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Effectiveness of Computer Utilization in Science Pedagogy among Secondary Schools in Ekiti State: An Inpetus For A Sustainable National Development

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Abstract

This paper is a study on the effectiveness of the use of computer in the process of teaching and learning science in the secondary schools in Ekiti state, Nigeria towards enhancing a sustainable development. The study was a descriptive research of a survey type. Four research questions were raised and three hypotheses formulated. The sample for the study comprised 400 science teachers purposively selected from 50 secondary schools across the state. The research instrument was a questionnaire designed by the researchers titled 'Effectiveness of Computer Use in Teaching and Learning of Science' and was administered personally by the researchers. The data obtained were subjected to descriptive analysis of mean and percentages and inferential statistics of X^2 and F-ratio, tested at 0.05 level of significance. The results of finding revealed that most of the science teachers have computer but do not make use of it in their teachings, even though they have the believe that the use of computer could enhance teaching and learning of science. Based on these outcomes, it was recommended among others that the government should go a step further to train the teachers on the application of computer in the teaching and learning process.

Keywords: Computer utilization, effectiveness, teaching, learning, school science, pedagogy, students performance.

Introduction

Access to information and communication technologies is increasing daily for its involvement in economic, education and political aspects of human endeavours. Explorations in electronic communication networks have led to numerous advances for opportunities in the developing countries. Advances in internet networking by many African countries have put them on the global connectivity and consequently enhanced their development. This development manifests in terms of increase in knowledge and skills capable of improving the quality of life. Adedayo and Ayeni (2015) observed that most of man's development is brought about through the knowledge of science and ICT. Information and knowledge are interrelated. Well informed, knowledgeable and skillful citizens are instruments for human – centered development. Acquisition of knowledge in this modern society is facilitated by information technology. A non-responsive attitude to the use information technology is synonymous to absconding from school. It is a choice between being left out or benefiting from enormous benefits of information technology.

The application of information and communication technologies (ICTs) has globally taken its ground firm in education enterprise. Computer seems to be the central device of ICT and the impact of its use in teaching and learning cannot be overemphasized. There has been a global sensitization on the use of computer in teaching and learning at all levels of education (Ajayi & Adedayo, 2017). It is rather becoming increasingly difficult to run a school without using computers. Education and training are keys to building indigenous capacity that would reduce dependence on developed world and as well solve local complex problems. The input of computer technology in this regards is desirable. In fact, (Ali 1996) submitted that:

Information technology and education have dual impact on each other. Information technology has a greater impact on education in the development of new concepts, improving resources sharing and advancing research. Information technology education is the main solution for building indigenous capacity in Africa.

The effective utilization of computer in teaching and learning processes is anchored on adequate availability of facilities necessary for its operation. These include a well-furnished building or hall or room as the case may be, continuous power supply, and other computer accessories. The presence of these necessary facilities would encourage the usability of computers by the teachers to teach, set questions, and give assignments. The impact of using computer in teaching has been noted to produce better academic performance of students.

Benefits of Computer in Science Pedagogy

The benefits of computer as a major and central device of ICT in science pedagogy may include the following:

- It makes learning active, participatory, co-operative and reflective
- students are more motivated and engaged in activities
- it arouses students' interest and sustains students' attention for a longer time
- it provides access to resources that are relevant to science teaching
- visualization and manipulation of complex models are possible through multimedia resources of ICT
- provision of wider range of materials capable of aiding science teaching and learning e.g. still and moving images
- It serves as an alternative teaching style to the old conventional style of the teacher
- it gives room for repetitive learning
- scientific activities/learning can be extended beyond the teaching space and class contact time
- it gives room for teachers' creativity in their teaching and in the students' learning of science.

The study of Abinbade (2003) revealed that use of microcomputers in the United Kingdom (UK) has made it easier for the teachers to emphasize the practical application of mathematics than ever. This was in agreement with the observation of Omotayo, Ajayi & Ayodele (2013) that 70% of the science teachers and 76% of the science students agreed that ICT had highly assisted the Nigerian students in the teaching and learning of science subjects. Adedayo (2019) submitted as well that effective use of ICTs has the potent of enhancing timely transmission of information and knowledge through merging of technology with pedagogy.

Issues on Advent of ICT in Educational system in Nigeria

The awareness of IT with its application and importance in transformation of man's society began to increase by the second half of the 1970s. By then, computer and computeracy were no longer exclusively preserved for scientific, defence and industrial sectors of developed countries but gaining extension into the educational system of both developed and developing countries of the world (Owhotu 2006). By 1980, the schools have become the test-ground of IT policy globally. For instance, a developed country like UK in 1980 launched the micro-electronics in education programme (MED) in collaboration with the British Department of Industry. The programme was meant to educate the young Britons in computer applications needed to cope with the demands of the world of work. On this basis, by the end of 1982, the department had made available computer and accessories to all the secondary schools in the country. Eventually, IT was made a core subject through the enactment of the British National Curriculum in 1988.

The curriculum, according to Owhotu (2006) stipulated that teachers should have:

- i. a clear understanding of what IT can offer them
- ii. the capacity to make effective use of it

- iii. suitable curriculum support materials and advice
- iv. sufficient access to appropriate equipment and technical support.

The developing countries were not idle or unaware of the IT trend and its potent on educational growth of a country. India for example, launched the Computer Literacy and Studies in Schools (CLASS) project in selected secondary schools to start with in 1983. The intent according to Dalta in Owhotu (2006) “was not intended to introduce computer science in schools rather, its intent was to demystify the computer applications and the computer’s potential as a learning mode”. With a time lag, Indian government had built strong partnership with IT and provided computer literacy and education at all levels of her education system.

Nigeria, like other developing countries, embraced the intervening potent of information technology at enhancing the education of a country. In response to the upcoming application of IT in education, the government of Nigeria in 1987 launched the National policy on Computer literacy and Education to catch up with the rest of the world on IT trend of event (Aminu1987).

The implementation of the policy began with the teachers training in the 45 Federal Government Colleges, Colleges of Education and Armed Forces secondary schools. Thereafter, 56 schools were used as pilot-schools where 504 pieces of computer were distributed among the schools (Owhotu 2006). The success of this intervention was faced with some challenges like funding, poor electricity supply and technical know-how which lingered on till 2002. However, 2003 witnessed a new dawn in the use of computer in Nigerian secondary schools. In 2001, the Federal Government of Nigeria launched a National Policy on Information and Communication Technology and later embarked on more concrete initiations like the establishment of the National Information Technology Department Agency (NITDA), under the Federal Ministry of Science and Technology and the National Institute for Information Technology (NIIT). This was a giant stride that served as the blue-print for the development of 21st century IT survival.

In September 2006, Nigeria hosted the world Digital Africa 2006 conference on the theme “ICT for education development empowerment in children and learning” where one-laptop-per-child initiative was launched. This resulted into the provision of one million dollar laptops for the e-secondary school project in Nigeria. On this basis, Nigerian software developers have been working on integrating local curriculum contents into the project covering all school subjects from Junior secondary class 1 to Senior secondary class 3 (The Vanguard 2006).

Introduction of Computer into Secondary Schools in Ekiti State

Ekiti state is noted all over the country Nigeria as a frontier in knowledge and education. Any issue that pertains to education is not held with levity but given the needed prompt attention. This impetus was extended to the introduction of computer into her secondary schools for utilization in the process of teaching and learning.

To start with, the state government organized a seminar for a teacher per few selected schools across the state through her Education Tax Fund titled ‘Capacity Building Training in Computer Pioneers and New Information and Communication Technologies’ which was held at the Federal University of Technology, Akure (FUTA) between 24th and 29th June, 2007. The seminar was co-sponsored by Ekiti state government with Nigerian Communication Council (NCC). The intent was to expose the participants to computer appreciation and introductory aspect of computer literacy. Later, a workshop was held at the Ministry of Education, Ado Ekiti for some selected teachers between 16th and 20th February, 2009. These teachers were regarded as the computer teachers in the affected schools and expected to train their colleagues on computer appreciation and introduction to computing.

In late 2012, all the students of secondary schools in senior classes 2 and 3 (SSII & SSS III) in the state were given ‘Note Computers’ to intimate them with computer awareness and appreciation. This was withdrawn from them after graduation, with the intent of distributing them to their successors. The problem still remained. The teachers who are to use the computer to teach the students were in the dark as to the nitty-gritty and technical know-how of computer. Invariably, the students misused the ‘Note Computers’ placed at their disposal for unethical purposes.

The state government, in her strives to make computer literacy see the light of the day in her secondary schools, deemed it needful to make computers available to the teachers. However, the teachers were requested to pay for the laptops on installmental basis from their salaries. On this premise, some of the teachers subscribed to this arrangement while some declined.

Thus in 2013, 6500 laptop computers were distributed to all willing secondary school teachers in Ekiti state in two strands (Ekiti Ministry of education, 2016). This was a giant step at making a considerable number of the secondary school teachers have access to laptop computer of their own. In addition to making computer available for the teachers, the state government ear-marked a period of two months for the training of the teachers who owned the computers on group basis, each group engaged in a weekintensive training on Microsoft words processing, spreadsheet and power point presentation. This was expected to put the teachers on their toes as to the application of computer in teaching and learning process. This may include note making, questions settings, lesson presentation and the like.

Statement of the Problem

Realizing the significant roles computer can play at enhancing effectiveness in the teaching and learning of science, the government of Ekiti State, Nigeria made computers available to all the teachers in the secondary schools across the state, including the science teachers. However, trend of students' academic performance over the recent years seems not to produce any difference. The performance of science students, who are expected to be frontiers in the technology application, neither showed any variation. The questions then arose: Are the teachers not making use of the computers in their teachings? or Does it means that the use of computer cannot enhance effectiveness in students' learning?

Objectives

The study was purposed to investigate:

- i. whether computer was adequately provided for the science teachers;
- ii. whether there is adequate provision of facilities to operate the computers;
- iii. the use to which the teachers put the computers in their possession;
- iv. the effectiveness of computer use at enhancing better academic performance of students in science.

Research Questions

The questions asked as the basis for the study are as follow:

1. Is there adequate provision of computers in the schools?
2. Are there enough facilities available for operating the computers?
3. Do the science teachers employ computers in their teachings?
4. Can the use of computer make any improvement in students' academic performance in the science subjects?

Research Hypotheses

The following null hypotheses were formulated as a guide for the study:

1. There is no significant difference in the use of computer by the teachers of sciences at the three senior secondary classes.
2. There is no significant difference in the use of computer by the teachers of biology, chemistry, physics and mathematics.
3. There is no significant difference in the use of computer in teaching science between male and female teachers of the senior secondary schools.

Materials and Methods

This study was a descriptive survey research. The targeted population was the teachers teaching the science subjects in secondary schools in Ekiti state. The science subjects here are biology, chemistry, physics and mathematics.

The targeted population for this study comprised all the teachers of the above science subjects in all the 184 public secondary schools in Ekiti state. From this, 140 science teachers were purposively selected from 7 schools. There were 35 teachers randomly selected from each of the science subjects (i.e. biology, chemistry, physics and mathematics) making a total of 140 that constituted the sample. In all, there were 77 male and 63 female teachers.

A questionnaire titled ‘Effectiveness of Computer Use in Science Teaching’ was the instrument used for this study. It has two parts A and B, where parts A was based on the bio data of the respondents and parts B consisted of 10 items statements on the focus of the study. Respondents were required to pick from two options of “Yes” or “No” for each of the items.

The instrument was administered by the researchers personally. It took the researchers three weeks to administer the questionnaire on the sample in the schools. As the instrument was distributed and retrieved immediately by the researcher, all the questionnaires distributed were returned.

Results

Descriptive Analysis

Question 1: Is there adequate provision of computers in the schools?

Table 1: Frequency counts and percentages of adequate provision of computers in the schools

Items	YES		NO	
	N	%	N	%
School has computer	51	36.40	89	63.60
Adequate computer available	47	31.60	93	66.40
Has personal computer	52	37.10	88	62.90
Average	50	35.46	90	64.54

Table 1 above showed that 51(36.4%) of the schools have computer while only 47(31.6%) have adequate computers in the school. 52(37.1%) of the science teachers have their personal computers. on the average, only 35.46% claimed that their schools have adequate computer. It can therefore be added that the provision of computer in the schools for teaching and learning is not adequate.

Question 2: Are there enough facilities available for operating the computers?

Table 2: Frequency counts and percentages of facilities available for operating the computers

Items	YES		NO	
	N	%	N	%
Enough facilities for computer operation	26	18.60	114	81.40
Building	93	66.40	47	33.60
Furniture	63	45.00	77	55.00
Power Supply	37	26.40	103	73.60
Accessories	22	15.70	118	84.30
Ventilation	75	53.60	65	46.40
Average	52.67	37.62	87.33	62.38

From table 2, it is revealed that 26(18.6%) agreed that there exist enough facilities to make the computer functional. 93(66.4%) have building for the computers, 63(45.0%) have adequate furniture in the computer rooms with 75(53.6%) ventilation while 37(26.4%) have regular power supply and only 22(15.7%) have necessary computer accessories available in the schools. on the average, 52.67 i.e. only 37.62% agreed that there are enough facilities in the schools for operating the computers. It can therefore be inferred that the facilities to operate computers are not enough in the schools.

Question 3: Do the teachers employ computers in their teachings?

Table 3: Frequency counts and percentages of computer use by the teachers

Items	YES		NO	
	N	%	N	%
Use computer for teaching	18	12.90	122	87.10
Assignment	11	7.90	129	92.10
Test Construction	-	0.00	140	100.00
Examination Construction	6	4.30	134	95.70
Average	8.75	6.25	131.25	93.75

It is showed from table 3 that only 18 out of 140 sampled teachers (equivalent to 12.9%) make use of computers in their teaching-learning process, 11(7.9%) use computer to set questions, no one (0.0%) use computer for class tests and only 6(4.3%) use computer to set examination questions. Averagely, only 8.75(6.25%) of the science teachers employ computer in the teaching–learning process. This implies that the teachers do not utilize computer in teaching science.

Question 4:Can the use of computer make any improvement in students’ academic performance in the science subjects?

Table 4: Frequency counts and percentages of computer impact on students’ academic performance in the science subjects

Variations	N	%
Yes	110	78.60
No	30	21.40
Total	140	100.00

Evidently from table 4 above, 110 (78.6%) of the sampled teachers believed that the use of computer in teaching and learning science is capable of improving the academic performance of the students in the science subjects.

The bar chart below further shows the teachers’ view of the impact of computer at improving the academic performance of the students in the sciences.

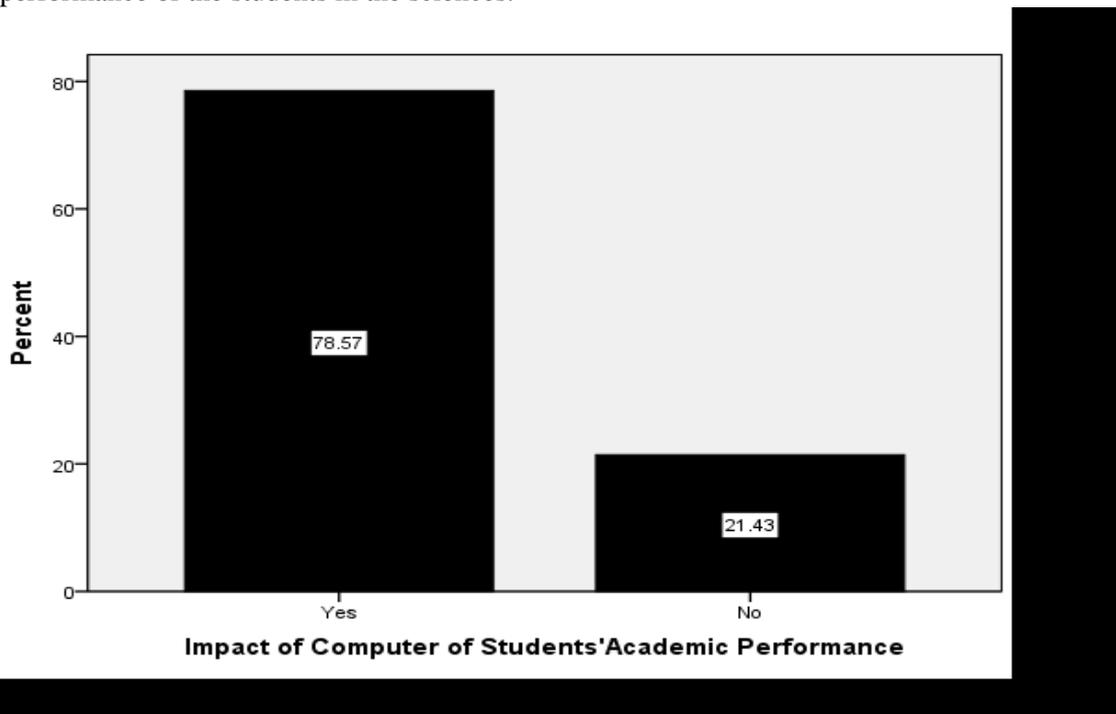


Figure 1: Percentages of science teachers' view on the impact of computer use on the academic performance of students

The wide variation of 57.14% (78.57 – 21.43%) in the believe of the teachers in the potency of computer use in the teaching and learning process at enhancing better academic performance of the students in the science subjects is revealed in the bar chart. The chart also shows the high believe (78.57%) of the teachers that if computer is effectively employed in teaching science, students will perform well in the subjects. Thus, the effective use of computer is capable of enhancing better academic performance of students in science.

Testing Hypotheses

Ho1: There is no significant difference in the use of computer by the teachers of sciences at the three senior secondary classes.

Table 5: ANOVA of computer use by science teachers in the three senior classes

Variations	SS	df	MS	F	Sig
Between Groups	1.112	2	.556	5.227	.006
Within Groups	14.574	137	.106		
Total	15.686	139			

$P < 0.05$

Table 5 showed a table significant value of .006 which is less than p-value of 0.05; the null hypothesis is therefore not rejected. This means that there is no significant difference in the use of computer by the teachers of science subjects at the three senior secondary classes.

Ho2: There is no significant difference in the use of computer by the teachers of biology, chemistry, physics and mathematics.

Table 6: ANOVA of computer use by teachers of the various science subjects

Variations	SS	df	MS	F	Sig
Between Groups	1.028	3	.343	3.179	.026
Within Groups	14.658	136	.108		
Total	15.686	139			

$P < 0.05$

It is evident from table 6 that $P (.026) < 0.05$ significant level. The null hypothesis is therefore not rejected which implies that there is no significant difference in the use of computer by the teachers of the various science subjects.

Ho3: There is no significant difference in the use of computer in teaching science between male and female teachers of the senior secondary schools.

Table 7: t-test analysis of computer use between male and female science teachers

Variations	N	\bar{X}	SD	df	t-cal	Sig
Male	77	1.922	.270	138	1.993	.048
Female	63	1.809	.396			

$P < 0.05$

From table 7, the t-calculated value was 1.993 giving a significant value of $.048 < 0.05$ critical level of significant. Therefore, the null hypothesis is not rejected. This shows that there is no significant difference in the use of computer in teaching science between male and female teachers of the senior secondary schools.

Discussion

The result of analysis showed that there was inadequate availability of computers for teaching in the schools. This result seemed confusing, since all willing teachers were given a piece of laptop computer by the state government. From the record, 650 pieces of computer given to the teachers represented 88.32% of the approximated science teachers in all the 184 secondary schools in the state as at the time of this study; a high percentage which suppose to be a sufficiently adequate value.

On further oral interview with the teachers, it was gathered that most of the teachers, on the premise that they are ignorant of the use of computer and due to the fact that there was no thorough training on its use, gave out their copy of the laptop to their children who they believe would be able to make good use of them while some of the laptops were stolen where they kept them. No wonder, they claimed not to have computer for teaching. This aligns with the study of Etebu (2010) on ICT availability which revealed that the situation was not encouraging. Moreover, Patil (2010) in his study found that users were not trained to use ICT-based products and services and therefore recommended an ICT training programme to increase the use of ICT products and services.

The finding of the study also revealed that there were adequate building and furniture for computer use but the power supply and computer accessories availability were very low. This aligns with the submission of Walmiki&Ramakrishnegowda (2009) that ICT infrastructures in university libraries lack sufficient hardware, software facilities and do not have adequate internet nodes and bandwidth. Also, Adeleke&Olorunsola (2010) observed that ICT facilities were the major constraints facing libraries in the use of tools, even though Shafi-Ullah& Roberts (2010) submitted that ICT infrastructure is necessary to provide a research culture in higher institutions of learning.

The result of the study showed that the teachers do not use the computers in teaching their subjects even though almost all of the teachers agreed that the use of computer in teaching has the potent to improve the academic performance of students in the science subjects. This was in agreement with the observation of Omotayo, Ajayi & Ayodele (2013) that 70% of the science teachers and 76% of the science students agreed that ICT had highly assisted the Nigerian students in the teaching and learning of science subjects.

The results of hypotheses testing revealed that the use of computer in teaching science do not differ among the teachers irrespective of the class or subject taught or gender. This may be so since the teachers' allocation to the classes were done randomly among the teachers on the basis of their area of specializations.

Conclusion

It can be concluded from the outcome of this study that there is inadequate availability of computers in the schools. Even though there were building and furniture for computer use, the power supply and computer accessories availability were very low. On this basis, the teachers do not use the computers in teaching their subjects despite the teachers' believe that the use of computer could improve the academic performance of students in the science subjects. The disposition of the teachers to the use of computer in teaching their subject is the same across the classes, subject taught and gender differences.

Recommendations

The following recommendations were suggested based on the outcomes of this study:

1. The government should organize intensive computer training for the science teachers aimed at using computer in the teaching – learning processes. Emphasis should be laid on note making, setting of tests and examination questions, collation of results and internet networking.
2. Government should enact a policy that would compel the science teachers to make use of computer in their daily job performances.
3. It should be mandatory for all science teachers in the secondary school to possess a personal computer for use in carrying out their jobs.

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Conflicts of interest – The authors declare that there is no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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