
Daily	7	28
Weekly	12	48
Monthly	2	8
Once a term	3	12
Total	25	100

TABLE 4.4: Internet Connection in School

Internet Connection	Number	Percentage (%)
No Response	2	8
Prepaid Modem	19	76
Internet Server	4	16
Total	25	100

TABLE 4.5: Gender Distribution of the Respondents

Respondents	Number	Percentage (%)
Male	18	72
Female	7	28
Total	25	100

TABLE 4.6: Level of Education of Teachers

Respondents	Number	Percentage (%)
Masters	4	16
Degree	12	48
Degree and PGDE	2	8
NCE	7	28
Total	25	100

TABLE 4.7: Teaching Experience of the Respondents

Respondents	Number	Percentage (%)
Below 5 Years	4	16
5-9 Years	8	32
10-14 Years	10	40
15 Years & above	3	12
Total	25	100

TABLE 4.8: Level of ICT training

Level of ICT training	Number	Percentage (%)
Unknown	3	12
Certificate proficiency package	17	68
Diploma in ICT	5	20
Total	25	100

TABLE 4.9: ICT Technical Support to Teachers

Factors	SA	A	U	D	SD
Lack of technician to help teachers with the computer hardware or the software	21%	56%	2%	19%	2%
High cost of computer maintenance and upgrading	29%	46%	4%	13%	8%
High cost of staff training on computer maintenance	7%	48%	8%	31%	6%
Fear of computer and technology breakdown during teaching process	8%	33%	11%	31%	17%
Frequent breakdown of computer and other digital equipment	11%	35%	8%	33%	13%

TABLE 4.10: The Extent to which ICT Infrastructure affects its use in Class

Factors	SA	A	U	D	SD
Inadequate number of computers	42%	46%	4%	8%	0%
Lack of internet connectivity	29%	56%	4%	8%	2%
Lack of access to computers	32%	50%	2%	14%	2%
Insufficient or irregular power supply	13%	35%	8%	29%	15%
High cost of hardware and software	31%	46%	8%	11%	4%
Unavailability of appropriate software	17%	52%	15%	6%	10%

Summary

The findings of the study revealed that integration of ICTs in the teaching and learning of chemistry in some selected Secondary Schools in Chanchaga Local Government was hindered by so many factors which include; inadequate number of computers in the Schools, inadequate power supply, limited internet connectivity and inappropriate chemistry hardware and software. Technical help is inadequate despite regular computer breakdown of old computers. This not only wastes time but also leaves the Teachers unable to continue using ICTs in class. Most Schools lack ICT policies that would enable proper integration of ICTs in teaching and learning chemistry. High cost of ICT maintenance pushes the Principals to cut down on the use of ICTs in teaching and learning.

Conclusion

The ICTs have great advantage in improving all sphere of life including education. The Researcher therefore concludes that some factors have negatively influenced and slowed the use of ICTs in teaching and learning chemistry in some Secondary Schools. This includes unavailability and inappropriate ICT infrastructure in the Secondary Schools; limited ICT knowledge and skills for both the Teachers and the Students characterized by inadequate time for in-service courses for Teachers, limited technical support during teaching and learning process and lack of proper ICT policies in the Secondary Schools. Therefore there has been limited use of ICTs in class presentation in Secondary School.

Recommendations

Based on the findings of the study, the Researcher recommends that:

- The Government should invest heavily to provide adequate number of computers in Schools.
- Also the Government should enhance Internet connection in the Schools to ensure easy access to teaching learning materials in the web.
- Ministry of education should develop pre-service and in-service Staff training programmes that are tailored to the School programmes to keep Teachers up to date with the technological changes which will promote proper integration of ICTs in teaching and learning.
- There should be ICT Technician in each school to help Teachers with computer hardware or the software they would assist the Teachers handle any computer breakdown.
- The Government should make available avenues through which the Schools can acquire computers at a low/reduced cost. This can be done through tax waiver on computers meant for learning in the Secondary Schools.

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