ASSESSING THE AVAILABILITY, UTILISATION AND CONSTRAINTS OF ICT INTEGRATION FOR SCIENCE AND TECHNOLOGY TEACHING IN SECONDARY SCHOOLS IN GWAGWALADA AREA COUNCIL

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Abstract
The study assessed the integration of ICT in science and technology education by teachers in selected secondary schools in Gwagwalada Area Council. The study adopted a descriptive survey research design because it concerned the collection of data from a large population for the purpose of describing and interpreting the data for generalization. The population consists of all teachers in secondary schools in Gwagwalada Area Council, FCT Abuja. Simple random sampling technique was adopted for selecting (50) respondents (teachers) from five selected secondary schools in Gwagwalada Area Council, FCT Abuja. The instrument used for data collection was a structured questionnaire constructed by the researchers. The instrument was validated through expert judgment and a reliability co-efficient of 0.68 was established by adopting test re-test method within three weeks interval. The data collected were analyzed using Mean and Standard Deviation. The results of the study revealed that; secondary schools in Gwagwalada Area Council have ICT facilities but not sufficiently available and utilized for teaching and learning in many schools. A lot of constraints are affecting effective usage of ICT in secondary schools. The study made some recommendations in line with the findings, one of which is to encourage science teachers to engage in ICT training.

Keywords: Integration, ICT, Science, Technology Education, Secondary Education

Introduction

The fast improvement in Information and Communication Technology (ICTs) has brought critical changes in the manner the world operates and communicates. This in turn has impacted science and technology education needs, in terms of both the content and the delivery of science and technology education services, but there has been increasing pressure on decision makers to acquire new technologies. Simultaneously, forms of ICT are multiplying with an increasing array of ICT options for teachers to choose from when integrating ICT into education and training. A clear picture of what education should be seeking to achieve, is the need to utilize ICT to the full potential within educational systems. In order to make successful use of ICT in enhancing the reach and quality of teaching and learning, stakeholders need to be aware of how ICT can be of best value in Nigerian educational system. There is also the need to develop a supportive policy environment and framework at the national level for the integration of ICT into the educational systems (Esoswo, 2011).

Information and Communication Technologies (ICTs) is a broader term for Information Technology (IT), which refers to all communication technologies, including the internet, wireless networks, cell phones, computers, software, middleware, video-conferencing, social networking, and other media applications and services. It enables users to access, retrieve, store, transmit, and manipulate information in a digital form. ICT integration in education means technology-based teaching and learning process that closely relates to the utilization of learning technologies in schools. Since students are familiar with technology they will learn better a technology-based environment. Hence, the issue of ICT integration in schools, specifically in the classroom is vital. This is because, the use of technology in education

contributes a lot in the pedagogical aspects in which the application of ICT will lead to effective learning with the help and supports from ICT elements and components (Jamieson-Procter et al., 2013). Information Technology has the following characteristics:

Acquisition, Storage, manipulation, management, transmission or reception of data or information, Real time access to information, Easy availability of updated data, Connecting Geographically dispersed regions, Wider range of communication media, Science encompasses every attempt of humans to explore, interpret and manage the natural world. It is dynamic and essentially concerned with the search and explanation of both regularities and irregularities in nature. It involves the quest for actions and reactions, causes and effects in the environment. The purpose of science is to transform the environment towards improving the general quality of life, thus making the world a better place. Science involves a systematic study of natural phenomena and its study allows students to experience the richness and the excitement of the natural world as they engage in inquiry, critical thinking and the demonstration of skills. Scientific enterprise is one that is challenging and innovative. It blends with technology, which, focuses on inventions and problem solving. Consequently, the harmonious interplay of science, technology and society is the springboard for sustainable development. It equally facilitates and enhances industrial and technological progress among the people and within a nation. This consciousness stems from global agitations for literacy in science and technology (https://lifelearners.ng/contribution-of-science-and-technology-in-education/).

Science education is the teaching and learning of scientific knowledge and skills, such as school children, college students, or adults within the general public. The field of science education includes work in science content, science process (the scientific method), some social science, and some teaching pedagogy. Several studies have argued that the use of new technologies (ICT) in the classroom is essential for providing opportunities for students to learn to operate in an information age. The use of ICT today for learning activities is minimal and ICT is used only for playing games, watching movies, social media, etc. Whereas in the 21st century, ICT implementation in learning should have be implemented maximally to improve the quality of education. The implementation of ICT in learning is one of the demands of technological development, but there are problems in its implementation in education. Besides, the use of ICT in learning in vocational schools encounters several obstacles, which it falls into the low category (Tamba, 2011 in Nurul, & Ixora, 2021).

Also, Tamba (2011) cited in Nurul, and Ixora (2021) opined that ICT implementation in learning is still relatively low because it can be influenced by several challenges. There are many studies on ICT, which includes challenges in science learning. Supposedly, the implementation of ICT in science learning can be carried out well if the challenges are reduced. Similarly, Bransford *et al* (2000) cited in Alkahtani (2017) reported that "what is now known about learning provides important guidelines for uses of technology (ICT) that can help students and teachers develop the competences needed for the twenty-first century. ICT can play various roles in learning and teaching processes. According to Bransford et al (2000) in Alkahtani (2017), several studies have reviewed literature on ICT and learning and have concluded that it has great potential to enhance student achievement and teacher learning. Wong *et al*. (2006) point out that technology (ICT) can play a part in supporting and improving face-to-face teaching and learning in the classroom. Many researchers and theories asserted that the use of ICT can help students to become knowledgeable, reduce the amount of direct instruction given to them, and give teachers an opportunity to help those students with particular needs.

Potential benefits from the use of ICT for science learning have been reported in several

research studies. One of these potential benefits is the enhancement of communication and collaboration in science research activities. This was buttressed by Gillespie (2006) cited in Ghavifekr, and Rosdy (2015) who noted that new technologies can be used in science education to enable students to collect scientific information and interact with resources, such as images and videos, and to encourage communication and collaboration. Murphy, (2006) cited in Ghavifekr and Rosdy (2015) reviewed the impact of ICT on the teaching and learning of science in secondary schools and concluded that internet is used in science both as a reference source and as a means of communication".

Another benefit from using ICT in science education is that it expands the pedagogical resources available to science teachers (Al-Alwani, 2015). Pickersgill (2013) explored effective ways of utilising the Internet when teaching science. It was found that the ease of Internet access allows teachers to help students to become experts in searching for information rather than receiving facts. He claimed it could "increase their [students'] awareness of the importance of the world around them, of citizenship and of a scientifically literate community". Kelleher (2010) reviewed recent developments in the use of ICT in science classrooms, in his study he noted that ICT cannot replace normal classroom teaching, the review indicated that ICTs could be positive forces in science classrooms for a deeper understanding of the principles and concepts of science and could be used to provide new, authentic, interesting, motivating, and successful educational activities.

The new ICTs have other potential benefits as tools for enhancing science teaching and learning in schools (Skinner & Preece, 2013). These tools include those for data capture, multimedia software for simulation, publishing and presentation tools, digital recording equipment, computer projection technology, and computer-controlled microscopes (Osborne & Hennessy, 2013).

Several studies argue that the use of new technologies in the classroom is essential for providing opportunities for students to learn to operate in an information age. It is evident, as Yelland (2011) argued that traditional educational environments do not seem to be suitable for preparing learners to function or be productive in the workplaces of today's society. She claimed that organizations that do not incorporate the use of new technologies in schools cannot seriously claim to prepare their students for life in the twenty-first century. This argument is supported by Grimus (2010), who pointed out that "by teaching ICT skills in secondary schools the students are prepared to face future developments based on proper understanding".

Similarly, Bransford et al. (2000) cited in Wongetal, (2016) reported that "what is now known about learning provides important guidelines for uses of technology that can help students and teachers develop the competencies needed for the twenty-first century".

According to Becta (2013), five factors influence the likelihood that good ICT learning opportunities will develop in schools: ICT resourcing, ICT leadership, ICT teaching, school leadership, and general teaching. Becta (2013) also indicated that the successful of the integration of new technology into education varies from curriculum to curriculum, place to place, and class to class, depending on the ways in which it is applied. In science education, there are some areas where ICT has been shown to have a positive impact.

The act of integrating ICT into teaching and learning is a complex process and one that may encounter a number of difficulties. These difficulties are known as "barriers or problems" (Schoepp, 2015). The following are list of barriers/problems to ICT integration into Science Technology Education: A significant number of researchers identified time limitations and the

difficulty in scheduling enough computer time for classes as a barrier to teachers' use of ICT in their teaching (Al- Alwani, 2015; Becta, 2014; Beggs, 2010; Schoepp, 2015; Sicilia, 2015). The barrier most frequently referred to in the literature is lack of effective training, this was supported by Pelgrum (2011) who argued that there were not enough training opportunities for teachers in the use of ICTs in a classroom environment. Similarly, he also found that one of the top three barriers to teachers' use of ICT in teaching students was the lack of training.

Another barrier, which is directly related to teacher confidence, is teachers' competence in integrating ICT into pedagogical practice (Becta, 2014). Newhouse (2012) found that many teachers lacked the knowledge and skills to use computers and were not enthusiastic about the changes and integration of supplementary learning associated with bringing computers into their teaching practices. Gomes (2015) found that science teachers' resistance to change concerning the use of new strategies is an obstacle to ICT integration in science technology teaching. At a broader level, Becta (2014) argued that resistance to change is an important barrier to teachers' use of new technologies in education.

It was against this background that the researcher examined the integration of ICT in Science Technology Education: a study of selected secondary schools in Gwagwalada Area Council.

Statement of the Problem

The utilization of Information and Communication Technology (ICT) is becoming an integral part of education in many parts of the globe. Nigeria is not left behind as ICT has gradually finds its way into the educational systems despite chronic limitations brought about by economic disadvantages. Realistically, several researchers and commentators in the developed nations including Nigeria have admitted that problems abound in educational systems that ICT could help improve. One of the greatest challenges in ICT use in education is balancing educational goals with economic realities. ICTs in education programmes require large capital investments and developing countries including Nigeria need to be prudent in making decisions about what models of ICT use will be introduced and to be conscious of maintaining economies of scale. Ultimately it is an issue of whether the value added by ICT use offsets the cost, relative to the cost of alternatives. Some teachers in Nigerian secondary schools find it very difficult to effectively tally their ICT instructional materials such as computers, audio visual aids, slides, video clip, electronic white boards, and electronic conferencing materials and so on, to the goals of their instructional objectives, which instigate information search and attribution formulation. It is upon this background that the study sought to investigate the problems and prospect of integrating ICT in Science Technology Education in secondary schools in Gwagwalada Area Council, FCT Abuja.

Research Questions

The following research questions were answered in the study:

(i) What is the level of availability of ICT facilities in secondary schools in Gwagwalada Area Council, Abuja?
(ii) What is the extent of utilization of ICT in the effective management of schools Gwagwalada Area Council, Abuja?
(iii) What are the constraints to the effective utilization of ICT in secondary schools in Gwagwalada Area Council, Abuja?

Methodology

This study adopted a descriptive survey research design because it involved the collection of data from a large population for the purpose of generalization. The population consisted of all teachers in secondary schools in Gwagwalada Area Council, FCT Abuja. A sample of 50 teachers was randomly selected from the five (5) selected secondary schools in Gwagwalada

Area Council, FCT Abuja. The selected schools include: The researcher developed questionnaire used for data collection. The instrument was made up of two sections A and B. Section A elicited biography information of the respondents while section B was designed in a four-point modified Scale to collect data on the research questions. The four-point scales for response are Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD). The instrument was validated through expert judgment involving two lecturers' in computer science and measurement and evaluation. This was done to establish both face and content validity. The questionnaire was further trial tested with similar sample of 12 teachers that were not involved in the study. A correlation coefficient of 0.68 was established for the instrument using test-re-test method within three weeks interval. Copies of the questionnaire were directly administered on the respondents and collected immediately after their response. This was done to reduce instrument mortality. A Mean score and Standard Deviation were used to answer the research questions. Mean of 2.50 and above was considered Agreed, while a mean score of 2.49 and below was considered Disagreed.

Results

Research Question One: What is the level of availability of ICT facilities in secondary schools in Gwagwalada Area Council, Abuja?

Table 1: Mean scores of respondents on the availability of ICT facilities

S/No	Items	N	SA	A	D	SD	Mean	S.D	Remark
1.	There is adequate availability of ICT facilities in my school	50	8	6	20	16	2.12	1.03	Disagreed
2.	There is ICT facilities in my school but they are not adequately used	50	14	26	4	6	2.96	0.92	Agreed
3.	There is no ICT facilities in my school	50	9	15	5	21	2.24	1.18	Disagreed
4.	The ICT facilities in my school are not functional	50	17	15	6	12	2.74	1.16	Agreed
5.	ICT in my school is neither available nor adequate	50	6	9	13	22	1.98	1.05	Disagreed
	Grand Mean						**2.40**		

Source: Field Survey, 2021

Table 1 above shows the mean score of respondents on the availability of ICT facilities in secondary schools Gwagwalada Area Council FCT Abuja with an average mean of 2.40. Majority of the respondents disagreed with the statement (items 1, 3 & 5) which state that "There is adequate availability of ICT facilities in their school" with mean score of 2.12 and SD of 1.03; that "there is no ICT facilities in their school" with mean score of 2.24 and SD of 1.18; and that "ICT in their school is neither available nor adequate" with mean score of 1.98 and SD of 1.05. While minority of respondents agreed with the statement (items 2 & 4) which states that "there is ICT facilities in their school but they are not adequate used" with mean score of 2.96 and SD of 0.92; and that "The ICT facilities in their school are not functional" with mean score 2.74 and SD1.16.

Research Question Two: What is the extent of usage of ICT in the effective management of schools Gwagwalada Area Council, Abuja?

Table 2: Mean scores of respondents on the usage of ICT in the effective management of schools

S/No	Items	N	SA	A	D	SD	Mean	S.D	Remark
6.	ICT is effectively use for management in my school	50	12	8	14	16	2.32	1.16	Disagreed
7.	ICT is not use at all in my school	50	5	10	16	19	2.02	0.99	Disagreed
8.	ICT is used but not effectively utilized	50	13	15	17	5	2.72	0.96	Agreed
9.	ICT is only used for administrative purposes and not in teaching and learning	50	17	12	9	12	2.68	1.17	Agreed
10.	ICT is not used regularly for teaching and learning	50	22	13	9	6	3.02	1.05	Agreed
	Grand Mean						**2.55**		

Source: Field Survey, 2021

Table 2 above shows the mean score of respondents on the usage of ICT in the effective management in secondary schools Gwagwalada Area Council FCT Abuja with an average mean score of 2.55. Majority of the respondents agreed with the statement (items 8, 9&10) which state that "ICT is used but not effectively utilized" with mean score of 2.72 and SD of 0.96; that "ICT is only used for administrative purposes and not in teaching and learning" with mean score of 2.68 and SD of 2.68; and that "ICT is not used regularly for teaching and learning" with mean score of 3.02 and SD of 1.05. While minority of respondents disagreed with the statement (items 6 & 7) which states that "ICT is effectively use for management in their school" with mean score of 2.32 and SD of 1.16; and that "ICT is not use at all in their school" with mean score of 2.02 and SD of 0.99.

Research Question Three: What are the constraints to the effective usage of ICT in secondary schools in Gwagwalada Area Council, Abuja?

Table 3: Mean scores of respondents on the constraints to the effective usage of ICT

S/No	Items	N	SA	A	D	SD	Mean	S.D	Remark
11.	Lack of adequate time for teaching and learning of ICT in schools	50	13	22	6	9	2.78	1.03	Agreed
12.	Lack of effective training of teachers is a challenges to effective usage of ICT	50	14	26	4	6	2.96	0.92	Agreed
13.	Lack of teachers confidence pose a challenge to effective ICT usage	50	20	16	5	9	2.94	1.10	Agreed
14.	Teachers resistance to change & negative attitudes as a barrier	50	17	15	8	10	2.78	1.12	Agreed
15.	Teachers lack of accessibility to ICT facilities	50	16	19	10	5	2.92	0.96	Agreed
	Grand Mean						**2.88**		

Source: Field Survey, 2021

Table 3 above shows the mean score of respondents on the constraints to the effective usage of ICT in secondary schools Gwagwalada Area Council FCT Abuja with an average mean of

2.88. All the respondents (items 11, 12, 13, 14, & 15) agreed that "lack of adequate time for teaching and learning of ICT in schools" with mean score of 2.78 and SD 1.03; that "lack of effective training of teachers is a challenges to effective usage of ICT" with mean score 2.96 and SD 0.92; that "lack of teachers confidence pose a challenge to effective ICT usage" with mean score 2.94 and SD 1.10; that "teachers resistance to change & negative attitudes as a barrier" with mean score 2.78 and SD .12; and finally that "teachers lack of accessibility to ICT facilities" with mean score 2.92 and SD 0.96.

Discussion of Findings

The finding indicates that secondary schools in Gwagwalada Area Council ICT facilities but they are not adequately available. This finding is supported by Tamba (2011), cited in Nurul, and Ixora (2021) who opined that ICT implementation in learning is still relatively low because it can be influenced by several challenges which include inadequate availability of ICT facilities.

The finding indicates that secondary schools in Gwagwalada Area Council use ICT for administrative purpose and personal use not used for teaching and learning. The study is supported by Pelgrum, (2011) who argued that there were not enough training opportunities for teachers in the use of ICTs in a classroom environment. Similarly, he also found that one of the top three barriers to teachers' use of ICT in teaching students was the lack of training.

Table 3 above shows the mean score of respondents on the constraints to the effective usage of ICT in secondary schools Gwagwalada Area Council FCT Abuja with an average mean of 2.88. The finding indicates that constraints bedeviling effective usage of ICT in secondary school are numerous. The finding is supported by Gomes (2015), who states that science teachers' resistance to change concerning the use of new strategies is an obstacle to ICT integration in science technology teaching.

Conclusion

The main objectives of this paper is to investigate the problems and prospects of integrating ICT in Science Technology Education in some selected secondary schools in Gwagwalada Area Council, FCT Abuja. The findings of this study indicate that (i) secondary schools in Gwagwalada Area Council ICT facilities are not adequately available (ii) secondary schools in Gwagwalada Area Council use ICT for administrative purpose and personal use not for teaching and learning (iii) constraint bedeviling effective usage of ICT in secondary schools are numerous, ranging from lack of time, to lack of effective training, to lack of teachers confidence, teachers resistance to change and negative attitude and teachers lack of accessibility to ICT facilities among others.

Recommendations

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

(i) Government and relevant stakeholders should provide for updated ICT devices in science technology classrooms, for both teachers and students;

(ii) There should be regular in-service training to develop and continuously update teachers' knowledge and skills for didactically meaningful implementation of ICT in the teaching practice of science subjects.

(iii) Subject specific ICT-based resources and e-learning platforms accompanied by training need to be provided to teachers so that their technology related knowledge can be promoted;

(iv) Encouragement of the participation of science teachers in ICT training to increase positive beliefs about teaching with ICT and understanding of its potential in improving students' learning outcomes in science;

(v) Organisation of training sessions for headmasters and principals to support teachers in their continuous acquisition of ICT skill development.

References

Ajayi, L. (2018). Towards effective use of information and communication technology (ICT) for teaching in Nigerian colleges of education. *Asian Journal of information Technology, 5*(5), 210-214.

Al-Alwani, A. (2015). Barriers to Integrating Information Technology in Saudi Arabia Science Education. Doctoral dissertation, the University of Kansas, Kansas.

Alkahtani, A. (2017). The challenges facing the integration of ICT in teaching in Saudi secondary Schools. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, 13(1).

Becta (2014). *A review of the research literature on barriers to the uptake of ICT by teachers.* Retrieved October 20, 2019 from http://www becta.org (United Kingdom)

Beggs, T. A. (2010). *Influences and barriers to the adoption of instructional technology.* Paper presented at the Proceedings of the Mid-South Instructional Technology Conference, Murfreesboro, TN.

Bransford, J., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: brain, mind, experience, and school (2nd ed.).* Washington, D.C.: National Academy Press

Dawes, L. (2011). *What stops teachers using new technology?* In M. Leask (Ed.), Issues in Teaching using ICT (61-79). London: Routledge.

Esoswo, F. O. (2011). Issues and challenges in the use of Information Communication Technology (ICTs) in education. *Journal of information and knowledge management, 2*(1), 2141-4297.

Gillespie, H. (2016). *Unlocking learning and teaching with ICT: Identifying and overcoming barriers.* London: David Fulton.

Grabe, M., & Grabe, C. (2017). *Integrating technology for meaningful learning (5th ed.).* Boston, NY: Houghton Mifflin.

Grimus, M. (2010). *ICT and multimedia in the primary school.* Paper presented at the16th conference on educational uses of information and communication technologies, Beijing, China. https://lifelearners.ng/contribution-of-science-and-technology-in-education.

Kelleher, P. (2010). A review of recent developments in the use of information communication technologies (ICT) in science classrooms. *Australian Science Teachers Journal, 46*(1), 33-38.

Lewis, S. (2013). Enhancing teaching and learning of science through use of ICT: Methods and materials. *School Science Review, 84*(309),41-51.

Murphy, C. (2016). The impact of ICT on primary science. In P. Warwick, E. Wilson & M. Winter bottom (Eds.), *Teaching and Learning Primary Science with ICT* (13-32). Berkshire, England: Open University Press.

Newton, L., & Rogers, L. (2013). *Thinking frameworks for planning ICT in science lessons*. School *Science Review, 84*(309), 113-119.

Nurul, J. Y., & Ixora. S. M. (2020). *Challenges towards the implementation of ICT in Biology learning: A review study.* 1st International Conference on Chemistry and Science Education (ICChSE). *Journal of Physics:* Conference Series. doi:10.1088/1742-6596/1788/1/012035

Osborne, J., & Collins, S. (2010). *Pupils' and parents' views of the school science curriculum.* London: King's College London.

Osborne, J., & Hennessy, S. (2013). *Literature review in science education and the role of ICT: Promise, problems and future directions.* London: Futurelab.

Pelgrum, W. J. (2011). Obstacles to the integration of ICT in education: results from a worldwide educational assessment. *Computers & Education, 37,*163-178.

Pickersgill, D. (2013). Effective use of the Internet in science teaching. *School Science Review, 84* (309), 77-86.

Schoepp, K. (2015). Barriers to technology integration in a technology-rich environment. *Learning and Teaching in Higher Education: Gulf Perspectives, 2*(1), 1-24.

Skinner, N. C., & Preece, P. F. W. (2013). The use of information and communications technology to support the teaching of science in primary schools. *International Journal of Science Education, 25*(2), 205-219.

Voogt, J., & Pelgrum, H. (2015). ICT and curriculum change. Human Technology: An Interdisciplinary. *Journal on Humans in ICT Environments*, *1*(2), 157–175.

Watson, G. (2016). Technology professional development: long-term effects on teacher self-efficacy. Journal of Technology and Teacher Education, 14(1), 151.

Wong, A. F. L., Quek, C. L., Divaharan, S., Liu, W.C., Peer, J., & Williams, M. D. (2016). Singapore students' and teachers' perceptions of computer-supported Project Work classroom learning environments. *Journal of Research on Technology in Education*, *38*(4),449-479.

Yelland, N. (2011). *Teaching and learning with information and communication technologies (ICT) for numeracy in the early childhood and primary years of schooling.* Australia: Department of Education, Training and Youth Affairs.