Effects of Information Communication Technology (ICT) on Students' Retention in Basic Electricity

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Abstract
The study investigated the effect of Information and Communication Technology (ICT) on students' retention in Basic Electricity in technical colleges in Rivers State. The retention of students' taught with ICT was compared with that of those taught with the Conventional Teaching Method (CTM). Three research questions guided the study while three hypotheses were tested for the study at .05 level of significance. A quasi experimental design, specifically, the non-randomized control group design involving four intact classes were used. The population was 212 vocational II Electrical Installation Works Department students from two technical colleges in the state. These students in their intact classes were assigned either to experimental group (ICT) or control group (CTM). Basic Electricity Retention Test (BERT) instrument was developed, validated and used for data collection. Reliability of the BERT was 0.89. Mean and standard deviations were used to answer the research questions while ANCOVA was used to test the null hypotheses. Findings of the study revealed that ICT has significant effect on students' retention in Basic Electricity as gender was found to be a significant factor in students' retention. It was recommended that Basic Electricity teachers should employ the use of ICT facilities in teaching, ministry of education at all levels including examination bodies like NABTEB, WAEC and NECO should organize workshops, seminars and conferences as to train and encourage teachers on the use of this innovative teaching technique.

Introduction

The increasing demands for skilled middle level manpower in Nigeria's emerging market economy highlights the developmental roles of technical and vocational education. These cadres of human capital according to Ogwo and Oranu (2006) are mostly trained at the polytechnics/monotechnics and technical colleges. The technical colleges provide secondary level education in technical and vocational education. Various theoretical and practical studies are carried out to come up with different and efficient ways of teaching in technical colleges. One of the ways is the use of Information and Communication Technology (ICT) in education.

Information and Communication Technology is the infrastructure and components that enable modern computing (Rouse, 2017). Information and communication technology refers to the applications found on most thin client computers, internet, radios, digital televisions and projectors among others that teachers can use as pedagogical tools (European Union, 2009). ICT among others is an electronic means of capturing, processing, storing and communicating information. Information and communication technology is a diverse set of technologies, tools and resources (Pilli, 2008). These technologies include radio and television (broadcasting technologies), computer and the internet (digital technologies) and telephony. These arrays of technologies have been touted as potentially powerful enabling tools for educational changes and reforms. Hernes (2002) posited that different ICTs when appropriately used help to expand access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by, and among others helping to make teaching and learning be an engaging active process connected to real life.

The use of ICT in the classroom teaching and learning is very important for it provides opportunities for teachers and students to operate, store, manipulate, and retrieve information, encourage independent and active learning, and self-responsibility for learning such as distance learning. Also it motivates teachers and students to continue learning outside school hours, plan and prepare lessons and design materials such as course content delivery and facilitate sharing of resources, expertise and advice. This versatile instrument has the capacity not only to engage students in instructional activities to enhance their learning, but also to help them solve complex problems in order to increase their cognitive skills (Jonnasen and Reeves, 1996 in Okorieocha and Eronini, 2016).

Several studies argued that the use of ICT in the classroom is essential for providing opportunities for students to learn as to function effectively in an information age. Ash (2005) in Pilli (2008) argued that traditional education environments do not seem to be suitable for preparing learners to function or be productive in workplaces of present day society. Ash further stated that organizations cannot seriously claim to prepare their students for life in this twenty-first century. The information and communication technology tool required in education among others include computer and the internet. Computers are used to present instruction by the means of a modern teaching method known as computer assisted instruction (CAI). Computer assisted instruction is an automated instructional technique in which a computer (electronic machine) is used to present an instructional programme to the learners through an interactive process on a computer (Ajelabi, 2000 in Okorieocha, 2010). Computer assisted instruction is learner centered and activity oriented. One of the most powerful features of CAI is its capacity to individualize instruction to meet the specific needs of learners (Rasmussen and Davidson, 1998 in Bontempi and Hazelwood, 2003).

Computer assisted instruction could be of great help because of the drill-and-practice-tutorial of simulated activities they often provide (Cotton 2004). Williams and Brown (1990 in Okorieocha, 2010) stated that effectiveness of CAI has been demonstrated through improved test scores, reduced learning time, higher course completion rate, and increased retention duration. Furthermore, Granito and Chernobilsky (2012) posited that the use of ICT in education can help to improve memory retention, increase motivation and generally deepens understanding.

Computer assisted instruction consists of the tutorial mode among others which is stored in a compact disc read-only-memory (CD-ROM). The use of a computer assisted instruction, tutorial in a CD-ROM is ideal to improve the conventional teaching methods (CTM). Conventional teaching methods are instructional strategies which make the teacher more active and the learner passive participants in the teaching and learning environment (Awotua-Ifebo, 1990 in Okorieocha and Eronini, 2016). Teaching methods like teaching methods teaching discussion, role-playing among others are classified as conventional or traditional teaching methods (Brownson and Atkus, 1998 in Okorieocha, 2010). Nwizu and Nwobi (2006) posited that lecture method makes the instruction boring and the facilitator not carrying the audience along. The discussion method is time consuming and is characterized with the problem of how to start the discussion.

Conventional teaching methods have made teachers lack the required modern skills to impart knowledge to their students mainly in technical subjects. Students in this regards, lack the employable skills demanded of them which according to Ogwo and Oranu (2006) is the ultimate candour in using any method of instruction for technical and vocational education. Conventional teaching method is adopted in technical colleges for instructional delivery.

Technical colleges have been characterized by high failure rates in technical courses at the public examinations which have been associated with two factors, which are quality and quantity of teachers and quality of teaching methods and facilities (Aina, 2002 in Okorieocha 2010). Aina asserted that a close examination of the factors responsible for this poor performance indicates that technical education is no longer attractive to the learners because of poor teaching, scanty infrastructural facilities and poor instructional techniques.

Technical education is one such educational programmes that provide the youth opportunity to acquire skills and knowledge for effective nation building, it is acquired in technical colleges. The range of subjects taught in the technical colleges include among others General Metal Work, Radio Television and Electronic Work and Appliances Repair, Electrical Installation (domestic and industrial) and Basic Electricity (National Board for Technical Education, NABTEB 2003). These courses are designed to produce knowledge based and practically skilled individuals who will be self- reliant and enterprising.

Basic Electricity as contained in the National Business and Technical Examinations Board (NABTEB) syllabus is one of the compulsory core subjects offered by electrical installation works students. Contents of basic electricity dwell on the principles of electricity which involves calculations mainly. According to NABTEB Chief Examiner's Reports (2006), in Okorieocha (2010), credit pass of students in basic electricity was very low and quite unimpressive. Asim, Bassey and Essien (2005) in Okorieocha (2010) reported that students performance in basic electricity in the West African Senior Secondary Certificate Examinations (WASSCE) from 1999-2003 was very poor. This implies that the there is poor retention of students in the subject.

Inability of students to retain what they have learnt has been pointed out as one of contributing factors of students' poor academic achievement in Mathematics. Retention is the ability to remember things. Retention is the ability to recall the piece of information whenever it is required or the process of maintaining a replica of required new meanings (Ogbonna, 2007). The amount of retention is directly affected by the degree

of original learning. Granite and Chernobilsky (2012) posited that instead of memorizing facts for a test, teachers want their students to retain the information longer than a week. It implies that if students did not learn a concept well initially, they will not retain it well either. Abbamondi (2004) maintained that in order to benefit from learning, students must retain information.

Succinctly the amount of retention is directly related to how well a student learns the information at the beginning. Among the attributes of retention that are closely related to success, are the power to recall (that is, memory) and to recognize (Ogbonna, 2007). Memory is the capacity to retain an impression of the past experiences. Memory is classified based on duration, nature and retrieval of perceived items. Iji (2003) in Obi, Agwagah, and Agah (2014) asserted that man is endowed with limited capacity for memorization and to correctly and effectively apply whatever one has learnt, retention must come to play a vital role. In the light of this, effort should be intensified to improve students' retention ability particularly in basic electricity

Statement of the Problem

It has become so obvious that there is an astronomical decline in students' achievement in basic electricity in technical colleges. Lack of success can lead to inappropriate behavior on the part of students (Igbo in Umunadi, 2009). This unsatisfactory situation could lead to breakdown in the economic, industrial, technological and economic growth of the nation since the main aim of technical education is to achieve self reliance. Moreover, technical education is geared towards skills acquisition for man power development to enhance national growth and development. It is sad to note that technical education graduates no longer possess employable skills needed of them. This makes it difficult for these graduates to secure jobs in companies and industries on completion of their courses of study thereby increasing the unemployment rate of the nation. The goal of the 21st century classroom is to prepare students to become productive members of the workplace (Agommuoh, 2016).

Furthermore the new requirement for working and living in the present 21st century is the ability of students to become technologically compliances. In order to achieve this feat there is need to turn from the conventional teaching method to the modern teaching method like the Information and Communication Technology (ICT) computer assisted instruction. Cotton (2004) posited that students receiving information and communication technology computer assisted instruction retrain learning better. Many educators believe that the use of computer assisted instruction is superior to other pedagogies (Kulik in Okorieocha, 2010). Therefore, the problem of this study, posed as a question is how does Information and Communication Technology improve students' retention in basic electricity?

Purpose of the Study

The major purpose of the study was to investigate the effect of Information and Communication Technology. Specifically, the study sought out to:

i. compare the mean retention scores of students taught with ICT and the CTM.
ii. ascertain whether differences exist in the overall retention scores of female and male students exposed to ICT.
iii. determine the interaction effect of ICT and gender on students' retention in basic electricity.

Research Questions

The following research questions guided the study.

i. What are the mean retention scores of students taught with ICT and CTM in

basic electricity retention test (BERT)?

ii. What differences exist in the mean retention scores of female and male students taught basic electricity with ICT as measured by BERT?

iii. What are the interaction effects of ICT and gender on students' retention in basic electricity?

Hypotheses

The following null hypotheses were tested in the study at .05 level of significance.

HO1 There was no significant difference in the mean retention scores of students taught with ICT and CTM.

HO2 There was no significance different in the mean retention scores of female and male Students' taught basic electricity using ICT.

HO3 There was no significant difference in the interaction effect between ICT and gender on students' retention in Basic Electricity Retention Test (BERT).

Methodology

The study adopted a quasi experimental design, specifically the non-randomize control group design involving two groups. The design is also termed 2x2 factorial design involving two independent variables (teaching method and gender). Each factor has two levels. The study was carried out in technical colleges in Rivers State. Population of the study was made up of 212 National Technical Certificate (NTC) II Electrical Installation works students. The entire population was involved in the study, hence there was no sampling. The study adopted purposive sampling technique because out of the four technical colleges in the state only two of them have ICT facilities and therefore were used for the study. At the end of the study it was discovered that only 123 students made up of 80 males and 43 females actively participated in both the pre-test, post-test and retention test. Instrument for the study was Basic Electricity Retention Test (BERT). The instrument was validated by three experts; one electrical lecturer from the Industrial Technical Education Department, one Measurement and Evaluation Specialist of the Educational Foundation Department, University Nigeria, Nsukka, and a lecturer from Technical Education Department, Rivers State University of Science and Technology, Port Harcourt. Reliability coefficient of the instrument was carried out to estimate the internal consistency using Kuder Richardson formula 20 (K-R20) techniques. The instrument was pilot tested on 30 NTC II Electrical Installation Works students of Government Technical College, Ekowe, Bayelsa State. The instrument has a reliability coefficient of 0.89. The data collected in the first administration served as the pre-test scores of the study. At the expiration of the treatment, which was for four weeks, the instrument was re-administered to the subjects immediately after the last teaching (post test). The retention test was conducted two weeks after the last teaching. The research questions were answered using mean and standard deviation. The hypotheses were tested at 05 level of significance, using a 2x2 (mode of instruction x gender) analysis of covariance (ANCOVA). The value of F-ratio at 0.05 significant level and above was accepted while the value of F-ratio below .05 level of significance was rejected. The statistical package for the social science (SPSS) computer analysis software was used for the data analysis in this study.

Results

The findings of this study are presented in accordance with the research questions and hypotheses.

Research Question 1

What are the mean retention scores of students taught basic electricity with ICT and CTM?

Table 1

Mean Retention Scores of Students taught Basic Electricity with ICT and CTM

Group	Number	Mean	Standard Deviation
Experimental (ICT)	46	74.24	13.53
Control (CTM)	77	57.76	19.34

Table 1 showed that the experimental (ICT) group had a higher mean retention score of 74.24 with a standard deviation of 13.53 while the control group (CTM) had mean retention score of 57.76 and standard deviation of 19.34. This implies that those taught with Information and Communication Technology computer assisted instruction had more retention ability than those taught the conventional teaching method.

Research Question 2

What difference exists in the mean retention scores of female and male students taught basic electricity with the ICT computer assisted instruction?

Table 2

Mean Retention Scores of Female and Male Students taught with ICT

Gender	Test	N	Mean	Standard Deviation	Mean Gain
Male	Post-Test	32	57.73	11.06	19.16
	Retention Test	32	76.88	9.98	
Female	Post-Test	14	55.71	12.11	12.50
	Retention Test	14	68.21	18.43	

Table 2 revealed that comparing the post-test mean score of male students with their retention test mean score which are 57.73 and 76.88 respectively, the mean gain is 19.16. On the other hand, the female students have post-test mean score of 55.71 and retention test mean score of 68.21 which gives mean gain of 12.15. This indicates that male students taught basic electricity with ICT have more retention ability than their female counterparts.

Research Question 3

To what extent would treatment gender interaction influence students retention in basic electricity?

Table 3

Mean and Standard Deviation of Retention Scores by Treatment – Gender Interaction

Gender		Experimental	Control	Overall
	Mean	76.88	62.19	69.53
Male	S.D	9.98	18.31	14.15
	N	32	48	80
	Mean	68.21	50.43	59.32
Female	S.D	18.43	19.05	18.74
	N	14	29	43
	Mean	72.55	56.31	64.43
Overall	S.D	14.14	18.68	16.41
	N	46	77	123

Table 3 indicates that male students in the experimental group had mean score of 76.88 while the male students in control group had mean score of 62.19. The female students in the experimental group had mean score of 68.21 while their counterparts in the control group had mean score of 50.43. Male students taught with ICT had a mean score 14.69 higher than their CTM counterparts while the female students taught with ICT had a mean score of 17.78 higher than their CTM counterparts. This reveals that students in the experimental (ICT) group both male and female have higher retention ability than those in the control (CTM) group. The mean score of female students taught with ICT being higher than the mean score of their male counterparts taught with ICT indicates that female students have more retention ability than the male students.

Hypothesis 1

There is no significant difference in the mean retention scores of students taught with ICT and CTM respectively.

Table 4

Analysis of Covariance (ANCOVA) of Students' Retention Scores in Basic Electricity Retention Test (BERT)

Sources	Sum of Squares	df	Mean Squares	F-cal	Sig.
Corrected Model	37160.512	4	9290.128	149.851	.000
Intercept	2030.446	1	2030.446	32.751	.000
Pre-Test	26111.023	1	26111.028	421.174	.000
Group	740.849	1	740.849	11.950	.000
Sex	1568.908	1	1568.908	25.307	.000
Group Sex	22.264	1	22.264	.359	.550
Error	7315.504	118	61.996		
Total	547068.750	123			
Corrected Total	44476.016	122			

*Significant at $P \leq 0.05$

Table 4 showed that F-cal value for group is 11.95 at .000 level of significant. This means that the null hypothesis is rejected. It then implies that there is significant difference in the mean retention scores of students taught with ICT and CTM respectively. That is, students taught basic electricity using ICT do not have equal retention ability with those taught the same subject using CTM.

Hypothesis 2

There is no significant difference in the mean retention scores of female and male students taught basic electricity with ICT computer assisted instruction.

Result in Table 4 indicates that gender (sex) is a significant factor in students' retention ability in basic electricity. The F-ratio at.000 level of significant is 25.307. With the hypothesis being tested at .05 level of significance which is greater than .000. It then implies that the null hypothesis 2 is rejected. This result means that there is significant difference in the retention scores of female and male students taught basic electricity with ICT computer assisted instruction. That is, female and male students do not have equal retention ability in the study.

Hypothesis 3

There is no significant difference in the interaction effect of ICT and gender on students' retention in basic electricity as measured by BERT.

With reference to Table 4 the effect of teaching methods on gender has F-cal value of 0.359 at .550 which is greater than .05. level of significance. It implies that the null hypothesis 3 is accepted. This means that there is no significant difference in the overall students' retention scores on BERT by treatment gender interaction.

Discussion of Findings

The study revealed that students taught basic electricity with ICT computer assisted instruction have higher retention than those taught the same concept using conventional teaching methods. The findings of the study with respect to students' retention agrees with that of Ezendu (1995) who observed that students taught with concepts map retained higher organic chemistry concepts than students taught with CTM. The findings is also in line with the views of Filgaro, Filgaro and Sababa (2017) who discovered that there was difference in the learning retention of students taught physical geography using mastery learning strategy and conventional method. Furthermore the findings of this study corresponds with opinions of Toklucu and Tay (2016) who in their study on effect of cooperative learning method and systematic teaching on students achievement and retention of knowledge on social studies lesson found out that there was a significance difference in the retention scores of the experimental and control groups. Also in agreement with the findings Abdu-Raheem (2011) observed that there was a significant difference in the retention scores of students in the experimental and control groups in a study on effect of discussion method on secondary school students achievement and retention in social students. This implied that the mode of instruction has insignificant effect on the retention rate of students. The higher retention rate exhibited by the experimental group could be as a result of the interactive exercises provided by the ICT which prevented students from proceeding to the next lesson without at least having an average score on the exercise attempted average score on the exercise attempted.

Furthermore, the study revealed a significant gender related difference in students' retention in basic electricity. Female students performed better than their male counterparts on retention test in basic electricity. This is contrary to the findings of Obi, Agwagah and Agah (2014) who observed that the mean retention of male and female students was not statistically significant in their study on effect of Origami on students' retention in geometry. The findings also disagrees with Nneji (2013) who observed that there was no significant difference in the retention scores of male and female students taught algebra with POGPROSMO.

Evidence from the study revealed that there was no significant difference in the combined effect on students' interaction

pattern in the combined effect on students' interaction pattern and gender on students' retention in basic electricity. The findings of this study with respect to treatment gender interaction is an agreement with that of Obi, Agwagah and Agah (2014) who observed that there is no significant interaction effect of Origami and gender measured by geometry retention test. The implication of this finding is that with ICT it might be possible to eradicate or minimize gender related differences in basic electricity retention ability.

Conclusion

Based on the result obtained this study indicates that the use of information and communication technology is very effective to enhance students' retention in basic electricity than the conventional teaching method. There was significant difference between the male and female students in their levels of retention. ICT and gender interact significantly relative to retention in basic electricity. Finally, there was statistical difference in the female and male students in experimental group with respect to retention.

Recommendations

Based on the findings, the following recommendations were therefore made:

1. With high mean retention score recorded through the use of ICT, it therefore calls for teachers to be abreast with this laudable and novel teaching technique in order to enhance students cognitive, affective and psychomotive outcomes of learning.
2. Basic electricity teachers should pay attention to the issue of gender differences in the classroom. They should try the much could to eliminate contents, instructional techniques, and materials that will introduce gender differences in the classroom.
3. There should be well trained personnel to handle such innovation like ICT as to make training and retraining of staff imperative.
4. Ministries of education at all levels including examination bodies like WAEC, NECO and NABTEB should organize workshops, conferences and seminars to train and encourage teachers on the use of this innovative technique.
5. Electricity distribution companies in Nigeria should as a matter of utter urgency connect every technical college with electricity. Beside, standby generators with adequate storage and security should be installed in all technical colleges to ensure constant power supply.

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