COMPARATIVE STUDY OF THE EFFECTS OF COMPUTER ASSISTED INSTRUCTION ON STUDENTS' ACADEMIC ACHIEVEMENT IN SCIENCE SUBJECTS IN HIGH SCHOOLS IN OSUN STATE, NIGERIA

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Abstract

In recent years, Information and Communication Technology (ICT) has been growing quickly and seems to become an integral part of individual life. Since the dawn of the twenty first century, technology has crept into learning and teaching environment. With the growing rate of technology, the education framework must be improved, and ICT be integrated into school activities. This may be the thought of the State of Osun in introducing computer into senior high schools to assist delivery of instructions. However, the effect of the introduction of computer on students' performance has to be considered. Therefore, this study investigated the effects of Computer Assisted Instruction (CAI) in science subjects (Biology, Chemistry and Physics) on senior school students' academic achievement. One school in each senatorial district was supplied with computer by the state government of Osun ahead other schools. These schools were purposively selected for the study. An intact Senior Secondary School Two science class was randomly selected from each school supplied with computer. In all, 152 students participated in the study. Pretest-posttest quasi experimental design was used for the study. Students' examination scores served as instruments. The examination questions were validated, and the reliability stood at r = 0.82. Data collected was analysed using descriptive and inferential statistics. Results showed difference between the mode of instruction and students' achievement in each of the subjects. The difference was highest in biology; physics and chemistry trailed behind respectively. It was recommended that computer be used in aiding the teaching of science subjects.

Introduction

Since ancient times, various techniques have been devised for communicating thoughts, needs, desires, etc among human beings. Communication being an integral part of everyday life of an individual has span through the entire world. Today, in this civilized dispensation of the twenty-first century, the communication system has advanced to carrying voice, text, pictures and many other types of information with the advent of Information and Communication Technology (ICT). ICT according to Adomi and Kpanghan (2010) are electronic technologies used for information storage and retrieval. Asli, Berrado, Sendide and Darhmaoui (2015) refer ICT to a large field that includes radio and television, as well as newer digital technologies such as computers and internet. The rapid rate at which ICT is growing has led to globalization and the world becoming a global village. The recent advances of ICT have led computers to become recognized and widely available to many people. According to Adomi and Kpanghan (2010), ICT has a significant impact on all areas of human activity. It has found its use in every area of human endeavour.

With communication being an integral part of education, the education system is not left out of the ICT move. When used appropriately, different ICTs are reported to foster access to education, strengthen the relevance of education to the increasing digital workplace and raise educational quality by teaching and learning in an engaging, active process connected to real life. The use of ICT is fast gaining prominence and becoming one of the important elements of defining the basic competence of students. The ICT breakthrough has made a landmark in globalizing education. Agari and Singh (2013) submit that the use of ICT in teaching is a relevant and functional way of providing education that will assist in

imbibing in the learners the required capacity for the whole word of work. Information and Communication Technology has entered the classroom in a big way and become part of the teaching and learning process. The introduction of ICT in education has been shown to be important in improving access to learning, creation of conducive learning environment, quality of knowledge delivery, expanded secondary and post-secondary education, reduction of expenditure on training among others (Ogunleye, 2007). It is now evident that the integration of ICT in teaching is central towards quality education. Supporting the accession, Adomi and Kpanghan (2010) remarked that ICT has undoubtedly affected teaching and learning.

In a rapidly changing world, basic education is important for an individual to be able to access and apply information. This ability is found in ICT usage. Also bearing in mind the submission of Economic Commission for Africa that the ability to access and use information is no longer a luxury but a necessity for the development of a nation (Adomi and Kpanghan, 2010), there is great need for integration of ICT in classroom for teaching and learning especially in sciences in developing countries like Nigeria where there is low ICT application in classrooms. Science is the basis for scientific and technological development of any country. The growth of any nation is a measure of its advancement in science. Fakorede (1999) remarked that any country that hopes to develop must not neglect science hence, science is taught in all schools in Nigeria.

Science is taught at Senior Secondary School (SSS) level as Biology, Chemistry and Physics. At this level, the teaching is not just concerned with knowledge of the subjects but more particularly with scientific method and the effect of the use of this method on individual student. Therefore, the teaching of sciences at SSS attempts to develop both manipulative and mental activities. The overall objective of science curriculum in SSS include application of students' scientific and technological knowledge and skills to meet social needs as well as take advantage of numerous career opportunities offered by science and technology. In view of this, it shows that there is a relevance of technology to science curriculum. Therefore, the use of ICT in science teaching and learning in classroom may be an expansion in the pedagogical resources available.
Though the use of ICT in science classroom cannot replace normal classroom teaching.

Al-Alwani, (2005) remarked that ICTs could be positive forces in science classrooms for deeper understanding of principles and concepts for better outcomes or achievements. Also, Agrahari and Singh, (2013) remarked that ICT integration in classroom may compliment a teacher's existing pedagogy and have positive effects on students' academic achievement. ICTs have been reportedly used for simulations and modelling in science and mathematics and have been shown to be effective in the development of students' language and communication as it has word processing and communication software.

Despite the entrant and effect of ICT in the field of education and its relevance to science teaching and learning, Adomi and Kpanghan (2010) reported that its application in Senior Secondary School is still low. Most teachers according Ogunleye, (2007), Ndudi and Chinedu, (2016) are not prepared to use ICT and most of the existing school buildings are not equipped to integrate the new ICT especially in public Senior Secondary Schools. In this case where secondary schools have been equipped with computers, effort has not been made to research into the effects this might have on students' performance especially in science which is central to the development of a nation.

Statement of the Problem

In this twenty first century, the use of ICT is fast gaining prominence in every aspect of individual life. Its application and integration has made the world to become a global village. The education system is also not left out of this growth. But the execution of ICT is still low. Its integration and application in classrooms is still very low especially in government schools. This may be the careful thought of the State Government of Osun in the supply of computer tablet ('Open imo') to individual student of Senior Secondary School Two in the state. In few secondary schools where ICTs have been integrated, one puzzling question is the impact of this technology on students' achievement. The impacts of its usage on the students' achievement have not been considered by the supplier who is the

government. Therefore, this study considered the effects of the use of computer tablets to SSS II students for teaching and learning on academic achievement in science subjects.

Purpose of the Study

The study examined difference in the achievement of students when taught biology, chemistry and physics with and without students' computer tablets and to compare the difference (s) if any occurred in students' achievements in biology, chemistry and physic without and with students' computer tablets.

Hypotheses

1. There is no significant main effect of treatment on students' achievement in:
   (i) Biology
   (ii) Chemistry
   (iii) Physics

Methodology

The research design adopted for the study is a pretest-posttest quasi-experimental design. Multi-stage sampling techniques were adopted. Firstly, purposive sampling procedure was adopted to obtain three secondary schools from three senatorial districts of Osun State. The three schools and the senatorial districts are Baptist High School (BHS) Iwo, from Osun West, Ataoja School of Science (ASS) Osogbo, from Osun Central and Ilesha Grammar School (IGS) Ilesha, from Osun East. These schools were sampled because they were the first set of schools given the computer tablets and all senior secondary school II students were given. Achievement Test (AT) was used as a test instrument, while Opon-Imo was used as a treatment instrument. Three science subjects were taught in the cause of the study. The science subjects are Physics, Chemistry and Biology. The AT was administered to the students as examination questions before the supply of the computer tablet. The test instrument used in collecting data for the study was researchers' adopted Physics, Chemistry and Biology Achievement Test. The achievement test consists of 60 multiple choice objective items with five options (A–E) adopted from past examinations of West African Examination Council (WAEC, May/June) and National Examination Council (NECO, June/July) for Physics, Chemistry and Biology Achievement Test.

Treatment instrument (Opon-Imo) was used for the three schools. The topics in the curriculum for Nigeria Senior Secondary School II (Physics, Chemistry and Biology) were taught using the treatment instrument. To test for the hypotheses, the data were analysed using a two-way Analysis of Variance (ANOVA) using Statistical Package for Social Sciences (SPSS) version 20 at 0.05 alpha level. The results are presented based on the research hypotheses.

Experimental procedure

The objectives and the modalities for the experiments were explained to the subject (biology, chemistry and physics) teachers in the three schools before the commencement of the treatment. The one science class in each of the schools was used for the study. Achievement Test was administered to the students at the end of first term before the supply of the tablets. This serves as the pre-test. The tablets were supplied to the students and teachers at the beginning (first week of the term) of second term. Biology, Chemistry and Physics contents as installed in the tablet given to the learners and the teachers cater for each of the units. The tablet was used in the teaching of the students instead of textbooks. The teaching was carried out for ten weeks. This was the treatment. Immediately, after the treatment, the Achievement Test was administered to the students again. This is the post-test.

Result
Research Hypotheses 1:
There is no significant main effect of treatment on students' achievement in Biology, Chemistry and Physics

Table 1:
Tests of Within-Subjects Effects for Physics, Chemistry and Biology

Source		SS	df	MS	F	Sig.	Partial Eta Squared
Factor	Sphericity Assumed	18083.03	1	18083.027	103.23	.00	.19
	Greenhouse-Geisser	18083.03	1.00	18083.027	103.23	.00	.19
	Huynh-Feldt	18083.03	1.00	18083.027	103.23	.00	.19
	Lower-bound	18083.03	1.00	18083.027	103.23	.00	.19
factor* Science Subjects	Sphericity Assumed	19766.85	2	9883.43	56.42	.00	.20
	Greenhouse-Geisser	19766.85	2.00	9883.43	56.42	.00	.20
	Huynh-Feldt	19766.85	2.00	9883.43	56.42	.00	.20
	Lower-bound	19766.85	2.00	9883.43	56.42	.00	.20
Error(factor)	Sphericity Assumed	79354.62	453	175.18			
	Greenhouse-Geisser	79354.62	453.00	175.18			
	Huynh-Feldt	79354.62	453.00	175.18			
	Lower-bound	79354.62	453.00	175.18			

Using the Sphericity Assumed, the table revealed that there was a significant main effect of 'Opon Imo' on the performance of senior secondary II students' performance in Physics, Chemistry and Biology with (F (1,453) = 103.23, p =.00, ηp2<.19). More so, the study revealed that there was a significant interaction among the science subjects of physics, chemistry and Biology when taught using 'Opon-Imo' with (F (1, 38) = 56.42, p =.00, ηp2<.20). This indicates that the use of 'Opon-Imo' to teach the science subjects enhances students' performance.

Table 2:
Test of Between Subject Effects for Physics, Chemistry and Biology

Source	SS	df	MS	F	Sig.	Partial Eta Squared
Intercept	947449.58	1	947449.58	5170.87	.00	.20
treatment	21697.20	2	10848.60	59.21	.00	.21
Error	83002.47	453	183.23			

Table 2 revealed that (F (1, 453) = 59.21, p =.00, $\eta p2 < .21$), Sig. 0.00 which is less than 0.05 is significant because the probability of 0.00 is lower than alpha value ($\alpha = 0.05$) for the students' performance in the three science subjects. Therefore, the null hypothesis is rejected. It implies that there was a significant main effect of 'Opon Imo' on the performance of senior secondary II students' performance in Physics, Chemistry and Biology.

Table 3:
Mean Difference of Students in Biology, Chemistry and Physics

Group	Treatment	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Biology	Conventional	52.51	1.43	49.71	55.32
	Opon-Imo	57.05	1.24	54.62	59.48
Chemistry	Conventional	38.00	1.43	35.20	40.80
	Opon-Imo	38.34	1.24	35.91	40.77
Physics	Conventional	32.88	1.43	30.01	35.68
	Opon-Imo	54.72	1.24	52.29	57.15

The table above revealed that students perform better in Biology with a mean of 52.51 for the conventional group and a mean of 57.05 for the treatment group revealing a mean gain of 4.54. Also, Chemistry has a mean score of 38.00 for the conventional group and a mean score of 38.34 for treatment group revealing a mean gain of 0.34 while Physics has a mean score of 32.88 for the conventional group and a mean score of 54.72 for the treatment group revealing a mean gain of 21.84. This indicates that students perform better in the science subjects (physics, Biology and Chemistry) using the Opon-Imo as the treatment.
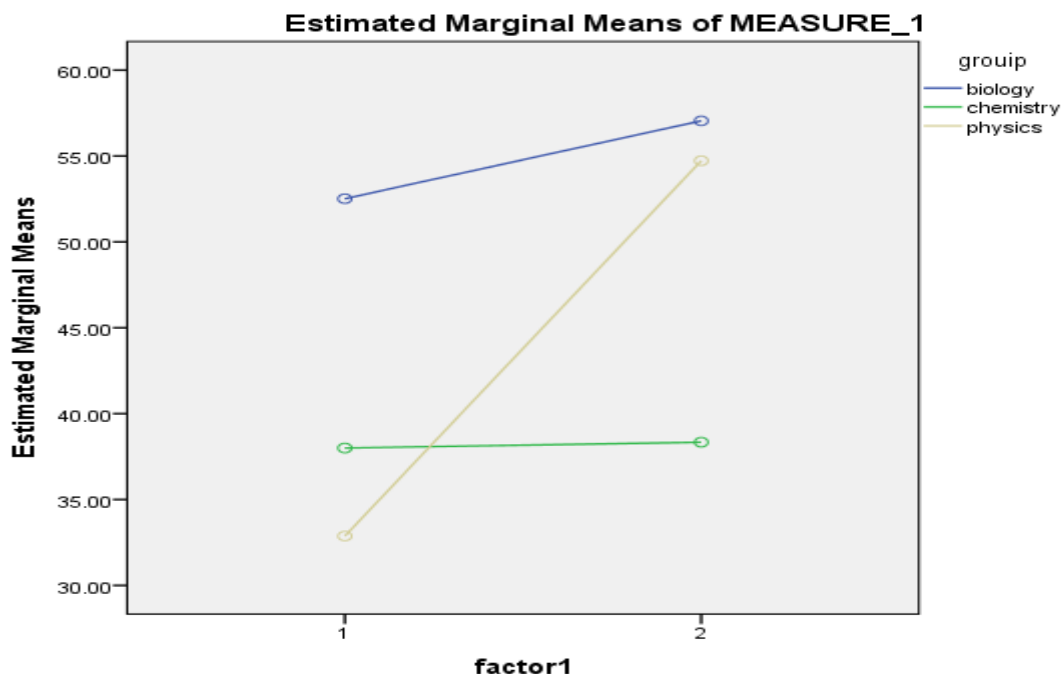
Figure 1:
Group Treatment

From the way the line slopes it was observed that participants performed well in the respective science subjects but much better for Physics group, followed by the Biology group and then the Chemistry group. The slope of the lines shows that the vertical distance between the dots for each group. Based on this, the group performance was shown as each group performed better when exposed to treatment.

Table 4:
Scheffe's Post hoc Test for the Performance of Students in Different Science Subjects

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
biology	chemistry	16.61*	1.55271	.00	12.96	20.26*
	physics	10.98*	1.55271	.00	7.33	14.63*
chemistry	biology	-16.61*	1.55271	.00	-20.26	-12.96*
	physics	-5.63*	1.55271	.00	-9.28	-1.98*
physics	biology	-10.98*	1.55271	.00	-14.63	-7.33*
	chemistry	5.63*	1.55271	.00	1.98	9.28*

*. The mean difference is significant at the 0.05 level.

The Scheffe's post hoc test revealed that there is significant difference in performance of students in the three science subjects (Biology, Chemistry and Physics). From Table 5, the direction of the significant difference in students' performance in the three science subjects of physics, Biology and Chemistry at 0.05 significant level of alpha ($\alpha = 0.05$).

Discussion

The study revealed that there was a significant main effect of treatment on students' achievement in the science subjects of Biology, Chemistry and Physics. This is in line with the report of Shih (2005). Shih believed the adoption of mobile devices for instructional delivery purpose is essential and helpful to students learning. The report of Goodwin (2012) also supports the finding of this study that effective learning using mobile device brings learner's creativity, collaborative, communicative and critical engagement. And it promotes effective learning. The report of Promoting and Supporting the Integration of ICT in Education (2017) revealed that students adapt quickly to modern technologies and tablets are attractive learning tools by students and have the potential to introduce more engagement and fun into learning as they increasingly have access to tablets and smartphones outside of school

Conclusion

The study concluded that students can adapt easily to the use of mobile devices in school. The usage of mobile devices is one of the factors that really affects the performance of students when exposed to the use of the 'Opon-Imo' for learning the science subjects.

Recommendation

Based on the findings of the study, this study recommends that all the students in secondary schools in the State of Osun should be given computer tablet i.e. 'opon-imo'. Students should also be given the 'opon-imo' from the junior secondary schools so that it could be used in the teaching of basic science. Also, other states may key into the ideas as it may help students to learn practical oriented science subjects, teachers should be trained continuously as facilitators to assist the students learning.

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