Differential Effects of Synchronous Virtual E-Learning and Conventional Strategies on Academic Achievements in Basic Technology Curriculum Implementation in Ibadan, Nigeria

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Abstract

The choice of appropriate instructional strategies remains a crucial factor in the delivery of a curriculum and on the learning outcomes of the recipients. Despite the instructional efforts by teachers of basic technology in Nigerian secondary schools to effectively instill in learners basic technological skills, the inadequacies in the teaching methodology are still a perennial problem. This study, therefore, examined the differential effects of synchronous virtual e-learning and conventional strategies on secondary school students' academic achievement in basic technology curriculum implementation. The study adopted a quasi-experimental pre-test and post-test design was adopted. A total of 100 junior secondary school III basic technology students participated in the study. The study findings established that there were significant differences between the students taught with Synchronous Virtual E-Learning Strategy (SVE-LS) and those taught with a Conventional Strategy (CS) (SVE-LS – x=38.50; CS – x=26.61; F_2, 95=456.632, P<.05). It was recommended that Synchronous Virtual E-Learning Strategy should be used in teaching basic technology.

Key words: Basic technology, Curriculum, Information and Communication Technology, Nigeria, Virtual E-learning

INTRODUCTION

The introduction of information and communication technologies (ICT) into teaching and learning activities has brought transformations such as innovations in pedagogical approaches and interactive curricular practices in this present digital age. Therefore, in order to align with the global voyage of reshaping today's school system and educational institutions with the effective integration of ICT resources, and with a view to enhancing teaching and learning, the use of virtual e-learning approaches in educational activities is paramount importance. This is due to the fact that ICT makes learning more student-centred and it improves teacher and student interaction (Ogumogu, 2015 & Oyelekan, 2008). There are various ICT tools that can be used as teaching tools that can support teacher's work inside and beyond the classroom (Osakwe, 2012). This have brought into existence, a transformation referred to as electronic learning (e-learning). E-learning is an innovative approach for delivering electronically-mediated, leaner-centred and interactive learning environment to anyone and in anyplace by utilizing the digital technologies in connection with instructional design principles (Hedge and Haward, 2004). E-learning utilizes technology to deliver, instruct or facilitate education (De-Santis, 2003).

Paris (2004) defines e-learning as the process of using a computer to aid learning process. In his own view, Wali (2005) views e-learning as a form of learning provided electronically using computers, satellite, telephones, the Internet, intranet and world-wide web. Ugwoke

(2011) indicates that e-learning involves face to face, distance, mixed and blended delivery model that utilizes electronic means. This description of e-learning is subsumed in virtual education which is any instruction given in a learning environment where teacher and student are separated by type or space, or both, and the teacher provides course content through course management application, multimedia resources, the Internet and video conferencing among others. The virtual concept characterize that the course or subject is not taught in a classroom face to face like the conventional traditional strategy but through electronic mode that can be associated with classroom teaching.

Students taught in virtual education environment typically acquire knowledge in a uni-directional manner first. Subsequent discussions of problem solving exercises, case studies and reviewing questions help the students to understand better what they learned before. This connotes that virtual e-learning strategy implies the different ways by which teaching can be transferred to students electronically in an environment where teacher and students are separated by time and space or both. This implies that, when help is needed, teachers, tutors or fellow students are available just like in a real school teaching and learning environments, but the difference is that all communication are channeled through electronic media.

Different modes or forms of virtual e-learning strategies exist from which professional teachers or tutors can choose. However, the conventional teaching method is an approach in which the teacher presents a verbal discourse on a particular subject. The conventional teaching strategy has been adjudged to be authoritative, boring for students, and that it places emphasis on writing, reading and listening to teachers' talk. Still, it is not uncommon to observe its usage in curriculum implementation process of basic technology and many other subjects in Nigerian educational institutions till date. But, its status in the implementation in the curriculum practices of basic technology curriculum has been a concern hence, the basis of this study.

The use of e-learning approaches grew out of constructivism theory that provides a useful framework for Computer-Assisted-Instruction (Phillips, 2000). In the context of this study, the application of constructivism demands that basic technology students should construct their own knowledge through previous experiences using virtual e-learning approach that is learner-centred. It appeals to more senses compared to some other technological tools and make concepts look concrete because of the electronic approaches to the teaching-learning process. Similarly, students play influential parts in accomplishing the pedagogical functions which result in to their learning.

In virtual e-learning approaches in curriculum implementation, different forms or modes of approaches can be mixed together (blended learning approach). In blended learning, the face to face portion is conducted in an instructor-led classroom while the online learning portion could be provided as synchronous or asynchronous strategy. In a synchronous virtual e-learning strategy, the participants (students) engage in exchange of ideas or information through the use of blogs, wikis, e-mail, without the dependency of other participants' involvement at the same time. Of much interest to the researchers in this study is synchronous virtual e-learning strategy which involves the exchange of ideas and information with one or more participants in the online teaching-learning engagement. Online synchronous design strategy could be online chart, video-conferencing, and/or conference calls. Meanwhile, Iji (2007) recommended to teachers to exhibit virtual e-

learning at the junior secondary school level. This is the level where basic technology is also offered in secondary school education in Nigeria.

Synchronous virtual e-learning strategies include but not limited to the following: (a) Synchronous physical formats such as instructor-led classrooms and lectures, hands-on laboratory and workshops, and field trips (b) Synchronous online formats (live e-learning) such as in e-meetings, virtual classrooms, web-seminars and broadcasts, online coaching, and instant messaging. In this respect, the mode of synchronous virtual e-learning strategy employed along with the conventional strategy is the integrated synchronous virtual e-learning strategy. The design and application of integrated synchronous virtual e-learning strategy is the combination of different facets of it in classroom instructional practices. Different learning materials have to be developed to take care of different requirements of learners; usage of slides with their textual counterparts; self paced presentation through electronic gadget allowing the distant learner(s) to get the same information as the attending ones; use of electronic chart, video conferencing and teleconferencing and through any other electronic media during the curriculum implementation and students learning with adequate interaction and group collaboration through the electronic system.

In the use of various learning strategies in curriculum instructional practices, several factors have been identified as influential either at significant levels or not. Such factors include learners' age, attitude, gender, school type, school location, home background, teacher factors and academic performance among others. However, of interest in this study, is to determine how learning strategies affect academic performance. In learners' achievement and ability, it has been argued that some have low academic performance, some others academic performance is average (medium) while the other category is high academic performance. It is worth noting that academic ability level is the mental and physical power of an individual to achieve in school academic work. The academic level of a learner is one of the determinants of accomplishment in academic success.

Several studies within Nigerian environment have shown that learners are qualitatively different in their academic performance levels and in learning problems especially with the rate at which principles and facts of a subject are being assimilated (Adesoji, 2008). Enyi (2004) also asserted that good teaching with appropriate method of instruction can circumvent the problem of medium and low performance level. Ekhasemombe (2010) reported that the achievement of high academic performance students is usually higher than that of medium and low performance students because some methods of instruction are beneficial to high ability students. Similarly, Ann, Sobowale, Nsofor, Oboh, Tukura & Kuta (2014) found out that there was significant difference in the achievement of high, medium and low performance level of students taught using computer-assisted instructional package in individualized learning setting and those taught with conventional method.

In Nigeria, one of the innovative broad field subjects introduced into junior secondary school education since 1980's is basic technology. This pre-vocational subject covers the inculcation of basic technological knowledge, vocational skills and habits formation as pre-requisite for further education and training in vocational-based disciplines at the higher level. Its curriculum structure is indeed vocational but the approaches often used in the implementation process have been of concern to vocational educators.

Despite the efforts and strategies of the teachers who implement basic technology curriculum over the years, obviously it is not uncommon to see students' knowledge and skills acquisition in the subject terminating at the junior secondary school level perhaps due to inadequacies in the teaching methodology often used, lack of students' interest and attitude towards this skill-based subject. In Nigeria secondary schools, students' preparedness for technological future and academic performance in the subject are not encouraging when compared to some other junior secondary school subjects. In an attempt to solve this problem, it is important to use appropriate teaching strategies as means to help students overcome these constraint (Tiamiyu *et al.,* 2012).

As a result, the use of e-learning strategies in teaching and learning are rapidly overtaking the conventional teaching approach which is predominantly a 'chalk and talk' method of presenting learning elements. E-learning offers an interactive learning environment that enables the learners to acquire and receive results within a specific time frame, and several factors are likewise influential in the process of using online-based learning strategies in teaching and learning process. It therefore becomes paramount to seek for online-based (virtual) strategies which would enhance the actualization of the objectives of basic technology at the junior secondary level of education in Nigeria, hence this study was conceived.

Research Questions

The study sought answers to the following research questions:

1. What is the difference in the academic achievement of students taught using synchronous virtual e-learning strategy and conventional strategy in basic technology curriculum implementation?
2. What is the difference in the academic achievement of high, medium and low achievement level students taught using synchronous virtual e-learning strategy and conventional strategy in basic technology curriculum implementation?

Research Hypotheses

Three null hypotheses were formulated and tested at 0.05 level of significance, they are:

Ho_1: There is no significant main effect of treatment on students' academic achievement in basic technology curriculum implementation.

Ho_2: There is no significant main effect of academic ability on students' academic achievement in basic technology curriculum implementation when taught with synchronous virtual e-learning strategy and conventional strategy.

Ho_3: There is no significant interaction effect of treatment and academic ability on students' academic achievement in basic technology curriculum implementation.

METHODOLOGY

The study employed a quasi-experimental design and non-randomized. The population of the study consisted of the entire junior secondary school (III) students of basic technology in the twenty (20) registered private schools in Ona-Ara Local Government Area, Ibadan Oyo State, Nigeria. The private schools were purposively selected for the study based on the availability of computer facilities in their respective schools. The two schools were

randomly selected to experimental and control groups, and intact classes were used so as not to disrupt the school programme of activities. A total of 100 students eventually participated in the study (50 students in each case). The students who were not regular through out of the period of the experimental study were not involved. The academic ability which was considered to be a likely influencing variable in the study was considered at 3 levels (high, medium and low) using the students results of the previous term in the session considered as supplied by their respective class teachers (High – 60% and above; Medium – 50% to 59.9%; Low – below 50%).

The study used two research instruments, they are:

1. Basic Technology Achievement Test (BTAT) – 100 multiple – choice items were selected from the standardized test items from the National Examinations Council (NECO) Junior Secondary Certificate Examination (JSCE). Efforts were made to ensure that the test items selected were within the topics in Basic Technology curriculum.
2. The researchers' adapted Synchronized Virtual E-learning Package (SVE-LP) from Virtual E-Learning Package developed by Kadelu (2016) by modifying it to suit the focus of this study.

The SVE-LP, has the following learning path for the "treatment process" (Delivery system):

Phase 1: Virtual network connection between the teacher and the learners and among learners – use of storage media/video/audio tape/satellite transmission and cable, to introduce and teach the selected topics as incorporated in teacher's lesson plan.

Phase 2: Learners following and keeping the record of the path by the teacher for a later review.

Phase 3: Learners participation, demonstration and illustrations on what is taught with co-learners/teachers through the available server based application (All were online).

Phase 4: Mentoring in the learning process: the teacher and other learners make themselves available on the server-based application (chat, e-mail, voice, video, stream/tape, video conferencing, web logs, and teleconferencing) in case there is the need to attend to questions or need assistance. The tutors also were passively watching the learners and intervene if problems seem to be occurring.

Phase 5: Review, quiz(s) and test/exams: at this phase, when the content module is almost concluded, revision is done, exercises/quizzes or tests given to grade the knowledge of or all that have been acquired by the learners through the sever based applications are integrated together in the synchronized process.

The SVE-LP was further validated by Vocational Experts with bias on ICT-based Instructional Packages on which the SVE-LP was modified.

The Basic Technology Achievement Test (BTAT) was a standardized test selected from NECO test items, but the template of the Synchronized Virtual E-Learning Package was trial-tested on a separate private secondary school in a basic technology class within two week interval and the two separate results were compared and Pearson Product Moment of Correlation Statistical tools was used to determine its reliability value. A reliability co-efficient of 0.78 was considered adequate enough for this study.

Method of Data Collection

The experimental and control groups were exposed to pre-test of the Basic Technology Achievement Test about three weeks before the commencement of the treatment in order to be sure of their entry level for the topics chosen and to avoid carry-over memory and transfer effects.

Group 1 (The Experimental Group) – The subject (Basic Technology Students) were exposed to the selected topics through online-based application using the designed instructional package (Synchronous Virtual E-Learning Package – SVE-LP). The members of this group were allowed to interact, participate, discuss and share views and opinions on any of the topics presented (Phase 1). Phase 2, 3, 4 and 5 followed (The paths on the instructional package was also available to the students for their optimum involvement.

Group 2 (The Conventional Group) – The BASIC Technology students in group 2 were not exposed to the SVE-LP. The teacher presents the subject matter in a traditional face-to-face classroom using the chalkboard and textbooks in going through the topic. They merely serve as the control group. The two groups were taught by two teachers only that the teacher who was in charge of group 1 was given adequate training on the use of SVE-LP and the objectives of the research. The groups were treated for four weeks, and academic achievement test (Post-test) was conducted at the end of the forth week.

The study used mean, standard deviation and Analysis of Covariance (ANCOVA) to analyse the data.

RESULTS

Research Question 1: What is the difference in the academic achievement of students taught using synchronous virtual e-learning strategy and conventional strategy in basic technology curriculum implementation?

Table 1: Mean Scores and Standard Deviation of Pre-test and Post-test Score of Students in Experimental and Control Groups in Basic Technology Achievement

Group	N	Pre-test Scores Mean (X)	Standard Deviations	Post-test Mean (X)	Score Standard (SD)
Deviations (SD)					
Experimental Group					
SVE-LS	50	29.40	11.21	38.50	10.03
Control	50	26.54	9.42	26.61	9.85

The data presented in table 1 show that the experimental group (Synchronous Virtual E-Learning Strategy – SVE-LS) had a post-test improvement of 9.10 (38.50 – 29.40) while the control group had a post-test pre-test improvement of 0.07 (26.61 – 26.54). This implies that the experimental group performed better than the control group (conventional strategy group)

Research Question 2: What is the difference in the academic achievement of high, medium, and low achievement level students taught using synchronous virtual e-learning strategy and conventional strategy in basic technology curriculum implementation?

Table 2: Mean Score and Standard Deviation of the Post-test Scores of High, Mean and Low Achievement Levels of Experimental Group (SVE-LS) and Control Groups

Variable	Number of Sample (N)	Mean (x)	Standard Deviation (SD)
High Level (SVE-LS)	11	16.45	6.29
Medium Level (SVE-LS)	40	18.12	5.03
Low Level (SVE-LS)	24	6.92	5.56
High level (Control)	21	12.97	6.01
Medium level (Control)	32	10.01	5.02
Low Level (Control)	22	7.21	2.10

Base on the students' academic ability on record as stated under methodology, the result of the basic technology students after post-test is presented in table 2. Table 2 shows the mean and standard deviation of the post-test of high, medium and low achievement level students in experimental group (SVE-LS) and control groups. The table shows that there was difference in the mean scores of the two (2) groups. The mean score of the high academic level synchronous virtual e-learning strategy (SVE-LS) group was 16.45, the medium academic level in SVE-LS group was 18.12, while the mean score of the low academic level in SVE-LS group was 6.92. The table also indicates that the high (control), medium (control), and low (control) academic levels in the control group were 12.12, 10.01 and 7.21 respectively. This means that the basic technology students in the high academic level and medium academic level in SVE-LS performed better than those in the high and medium academic level of the control group.

Ho_1: There is no significant main effect of treatment on students' academic achievement in basic technology curriculum implementation.

Table 3: Analysis of Covariance (ANCOVA) of the Scores of Experimental and Control Groups in Academic Achievement in Basic Technology

Sources of variance	Sum of squares	Df	Mean Square	F-Value	F-Sig.	Remark
Pre-test Co-variance	152.601	1	522.645	9817.657		
Combined	1474.620	5	143.682	362.321	.000*	Sig.
Treatment	3041.611	2	4581.452	456.632	.000*	Sig.
Academic Ability	7.664	3	8.120	1.860	.000*	Sig.
2-way Interaction	107.261	7	19.021	1.028		
Combined Treatment + Academic Ability	2.952	2	0.457	21.112	.502*	Not Sig.
Model	3510.011	5	123.345	38.212	.000	
Residual	3842.595	95	3.265			
Total	200110		20011.100	8.102		

Table 3 shows ANCOVA results of the post-test mean achievement scores of experimental group and the control group (combined) (F_2, 95 = 456.632, P<0.05). It shows that there was a significant mean effect of treatment on post-test scores of academic achievement of students taught with the use of Synchronous Virtual E-learning (SVE-L) strategies compared with the control strategy. Hence, hypothesis 1 was rejected.

Ho_2: There was no significant main effect of academic ability on students' academic achievement in basic technology curriculum implementation when taught with synchronous virtual e-learning strategy and conventional strategy.

Table 3 also reveals that academic ability had significant mean effect on students' academic achievement when exposed to synchronous virtual e-learning strategy (F_2 95 = 1.860, P < .05). Hypothesis 2 was thus rejected.

Ho_3: There was no significant interaction effect of treatment and academic ability on students' academic achievement in basic technology curriculum implementation.

The results on table 3 further shows that there was no significant interaction effect between treatment and academic ability in each study (F_2, 95 = 1.028, P<0.5), hence, hypothesis 3 was not rejected.

DISCUSSION

The analysis of data presented in table 1 indicates that the post-test mean score (38.50) of the synchronous virtual e-learning strategy group was higher than 26.61 post-test mean score of the conventional strategy (control) group with a test improvement difference of 9.10. The differences in the mean scores of the experimental group (Synchronous Virtual E-Learning Strategy – SVE-LS) compared with the control group in the pre-test may however be

attributed to the initial difference in the knowledge, and skills and academic ability possessed by the students in both groups before the treatment. The post-test result in which the students taught with SVE-LS performed better than those taught with conventional strategy showed the positive influence of the applied learning strategy (Table 1). This finding agrees with Kulik (2006); and Anaele and Virgil (2010) who revealed that on average, students who use computer-based instruction score higher than students who do not.

The results in table 2 on post-test mean scores of high, mean and low achievement levels students showed that on average, basic technology students which fall within the medium level in the experimental performed better than those with high academic achievement level (experimental group) with a mean score of 18.12 and 16.45 respectively, while those at the low academic level of the same experimental group still had the least mean score of 6.92. The results obtained from the test of the first null hypothesis imply that there was significant main effect in the academic achievement of SVE-LS group compared with the control group. From the result in table 3, it is clear that synchronous virtual e-learning strategy improves students' academic achievement in the implementation process of basic technology curriculum.

Similarly, there was significant main effect of the academic achievement of students when taught with the synchronous learning package which is e-learning (Table 3). This finding corroborates that of Umeh, Sobowale, Nsofor, Oboh, Tukura and Kita (2014) who deduced that with computer-assisted instructional package, there may be enhanced achievement of medium and low level learners. The findings of this study actually established that the instructional methods or strategies teachers employ in teaching and learning have significant effects on students' achievement. If students are exposed to synchronous virtual e-learning strategy in which they interact freely through online system with their co-learners and teacher(s), their academic achievement in the subjects they offer could be enhanced.

It is clear in this study that synchronous virtual e-learning strategy produces academic effects superior to those obtained with conventional strategy alone. Similarly, the academic level of learners could have positive effect on students' academic performance in curriculum implementation process than those taught with conventional strategy. Learning is more effective when learners actively interact with the subject matter and one another with moderate teachers' guide. Such application of SVE-LS promotes learners' understanding, autonomy, and collaborative learning without predominant contact with the teacher in instruction-led classroom. Synchronous Virtual E-Learning Strategy has been put to test in the implementation of basic technology curriculum in this study and has shown to be effective, more convenient to students separated by distance/space, adequate for instruction-led virtual classroom, interactive, encourages and enhances online monitoring and is learners' friendly.

CONCLUSION

Based on the study findings, it was established that teaching and learning strategies adopted by teachers or tutors were bound to have impact on students' learning outcomes as well as academic achievements. The choice of instructional strategies was thus a strong factor in the curriculum implementation of educational programmes at all levels of education. Consequently, such strategies largely determine the quality of performance of learners. The

use of synchronous virtual e-learning strategy would generally aid students understanding and assimilation. Despite the usefulness of this instructional strategy, the cost of implementation and maintenance could be a limiting factor in a developing society like Nigeria. However, the use of technologically-based strategies if applied appropriately will maximize teachers' effectiveness in teaching as well as learners' achievement.

RECOMMENDATIONS

Based on the findings of this study, the researchers recommend as follow:

1. The use of synchronous virtual e-learning strategy should be encouraged in curriculum delivery in educational institutions with a view to enhancing students' academic achievement and making them more productive.
2. Computer and Internet facilities should be provided in schools by the government or school owners in adequate numbers.
3. Training on the use of electronic media should be provided for teachers to equip them with the required skills for effective design of instructional strategies and packages and how to integrate them into teaching and learning.
4. Policy makers in Nigeria should ensure that schools have access to ICT for effective teaching and learning for teachers as well as the learners respectively.

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