
Information and Communication Technology (ICT) as it Relates to Science

By

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Abstract

This study investigated on how Information and Communication Technology (ICT) relates to science education that is globally accepted, and which is equally in line with the National Policy on science education (2004). This Policy spelt out that proper training should be given so as to impact the necessary skills to individuals who shall be self – reliant economically in the country. Two groups, such as Group “A” were students taught with ICT materials while Group “B” were students taught with conventional traditional method and they were compared. 40 items in the BSAT instrument to measure their cognitive skills levels was developed. Business studies achievement tests (BSAT) in both pre and post tests were conducted. T – test was the statistical methods applied to analyze the data. The result showed that students in the Experimental group performed better than those students in the control group. Base on this it was recommended among others that curriculum needs to be reformed and make them suitable to produce competent teachers to train others with adequate and necessary ICT materials so as to make the learners become self reliance so that the country becomes economically great.

Science has made the whole world to become technologically complex. The panacea for achieving this great millennium goals is science through which information and communication technology materials are developed. That is, ICT is an indispensable part of the contemporary world. It means that every sector of the economy must adjust to meet with this development (Fati B. Shuaibu 2007). Science education is the base of all science subjects or courses; in which information and communication technology (ICT) stemmed out from. It’s use in all educational levels

has been one of the greatest innovations in teaching and learning process (Solomon, Onyemaechi, and Ogbenyealu, 2011).

The most important instrument in this information and communication technology is the computer which is globally accepted and people need to learn how to use it effectively in order to go along with scientific world and to function well with the society (Solomon, I.). The rapid spread of ICT has brought about rapid technological, social, political and economic transformation, which has made society network organized around ICT. (Castells, 1996) as it was cited in Chiadika, O.D.M., Awili, C.P.N: and Nwabudike, A.A, (2012). ICT has impacted on the quality and quantity of teaching, learning and research in traditional and distance education institutions. Science education is the base where most of the scientific results are implemented to see the effect. Education is generally being penetrated by the influence of information and communication (Aviran and Talmi, 2004) identified several groups that are active in ICT in education. ICT involves active hands-on learning which relates to cognitive apprenticeship (Solomon I, 2011).

According to Chiadika (2012) and Oriseyi 1977.) ICT can enhance teaching and learning through its dynamic, interactive, and engaging content. It can provide real opportunities for individualized instruction. The potential quality to accelerate, enrich and deepen skills, are possessed by the ICT. It also motivates and engages students in learning. ICT helps to relate school experiences to work practices. It creates economic viability for tomorrow's workers. ICT contributes to radical changes in schools (Chiadika 2012) and Orisaseyi 1977). And most Educators see ICT as being a major driver of school reform (Fati B. Shuaibu 2010; and Omosowo, 1997). ICT strengthens teaching, and provides opportunities for connection between the school and the world (Davis and Tearle, 1999; Lemke and Coughlin, 1998). The school can be made more efficient and productive by information and communication technology thereby engendering a variety of tools to enhance and facilitate teachers professional activities (Kirschner and Wokperies, 2003).

Influence of ICT on Human Life

In various researches, data analysis, ICT provides opportunities to analyze data which would have been a terrible brain storming to the researchers. It also provides opportunities for schools to communicate with one another through email, mailing list, chat rooms and so on. Also, ICT offers quicker and easier access to more extensive and current information. In addition, it can be used to do complex mathematical calculations.

Furthermore, it provides researchers with a steady avenue for dissemination of research reports and findings (Yusuf and Onasanya, 2004). According to Culp Honey and Mandinach (2003), three major reasons were advanced for ICT in education concerning about 28 reviews and major reports on technology integration in American

schools, they suggested that technology is usually (i) a tool for addressing challenges in teaching and leaning (ii) a change agent, and a central force in economic competitiveness (Chiadika, Awili, Nwabudike, 2012). (iii) ICT is a central force in economic competitiveness.

(i) ICT is a tool for addressing challenges in teaching and leaning. That is, technology is capable of delivery, management, and support of effective teaching and leaning. It helps students to collect and makes sense of complex data. (ii) ICT as a change agent, it catalyses various other changes in the content, methods and overall quality of teaching and learning, thereby bringing about inquiry-Oriented classrooms. (iii) ICT is a central force in economic competitiveness, it deals with economic and social shifts that have technology skills critical to future employment of today's student.

Science education as an umbrella subject from where other branches of sciences stem out most especially ICT, is very important for the economic and technological advancement of any nation though its usefulness cut across all fields of human endeavour but the gross inadequacy of the instruments or computers to engage the students in practical exercise in both junior and senior levels has been a source of concern to various people especially Business educators at various times (Omosewo 1997; Balogun, 1985; Ogunneye, 1982; Orisaseyi 1977; Ogunyemi and Eboda, 1974). This brings about lack of active participation of students in any on-going lesson which consequently results to their poor performances in west African Examination council (WAEC) results in secondary schools where students' performance were generally poor in all the science subjects particularly in ICT related subjects (Solomon, Onyemaechi and Ogbenyealu, 2011). The traces of these students poor performance is also observed in tertiary institutions (Ibraheem, 2008 and Olorinoye, 1987).

More to this, teachers are indispensable for successful learning about ICT. The computer education introduced into the Nigerian secondary schools since 1988 has largely been unsuccessful as a result of teachers' incompetence (Yusuf, 1998). Most schools do not have modern instructional equipments and media. That is why above 80% of teachers in Nigeria are mostly using the chalkboard and textbook method which is regarded as traditional method in teaching and learning process. Some teachers are not all that capable to operate the ICT available equipment, so the few schools that have them are unable to use them effectively; which will result to inability of the teachers to put across the concepts to the students. This also results to lack of skills and competence required for teaching. This contributed to the poor performance of students in examinations (Chiadika, Awili, and Nwabudike, 2012; Solomon I., 2011; and Osagiede , 2012).

Advanced countries have specific plans for ICT. For instance in Britain the National Grid for learning initiatives, and strategy for Education Technology,

specifically addressed ICT issues in united Kingdom and Northern Ireland respectively (Seliger and Austin, 2003).But Nigerian National policy does not give any guidelines on school technology plans (Chiadika, Awili, and Nwabudike,). The need for integration in teaching and learning, the need for quality professional development programs for pre-service and serving teachers, research, evaluation and development, and the development of local content software are not addressed in Nigerian National Education Policy (Solomon, Onyemaechi, and Ogbenyealu, 2012). So, the products of some few schools where these ICT modern instructional equipments are adequately available and effectively put in use will be compared with those schools where inadequate ICT equipments are.

The dynamic nature of science that is continuously in search of progress has brought about what we now call information and communication technology (ICT). The perennial mass failure in it's related subjects like business studies at WAEC level has been a great concern to many people especially Business Educators at various times (Omosewo, 1997; Belogun, 1985; Ogunneye, 1982; Orisaseyi 1972).

The implementers of knowledge in the teaching process need to be upright with their subject matters. The few schools where computers are available, teachers are unable to put them in use effectively and consequently this results to inability of teachers to put across the concept to the students.

When computer is well utilized, it will transform classroom instruction into a series of rich memorable experiences and thus reduce boredom and forgetfulness in teaching any subject (Solomon .I, et al, 2011).

Statement of the Problem:

A good number of educators have been showing a great concern with parents about the annual poor performances of students in ICT related subjects at WAEC level.

Over 80% of the schools do not have modern instructional equipments. This limits the teaching process to chalkboard and textbooks method. One of the most important factors that contributed to students' poor performance is non-availability of equipped Laboratory and inadequacy of modern instructional equipments for teaching and learning processes.

Purpose of the Study

This study aimed at:

- i. Making students to know that using computer increases the learners time devoted to the learning.
- ii. To sensitize the students that computer enhances the speed of available data and effectiveness and it increases teachers' efficiency and effectiveness

- iii. To find out the effect of non-availability of ICT instructional materials in the teaching learning process.
- iv. To determine the extent at which inexperience and incompetent type of teachers teaching the subject contributed to annual failure of the students at WAEC level.

Research Question

The following research questions were formulated to guide the study:-

- i. Is there any significant difference between the experimental group treated with the ICT instructional materials and the control group without treated with ICT instructional materials?
- ii. Is there any significant difference in the performances of male and female students taught with ICT instructional materials?

Hypotheses: The following two hypotheses were formulated by the researcher to carry out the investigation:

Ho 1: There is no significant difference between the experimental group treated with the ICT instructional materials and the control group treated with conventional traditional method.

Ho 2: There is no significant difference between male and female students taught with the ICT instructional materials.

Methodolgy

This research was carried out in some secondary schools in Okene L.G.A. Kogi State.

Research Design

The research design used for this study was a pre - test, post - test and experimental control group. This research was carried out in some junior secondary schools in Okene L.G.A, Kogi State, Nigeria between January and July, 2011. The students were randomly selected into two groups. An experimental research approach was applied in this research work.

Sample and Sampling Procedure

This research has a population of Business or ICT students in selected secondary schools in Okene L.G.A. Kogi State where the investigation was carried out. Five secondary schools were randomly selected using a stratified sampling procedure. There was a total of one hundred and fifty students selected from all the five schools for the study; That is, 75 male students and 75 female students.

Instrumentation

The instrument used was made up of 40 items of Business Studies Achievement test used as Pre - test and Post - test to measure every student's cognitive skill level. Multiple choice objective questions with five options (A-E) as the possible answers to the questions in the test items. Students answered these questions before and after the experiment. The students in experimental group were (exposed i.e) allowed to attend business studies lessons using ICT method for a period of 8 weeks. Then, the same business studies lessons were taught to group B (the control group) without using ICT instructional materials.

Then, after eight weeks of treatment for both experimental and control groups; the post-test of Business Studies Achievement Test (BSAT) was conducted to both groups. The development of courseware for these research materials followed the systematic and recursive approach of instructional development model put forth by Mervill and Goodman (1997) and Phillip (1987) as cited by Solomon, (2011).

Validity and Reliability of the Instruments

Three experts in educational technology, and science education departments, validated the instrument. The BSAT items were pilot tested and it was found satisfactory. Item analysis of the instrument was carried out and the reliability coefficient was computed and the value obtained was 0.95 and this was considered to be adequate for the study.

Data Analysis

The statistical analysis of data was carried out, mean, standard deviation and the t - test analysis of the two groups of students both in experimental and control groups were computed and used in answering the research questions. And $P \leq .05$ was the level of significance adopted for the analysis; which set the basis of significance for rejecting or accepting each of the hypotheses.

Result of the Findings

The two research questions using the two null hypotheses as guide; means, standard deviations and the t-test were employed in analyzing the pre – test and post – test data at the level of $P \leq .05$ significance of rejecting or not rejecting each of the hypotheses.

The BSAT instrument was administered in pre – test and post – test on both the experimental and the control groups of business education students randomly selected from the five secondary schools in Okene Local Government. The instrument i.e the business studies test were made up of 40 items of multiple choice purely on business studies to be answered in 40 minutes duration. This was aimed at determining the academic equivalent of experimental and control groups. The mean scores of both groups of students on the pre – test were calculated and t – test computed for the two

means. The means scores and the standard deviations and the result of t – test analysis are clearly shown in the Table I below.

Hypothesis I: There is no significant difference in the performances between the experimental group taught with the ICT instructional materials and the control group taught with conventional traditional method.

T – Test statistical method was used to compare the mean scores of the experimental and control groups. The result is shown in table I below.

Table I: Comparison of the Mean Scores Standard Deviation and Variance of Performances of Students in BSAT Instrument.

| Test | Experimental group | | | | Control group | | | |
|-------------|--------------------|-------|------|----------|---------------|------|-----|----------|
| | N | Mean | SD | Variance | N | Mean | SD | Variance |
| Pre – test | 75 | 47.3 | 6.5 | 34 | 75 | 46.9 | 6.4 | 32.6 |
| Post - test | 75 | 76.15 | 12.9 | 132.9 | 75 | 67.6 | 8 | 51.4 |

In table 1 above shows that there was significant difference between the post mean scores of the experimental and control groups at 0.05 level of significance. At a glance, it is obvious that from pre-test records of both experimental and control groups, there was no significant difference. Then from the post –test records the result of post-test revealed that there is a great gap in mean score, standard deviation and variance of that experimental group above those recorded in the column of control group.

Hypothesis II: There is no significant difference in the performances between male and female students taught with the ICT instructional materials.

Table II: T – Test Showing the Post – Test Performance of Male and Female Students in the Experimental Group.

| Variable | N | X | SD | SE | DF | T - cal | T - Critical | P. value |
|-------------|----|-------|------|------|----|---------|--------------|----------|
| Pre – test | 75 | 62.26 | 6.23 | 0.04 | 58 | 0.29 | 2.07 | 0.757 |
| Post – test | 75 | 63.73 | 5.78 | 0.07 | | | | |

Significant at $P \leq 0.05$

To test the above hypothesis II, the post test mean scores of male and female students in the experimental group were computed. The analysis was carried out using the t – test statistics and the result shown in the table II above. From the result, in table II, it can be seen that there was no significant difference ($t = 0.29, df = 58, p > 0.05$). so

null hypothesis II was therefore not rejected. Male and female students in the use of the experimental group were equally enhanced by the use of the ICT software; hence ICT instructional materials are gender friendly.

Discussion

The hypothesis I result which states that, there is no significant difference in the performances between the experimental group treated with the ICT instructional materials and the control group taught with the conventional traditional method. The earlier studies taught with computer achieved cognitively higher than those taught with chalkboard or lecture method (Solomon I, Onyebnachi K.E and Ogbenyeolu, U.U, 2011; and Jonah, 1991).

Then, from table I, it shows that there was no significant difference between the experimental group and control group in the pre – test but those, students taught with the ICT materials aided leaning achieved higher after the treatment in the post - test. That means, those student in the experimental group performed better particularly in the business studies and other science subjects like mathematics, physics, biology and chemistry etc. The experimental group students performed better in the business studies Achievement test (BSAT) when compared with those students in control group, computer influences positive leaning and promotes a sort of motivation for graduate students to learn better thereby serve as a tool for effective teaching and leaning science (Solomon I, and Onyemacchi K.E.(2011). ICT is an effective tool that can effectively develop individual's cognitive structure, psychomotor and effective abilities.

The data analysed in the table II, indicated that there is no significant difference between the performances of male and female students who were taught with the ICT instructional packages. Male and female students performed equally in the BSAT instrument. Adeniyi in (1982) equally revealed in his work that, students taught science subjects with ICT instructional materials achieved cognitively higher than those taught with traditional method only.

Conclusion

Teaching science at secondary school level depends largely on the instructional strategies that the teachers employ (Fati. B.Shuaibu, 2007 and Solomon, 2011). That means instructional strategies have significant effect on the learners' achievement. This study proved that better performance particularly in business studies can be achieved by either male or female students through the use of ICT instructional materials. Abdullahi (1982) established in his research finding, that gender did not influence performances in science generally.

Recommendations

1. The federal government and the curriculum planners should make ICT and Computer science compulsory in all the primary schools and secondary schools.
2. Curriculum planners should make necessary review on the ICT curriculum and computer science in the national policy on Education
3. Teachers should be allowed and sponsored to undergo in-service training on educational technology especially the production and use of computerized instructional materials.
4. Federal, states and local governments should endeavour to supply computers, internet facilities and other necessary instructional materials like slide and video presentation materials to all the institutions in the country i.e primary, secondary and thirtiary institutions.
5. Science Educators should continue to lay more emphasis and implement the good quality concept to promote quality education.

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