Effectiveness of Web-Based Software in Achieving Virtual Learning Practices in Senior Secondary Schools in Oyo Metropolis

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Abstract
Web based software, (or a web-based application) is a software that runs on a server (computer connected to the Internet), while users connect to it from their computers using an Internet browser. Virtual learning (VL) is a form of teaching and learning designed to enhance students' learning experience by including computers and the Internet in the learning process. This can be achieved with web-based instructional software, which this study sought to do. Purposive random sampling technique was used in selecting two hundred and seventy (270) Senior Secondary Schools One (SSS 1) students from six (6) secondary schools in Oyo metropolis for the study. Three levels of treatment were used: Collaborative Web-based Instruction, Individualised Web-based Instruction and Conventional Instruction. The researchers generated and tested three (3) hypotheses using t-test. Results of these hypotheses showed that there was no significant difference in the achievement of Mathematics students exposed to Individual Web-based Instruction and Conventional Instruction {13.3 ($t = 5.930$; $p > .05$) and 11.2 ($t = 5.930$; $p > .05$), no significant difference in the achievement of Mathematics students exposed to Individualised and Collaborative Web-based Instruction {13.3 ($t = -2902$; $p < .05$) and 14.3 ($t = -2902$; $p < .05$ Based on the above findings it was recommended that Web-based Instruction should be used in achieving virtual learning practices in senior secondary schools among others.

***Keywords**: Web-Based software, Virtual learning practices, Conventional instruction, Individualized and collaborative web-based instruction*

Introduction

Many students today have grown up with ubiquitous access to technology and the Internet earning them the title of the "Net Generation" (Montgomery, 2009; Palfrey and Gasser, 2008; Tapscott, 2008). Outside the classroom, these students use the web to perform a wide range of personally meaningful tasks including communicating, socialising, searching, learning, and entertaining themselves (Tapscott, 2008). Inside the classroom, technology is used sporadically and the overall impact on learning appears to be negligible (e.g., Cuban, 2001; Roberston, 2003; Russell, Bebell, O'Dwyer, and O'Connor, 2003). There is an increasing worldwide drive to the utilisation of technologies based on around the World Wide Web as a means of addressing a number challenges which face-to-face education. The World Wide Web itself has brought about the prospect of global education marketplace and with it the advent of non-traditional corporate education providers. At the same time, every successive government has recognised the need for a greatly widened mass access to education and the need to equip students with the initial solid foundation and lifelong learning skills which will be needed to provide the responsiveness and flexibility required for an ever-accelerating rate of change. It is worthwhile, therefore, to lay emphasis on what is being developed in the individual learner. The process is concerned not just with the acquisition of subject-specific

knowledge and skill but also the development of more general, or strategic, approaches and skills.

A Virtual Classroom is a teaching and learning environment located within a computer-mediated communication system. Rather than being a building of bricks and boards, it is a set of group communication work "spaces" and facilities constructed in software. Some of its communication structures resemble facilities or procedures used in traditional classrooms; others support forms of interaction that would be difficult or impossible in the "face-to-face" environment of the traditional classroom are all possible in a Virtual Classroom (VC). All its features are accessed not by travelling to a university but by typing into, and reading from, a personal computer which connects to a mini or mainframe computer operating the Virtual Classroom (VC) software. Participation is asynchronous; that is, participants access at any time from any location in the world (Starr, 1990).

Virtual Learning Environment (VLE) is education via Computer-Mediated Communication (CMC) or Online Education (Wikipedia, 2010). Virtual Learning Environment (VLE) or Learning Management System (LMS) is a learning system designed to act as a focus for students learning activities, their management and facilitation, along with the provision of content and resources required to help make the activities successful. It is also a computer programme that facilitates computerised learning or e-learning. Such e-learning systems are sometimes also called Learning Management System (LMS). Content Management System (CMS), Learning Content Management System (LCMS), Managed Learning Environment (MLE), Learning Support System (LSS), Online Learning Centre (OLC), Open Course Ware (OCW), or Learning Platform (LP).

The potential benefits of Web-Based Instruction (WBI) cannot be underestimated in the contemporary world. There are several findings on the instructional value of web-based learning, particularly in advanced countries on different subjects. It is obvious that the current trend in research all over the world is the use of ICT facilities and resources to enhance students' learning. This might be connected with why Handelsman, et. al. (2004) opined that many exercises that depart from traditional method are now readily accessible on the web, even though teachers do not use these facilities. Studies have shown that WBI is one of the best systems that provide the same opportunities for the teaching and learning process beyond the physical limits of the conventional classroom walls (Hsu, 2009 and Hombrth, 2001). This is in consonance with Kerstey's view in Charakup (2002) that teaching in an on-line environment is quite different from the traditional classroom setting. Online teaching and learning activities allow for increased flexibility in scheduling and location. It allows for intensive interaction among learners and instructors to take place. Elusoji (2010) also stressed that web-based software would offer significant independence to students to learn at their own pace.

In addition, the ability to link to related sites on Internet is also a key advantage over the traditional textbook method of study whereby learning is made more interesting and study resources can be easily widened and enriched. Thus, a multi-media based approach to detaching ethics is likely to be more effective than a traditional textbook approach. Access to instruction through the web is flexible and ensures greater educational opportunities. However, the Federal Government, in a bid to improve education in Nigeria, established at least nine ICT education initiatives at various stages of development being carried out by the education coordinating agencies of government and the Ministry of Education. The School Net project was established for the secondary schools.

Since virtual learning environments are a new generation of computer-based educational systems, it is worth looking at whether computer web-based learning with virtual learning is more effective than learning in a traditional classroom. According to Kulik et al., (1985), studies showed a slight advantage for computers especially when considering the time for learning. These results have been questioned but even if they were granted, how could policy makers generalised from these studies?. Until recently, one of the main advantages associated with computer use in schools is seen in terms of the individualised learning as the most important feature in computerised instruction is that it permits a high degree of individualisation. This, in effect means that, students can proceed at their own pace, following a path through the curriculum, as suited to their particular interest and talent. As a result of the great speed of operations, many students can access a computer–based instruction simultaneously, each having the feeling that he has control over the system. A student making exceptionally good progress may be moved ahead in the lesson sequences or branches out to special materials designed to enrich his understanding of the curriculum. On the other hand, a student having difficulties may be directed to review earlier materials or to a special remedial sequence (Babalola 1998).

In short, web-based instruction offers multiple dimensions of use in education and training environments. As with CBI, it is capable of providing direct instruction to meet individual learning objectives. Due to its networking capability, the web can play additional roles. These include promoting and facilitating enrolment into courses, availing the syllabus or programme of instruction, posting and submitting assignments, interacting with instructors and fellow students, collaboration on assignments, and building learning communities. The web has become a powerful tool for learning and teaching at a distance. Its inherent flexibility allows application in a variety of ways within an educational context, ranging from simple course administration and student management to teaching entire courses online. Each of these types of use works towards a different goal. These goals should be recognised when evaluating the use of the Web. For example, an instructor may hold face-to-face lectures in a classroom but post the class syllabus, assignments, and grades on the Web. In this case, it may not be appropriate to evaluate the use of the Web with respect to learning outcomes since the Web was not used in a direct instructional role.

In collaborative learning, there is a great interaction and cooperation among learners. Collaborative learning is defined as learning that emphasises group or cooperative efforts among faculty and students. It stresses active participation and interaction by both students and instructors. Knowledge is gained through an active dialogue that enables the sharing of ideas and information (Starr, 1990). However, since schools generally have more students than computers, students often work in groups on the computer. Several empirical results suggest that group work on the computer may enhance the benefit derived from the collaborative learning situation (Blaye et al, 1990). The specific questions to be addressed here deal with the extent to which learner(s)-computer interaction and human-human interaction can reciprocally enhance one another. For instance, interfaces which induce specific distribution of roles between learning partners help to foster social interaction (O'Malley, 1992; Blaye et al., 1991). Such interfaces can serve to scaffold the executive and regulative aspects of the collaborative task. This paper is out to provide an answer in the study carried out in six (6) Senior Secondary Schools in Oyo metropolis, Nigeria.

Objectives of the Study
The specific objectives of the study are to:

1. examine the effect of web-based software in achieving virtual learning practices in mathematics in senior secondary schools in Oyo metropolis, Oyo State, Nigeria.
2. identify the difference in the performance of students exposed to web-based teaching and those exposed to traditional teaching in senior secondary schools in Oyo metropolis, Oyo State, Nigeria.

Research Hypotheses
Arising from the objectives of the study, three hypotheses were tested for the study at 0.05 level of significance

1. There is no significant difference between the performance of Mathematics students exposed to individualised web-based teaching and conventional instruction in senior secondary schools in Oyo metropolis, Oyo State, Nigeria.
2. There is no significant difference between the performance of Mathematics students exposed to collaborative web-based teaching and those exposed to conventional instruction in senior secondary schools in Oyo metropolis, Oyo State, Nigeria.
3. There is no significant difference between the performance of Mathematics students exposed to collaborative web-based teaching and those exposed to individualised web-based teaching in senior secondary schools in Oyo metropolis, Oyo State, Nigeria.

Methodology
The research design is quasi experimental design. The design consisted of two experimental groups' collaborative web-based teaching and individualised web-based teaching and the control group. The subjects were exposed to post-test three (3) weeks after the pre-test. The target population for this study comprised of some senior secondary school one (SSS 1) Mathematics students in Oyo metropolis. Six secondary schools were sampled. The choice of SSS 1 students for this study hinged on the fact that the students have not been exposed to any of the selected topics for the study. The nature of this study required the purposive selection of the research sample since a study on web-based teaching must be conducted in schools where students are computer literate, there is availability or easy access to computers, constant electricity, Internet access, a Local Area Network (LAN) and other needed equipment are readily available for students' use. A total of Two hundred and seventy (270), that is, forty-five (45) SSS 1 Mathematics students from each of the six schools were purposively selected. The SSS 2 and SSS 3 students have been taught the topic for the study; hence they were not qualified for the study.

The instruments for this research were the treatment instrument Web-Based Software (WebSoft) and the test instrument, Mathematics Performance Test (MAPET). The researcher developed the WebSoft on Mathematics using Blackboard Learn 9. Blackboard Learn 9 is the first version of the new totally rewritten/redesigned Blackboard Next Generation teaching and learning platform. It offers an intuitive Web 2.0 interface, drag-and-drop simplicity, context-sensitive menus, notification dashboards, new learning tools, blogs, journals, significant accessibility improvements, and others. The software was interactive, and learner centred. It was structured using some selected topics in Mathematics and relevant information necessary to comprehend the topics development by the researchers. The lesson lasted for 2 hours. After the lesson, the students answered the multiple-choice questions that followed and 2 marks

were awarded for each question. WebSoft was used for groups A and B while Group C was exposed to conventional instruction. The mathematics teacher used the structured lesson note to teach the students, and they had the opportunity to ask questions where they were in doubt. Group A and B were guided severally by the researchers on how to use the software effectively. Group A and B were exposed to the same topic simultaneously in order to prevent interaction effect.

The face and content validity of the MAPET was established by giving it to colleagues who are versed in the field of Mathematics. Also, the Web-Soft passed through some lecturers in the Department of Mathematics, in the School of Science, Federal College of education (Special), Oyo, Oyo state. The instruments were also given to experts for further face and content validity. The reliability of the instrument was tested using the test-retest method. The reliability coefficient (r) for the instrument was 0.84 (the is r = 0.84) which was suitable and reliable for the study. Students in group A and B were assembled in their school computer laboratories at different times and the twenty multiple choice test items were administered on them by the researchers as pre-test. Same test was conducted for Group C in the conventional classroom. The tests were marked and recorded. The post-test was conducted after three weeks and possible interactive effects were highly controlled. The scores of students in the three groups were analysed using t-test technique and Statistical Package for Social Scientist (SPSS) was used for the analysis.

Data Analysis and Interpretation of Results

1. There is no significant difference in the performance of Mathematics student when exposed to individualised web-based teaching and conventional instruction in senior secondary schools in Oyo metropolis, Oyo State, Nigeria

Table 1: Mean table of pre-test achievement of Mathematics students in individualised web-based instruction and conventional instruction.
Group Statistics

	Teaching Methods	N	Mean	Std. Deviation	Std. Err Mean
pre-test achievement 1	Individualised web-based instruction	90	10.2778	1.34104	.14136
	conventional instruction	90	11.2111	1.35327	.14265

Table 1 shows the result of the mean scores of students exposed to individualised web-based instruction (mean = 10.2778) and conventional instruction (11.2111) respectively. The pre-test score indicated that students in the individualised group performed better than those in the conventional group.

Table 2: Mean table of post-test achievement of Mathematics students in individualised web-based teaching and conventional instruction.
Group Statistics

	Teaching Methods	N	Mean	Std. Deviation	Std. Err Mean
post-test achievement 2	Individualised web-based instruction	90	13.2778	3.01691	.31801
	conventional instruction	90	11.2111	1.35327	.14265

The Table 2 shows the result of the mean scores of students exposed to individualised web-based instruction (mean = 13.2778) and conventional instruction (11.2111) respectively. The post-test score indicated that students in the individualised group performed better than those in the conventional group.

Table 3: T-test table of Mathematics students in individualised web-based teaching and conventional instruction.

Independent Samples Test

	Levene's Test for Equality of Variance		T-test for Equality of Means						
	F	Sig.	t	df	Sig.(2-tailed)	Mean difference	Std. error difference	95% Confidence Interval of the Difference	
								Lower	Upper
Post-test achievement 2 Equal Variances assumed	67.291	.000	5.930	178	.000	2.06667	.34854	1.37887	2.75446
Equal Variances not assumed			5.930	123.421	.000	2.06667	.34854	1.37678	2.75446

From table 3, the test analysis of students exposed to individualised web-based instruction and conventional instruction respectively were analyzed. The result shows that there is no significant difference in the performance of students with the mean score {13.3 (t=5.930; p > .05) and 11.2 (t=5.930; p > .05) when exposed to individualised web-based and conventional instruction. The null hypothesis was therefore not rejected.

2. There is no significant difference in the performance of Mathematics student when exposed to individualised web-based teaching and conventional instruction in senior secondary schools in Oyo metropolis, Oyo State, Nigeria

Table 4: Mean table of pre-test achievement of Mathematics students in collaborative web-based teaching and conventional instruction.

Group Statistics

	Teaching Methods	N	Mean	Std. Deviation	Std. Err Mean
pre-test achievement 2	Collaborative web-based instruction	90	11.6000	.93376	.09843
	Conventional instruction (Group C)	90	8.4000	1.18795	.12522

Table 4 shows the result of the mean scores of students exposed to collaborative web-based instruction (mean = 11.60) and conventional instruction (8.40) respectively. The pre-test score indicated that students in the collaborative group performed better than those in the conventional group.

Table 5: Mean table of post-test achievement of Mathematics students in collaborative web-based teaching and conventional instruction.

Group Statistics

	Teaching Methods	N	Mean	Std. Deviation	Std. Err Mean
post-test achievement 1	Collaborative web-based instruction	90	14.3444	1.74923	.18438
	Conventional instruction	90	11.2111	1.35327	.14265

Table 5 shows the result of the mean scores of students exposed to collaborative web-based instruction (mean 14.34) and conventional instruction (11.21) respectively. The pre-test score indicated that students in the collaborative group performed better than those in the conventional group.

Table 6: t-test table of Mathematics students in collaborative web-based teaching and conventional instruction.

Independent Samples Test

	Levene's Test for Equality of Variance		t-test for Equality of Means						
	F	Sig.	t	df	Sig.(2-tailed)	Mean difference	Std. error difference	95% Confidence Interval of the Difference	
								Lower	Upper
Post-test achievement 2 Equal Variances assumed	67.291	.000	5.930	178	.000	2.06667	.34854	1.37887	2.75446
Equal Variances not assumed			5.930	123.421	.000	2.06667	.34854	1.37678	2.75655

Table 6 shows, the test analysis of students exposed to collaborative web-based instruction and conventional instruction respectively were analysed. The result shows that there is no significant difference in the performance of students with the mean score {14.3 ($t=13.441$; $p > .05$) and 11.2 ($t=13.441$; $p > .05$) when exposed to individual web-based and conventional instruction. The null hypothesis of no significance difference was therefore not rejected.

3. There is no significant difference in the performance of Mathematics student when exposed to collaborative web-based teaching and individualised web-based teaching in senior secondary schools in Oyo metropolis, Oyo State, Nigeria

Table 7: Mean table of post-test achievement of Mathematics students in collaborative web-based teaching and individualised web-based teaching.

Group Statistics

	Teaching Methods	N	Mean	Std. Deviation	Std. Err Mean
post-test achievement 3	Individualized web-based instruction	90	13.2778	.301691	.31801
	Collaborative instruction	90	14.3444	1.74923	.18438

Table 8: t-test table of Mathematics students in individualized web-based teaching and collaborative web-based teaching.

Independent Samples Test

	Levene's Test for Equality of Variance		t-test for Equality of Means						
	F	Sig.	t	df	Sig.(2-tailed)	Mean difference	Std. error difference	95% Confidence Interval of the Difference	
								Lower	Upper
Post-test achievement Equal Variances assumed	31.015	.000	-2.902	178	.004	-1.06667	.36760	-1.79208	-.34126
Equal Variances not assumed			-2.902	142.763	.004	-1.06667	.36760	-1.79331	-.34003

Table 8 shows, the test analysis of students exposed to collaborative web-based instruction and conventional instruction respectively. The results show that there is no significant difference in the performance of students with the mean score {13.3 (t=-2902; $p < .05$) and 14.3 (t=-2902; $p < .05$) when exposed to individualised web-based instruction and collaborative instruction respectively. The null hypothesis of no significance difference was therefore not rejected.

Discussion of Findings

The study investigated the relative effectiveness of web-based instruction in achieving virtual learning practices in Oyo metropolis. In hypothesis one, the t-test analysis indicated that there is no significant difference in the academic achievement of Mathematics students' exposed to individualised web-based instruction and conventional instruction. It means both learning strategies enhance students' academic achievement in Mathematics. Individualised web-based instruction however proved to be more effective (mean score = 13.23). The reason for this may be due to the exposure of individual student to the learning strategy that makes him/her learn at his/her own pace, and the interactivity the individualised web-based instruction has over the former. The finding of this study is in support of Snelling and Karanicolas (2008), which showed a high positive response to on-line group learning by the students. The result of hypothesis two showed that students taught through collaborative web-based instruction method achieved significantly higher than those taught through conventional instruction. This is probably due to the opportunity of the former to learn in groups and at their own pace over the latter group. This finding agrees with the earlier findings of Urtel, et al (2006). The result of hypothesis three shows that students exposed to individualised web-based instruction and collaborative instruction achieved equally in their academic performance. It means both learning strategies enhance students' academic achievement in Mathematics since both of them are Web-based instruction. This finding is in line with the earlier findings of Okure, (2008).

Conclusion

Instructors have to decide on a learning strategy that is most productive for accomplishing their particular objectives in learning such as developing conceptual understanding and experiencing what science is. Computer Education has opened new frontiers in Science Education. From the results of this study, it is clear that Virtual Learning practice using web-based technology is a necessity in Oyo metropolis and Nigeria at large since it gives equal opportunity for learning. Virtual Learning strategy using web-based technology is an indispensable modern strategy in the teaching-learning process, and its adoption in secondary schools in Oyo metropolis, Oyo state will go a long way to remove the barriers usually created by age, gender, religion, and distance. If properly implemented, content creation, self-assessment, self-study, collaborative learning, and task-oriented activities will be facilitated.

Recommendations

Based on the findings, the following recommendations were made;

1. Conferences, workshops and symposium should be organised by the Oyo state Teaching Service Commission to train all teachers in Oyo State and enlighten them on the need for virtual learning practices.
2. Provision of fully computerised laboratory and classroom in all secondary schools in the state for virtual learning practices.
3. Provision of improved bandwidth/fast Internet connectivity and availability of reliable electricity
4. The School authorities should put in place an effective ICT Board that will oversee the implementation of virtual learning practices.
5. The Federal Ministry of Education should, as a matter of urgency, give attention to funding the development of Virtual Learning practice using web-based technology in all Federal and State owned Secondary Schools.
6. Curriculum planners of Teacher Training Institutions should integrate computer education in the curriculum of the pre-service teachers who should also be exposed to Virtual Learning practice during their course of study.
7. Government should give maximum support to web-based developers in developing software suitable for Virtual Classroom (VC).
8. Government should address the problem of irregular power supply and find permanent solution to the problem.
9. Students should be able to embark on Virtual learning practices at minimal cost.

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