

Effect of E-Learning Devices on Chemistry and Students' Academic Performance in Calabar municipality, Cross River State

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Abstract

The study examined the effect of e-learning devices on Chemistry students' academic performance in Calabar municipality. Two (2) null hypotheses were formulated and tested at 0.05 level of significance. Post-test nonequivalent control group quasi-experimental design was used for this research. The sampling technique adopted for the study is purposive sampling technique; this was used to select four schools from the study area and also used to select respondents used for the study. The research instrument was 20 questions for the Chemistry Achievement Test and the reliability was ascertained using Kuder Richard formula -20 which yielded a reliability coefficient of 0.89. Data obtained was analyzed using independent t-test statistics. Treatment package was administered to the experimental and control groups using different e-learning devices in teaching Chemistry concepts. Result of data analysis revealed that the experimental group taught with e-learning devices significantly outperformed their counterparts taught with conventional method. More so, gender and school location showed a significant difference when taught with e-learning devices. Based on the finding recommendation were made that secondary schools and tertiary institution teachers should make a concerted effort toward the use of e-learning devices that would enhance students' performance in Chemistry and facilitate creativity in the learner.

Keywords: E-learning, teaching and learning, Chemistry and academic performance.

Background to the Study

E-learning is the use of information and communication technology e.g. internet, computer, mobile phone, learning, televisions, radio and other devices to enhance teaching and learning activities. E-Learning is a unifying term used to describe the fields of online learning, web-based training and technology delivered instructions (Eloma and Anefiok, 2016). E-learning has become an increasingly popular learning approaches in the education system due to vast growth in

technology. Abdai-Radham (2009) noted that e-learning devices are educational channels that use computerized communication system as an environment for communication and provides synergy for exchange of information and interaction between students and instructors.

However, there are still other universities, secondary schools and academic institutions that use very low interactive e-learning devices or channels which are not sufficient enough to contribute to the achievement of the students. On the contrary, other educational institutions use highly interactive e-learning materials which directly improve students' performance in general (Bielefeldt, 2000). Today, technology has brought sporadic learning opportunity that removes teaching and learning barriers in Science. The interactive nature of teaching and learning of Chemistry offers a clear and enjoyable learning paradigm as in constructivist's learning (Neji and Meremikwu, 2016). Effectiveness in teaching and learning could be accomplished depending on the availability of information on the subject matter, this includes E-learning materials in form of e-library, e-journals, virtual chemistry laboratory, e-textbook. Students at the higher institutions of learning can harness this information with the use of a well equipped computer library, cell phones, laptops, tablets and many other electronic materials.

According to Neji & Ntibi (2017) learning is promoted when the students are actively engaged in the learning process through activities and the use of material resources which encourages thinking and enables learners to link new information to old and acquire meaningful knowledge must be created; hence it is the instructional strategy and not the technology that influences the quality of learning.

Theoretical frame work / literature review.

Ausubel's theory of learning (1966)

Ausubel is an American psychologist and educator. He was influenced by the teaching of Jean Piaget. His ideas are similar to Piaget's idea of conceptual schemes, Ausubel related his explanation of how people acquire knowledge by being exposed directly to it rather than through discovery. David Ausubel propounded three theories of learning:-

- Meaningful verbal learning
- Subsumption theory
- Motivation theory

In his meaningful verbal learning theory, David Ausubel stated that meaning is created through some forms of representational equivalence between language and mental context. There are two processes involved.

- First: Preception which is employed in meaningful verbal learning

- Second: Discovery which is involved in concept formation and problem solving.

In his second theory which is the subsumption theory, Ausubel based his ideas that, an individual existing cognitive structure which involves (organization, stability and clarity of knowledge in a particular subject) is the principal and basic factors influencing the learning and retention of meaningful new materials. It describes the importance of relation new ideas to a students' existing knowledge base before the new materials is presented. This theory is applied in the "advanced organizer" strategy. According to Ausubel, when one encounters completely new unfamiliar materials, then rote learning, as opposed to meaningful learning, takes place, the theory view cognitive structure as something preserved which can later be used in meaningful way.

Research indicates that: motivation, moderate-intensity excitation or to arouse, to learn with good result. The implication of this theories is that the most general ideas of the subject should be presented first detailed and specify. Ausubel indicates that his theory applied to reception (expository) learning in school settings should attempt to integrate new materials with previously presented information through comparisons and that cross- referencing of new and old ideas. It is believed that organizers are extremely helpful as this group of student need additional help structuring their thinking. Teachers have to enable learners to instruct new knowledge based on their existing knowledge.

Research has revealed that electronic learning materials offers students variety of new possibilities to learn new concepts (Dawn and Kraemar, 2000). In addition to having a positive effect on students achievement in different subject matter areas (Chambers, 2003) other benefits of e-learning materials/electronic education includes increase in enrollment or time in school as education programs reach underserved regions, broader educational opportunity for students who are unable to attend traditional schools, access to resources and instructors not locally available and increase in student-teacher communication.

Electronic education of the use of e-learning materials alone is not the most effective choice in all situation, Students may feel isolated, parents may have concerns about children's social development, student with language difficulties may experience a disadvantage in a text heavy online environment, and subjects requiring physical demonstration of skill such as music, physical education or foreign language may not be practical in a technology-mediated setting.

Bond (2002) found that distance between tutor and learner in an online instrumental music program has negative effects on performance quality, student engagement, development and refinement of skills and knowledge. Virtual school students show less improvement than those in conventional schools in listening and speaking skill (Barker &Wendel, 2001). Highly technical subject have also

proven to be difficult to reach with online instructions. The Alberta consortium evaluated students' performance on end-of-year exams among virtual school students across the province, and found that virtual school students scores in mathematics, and the science lagged significantly behind score of non-virtual school student (Schollie, 2001). Keausky (2000) notes that given instruction of equal quality, group of students learning online generally achieve at levels higher to their peers in classrooms. Equally, between the delivery system has been well documented over decades for adult learners. Evidence to date convincingly demonstrate that when used appropriately, electronically delivered education, e-learning materials can improve students' learning outcome in Science and can deliver high quality learning to all children (NASBE, 2001). Kozma (2001) argues that the particular attributes of the computer are needed to bring real-life models and simulations to the learners; this the medium does influence learning. However, it is not the computer or electronics pursuance that makes students learn, but the design of the real life models and simulations. This electronics are merely the vehicle that provides the processing capability and delivers the instruction through e-learning materials to the Learner (Clark, 2001).

Statement of the Problem

The academic performance of Chemistry Students in The past years has shown a deplorable trend. Most research work attributed this ury trend to poor teaching approach, lack of teaching materials and others. It is against the problem that this research work is meant to find out if the use e-learning devices can help enhance students' learning outcome in Chemistry.

Research Hypotheses

The following null hypotheses were formulated to direct investigation.

1. Ho: There is no significant difference in students' academic performance taught Chemistry with e-learning devices.
2. Ho: There is no significant difference between male and female students' academic performance in the use of e-learning devices in Chemistry

Research Methodology

The research design adopted in this study was quasi-experimental design. The design was specific with Posttest only quasi-experimental group. The area of the study was Calabar Municipality, Cross River State, Nigeria. The sampling technique adopted for the study was purposive sampling technique. Sample of this study was one hundred respondents (100) senior secondary school (SS11) students' in Calabar municipality, Cross River State. Instruments employed for data collection in this study were;

A Chemistry Instructional package used Information Communication Technology (ICT) devices as treatment for the experimental group.

B Chemistry Achievement Test (CAT).

The instructional package consisted of prepared lesson notes on Chemistry concepts. Before the treatment, a posttest was administered to the students after the treatment package. The students were taught Chemistry concepts with (ICT) devices while the control groups were taught with the conventional method. A posttest measure was also carried out on the students to ascertain the learning outcome of the students. The instrument used to obtain data was Chemistry Achievement Test (CAT) consisting twenty (20) multiple test items each. The reliability of the Chemistry Achievement Test (CAT) was ascertained using Kuder-Richardson's formula (KR-20) which yielded a coefficient of 0.86. The data obtained was analyzed using independent t-test analysis. Result is interpreted and discussed in tables below.

Results and Findings

Hypothesis one:

There is no significant difference in students' academic performance taught chemistry with e-learning devices.

Table 2
Mean, standard deviation of the difference in academic performance of students who are taught with electronic learning devices in Chemistry (N=100)

Variable type	N	\bar{x}	SD	t-cal
Students taught with e-learning devices.	50	19.67	5.43	4.71
Students taught with conventional method.	50	10.23	2.17	

$P < 0.05$; $df = 98$; critical $t = 1.96$

Hypothesis one sought to investigate the difference of students taught with e-learning devices in chemistry. Result of data analysis shows that students who consult electronic devices had higher mean score of (19.67) than those who do not use electronic materials with ($\bar{x} = 10.23$). Therefore since the calculated t-value of (t=4.71) is statistically greater than the critical t-value, the null hypothesis which states that there is no significant difference in the academic performance of chemistry students who use e-learning devices is rejected at 0.05 level of significance and the alternate hypothesis retained. Thus, there is a significant difference in the academic performance of students who use e-learning materials in Chemistry.

Hypothesis Two

Table 2
Independent t-test analysis of the difference between male and female students academic performance with the use of e-learning materials in Chemistry.
(N=100)

Variable types	N	\bar{x}	SD	Cal-t
Male students	50	16.38	4.37	2.69
Female students	50	12.42	2.14	

$P < 0.05$; $df = 218$; critical $t = 1.96$

Hypothesis two sought to investigate the difference in academic performance between male and female students in the use of e-learning devices findings revealed that male students who use e-learning materials has mean score of ($x = 12.38$; 2.14) respectively. Since the calculate t-value of ($t = 2.69$) is greater than the critical ($t = 1.96$). The null hypothesis is rejected at 0.05 level of significant and the alternate re-stated. Thus, there is a significant difference between male and female students who use e-learning devices than those taught with conventional method.

Discussion of Finding

E-learning materials on students' academic performance in Chemistry

Hypothesis 1 sought to investigate the use of e-learning devices on students' academic performance in chemistry. Finding revealed that there is a significant difference in the performance of student taught with e-learning materials in chemistry. The more the students use e-learning materials the better their performance. this finding agrees with Calderoni (1998) which revealed that academic advantages over traditional classroom instruction were demonstrated by students in Mexico's Telesecundaria program, who were substantially more likely than other group to pass a final 9th grade examination administered by the state by students taking a Chemistry satellite course and by students learning reading and mathematics via interactive radio instruction (Yasin & Luberisse 1998). Electronic education of the use of e-learning materials alone is not the most effective choice in all situations.

Gender difference on students' academic performance in Chemistry.

Hypothesis two sought to investigate the significant difference between male and female students academic performance with the use of e-learning

materials in Chemistry. Findings revealed that there is a significant difference between male and female students who use e-learning materials than those who do not use.

Thus finding agrees with a study by (Eze, 2008) asserted that gender had significant effect on students achievement in Chemistry and showed that male students achieve higher than female counterpart did. Adigwe (1992) showed in his study that male students perform better in both achievement and acquisition of problem solving skills than female students in Chemistry. In most secondary schools, factors such as the lack of safe learning environment, gender based violence, poor sanitation facilities, the burden of caring for younger siblings acutely constrain girls ability to participate fully in school (Ugwuibe, 2009).

Ifeakor (2005) showed a significant gender related difference in students' cognitive achievement in favour of male students over their female counterparts. This is likely because male student make out more study time for themselves than their female counterpart, and also because the male students have a higher level of anxiety than the female students.

Sempala (2005) in his investigation on gender differences in the performance of practical skills on quantitative analysis, an aspect of chemistry among senior secondary school girls and boys in selected co-educational schools. He showed that there were no statistical significant difference between girls and boys in their ability to manipulate the apparatus/equipment, take observation, report/record correctly. Boys performance slightly than girls in the following skills: records/reporting result correctly and computing/interpreting/analysis results while girls perform slightly better than boys overall.

Conclusion

From the result of the study, it is concluded that e-learning significantly improve academic performance in Chemistry, learning process and self development. It is also observed that there is more likelihood that majority of the students in secondary schools and tertiary institutions have not fully utilized the self-development aspect of e-learning to significantly improve their learning process. There is a significant difference in the academic performance of male and female students in Chemistry.

Recommendation.

- (1) Based on the research findings, it is recommended that Science teachers and students should be encouraged to use of electronic devices in teaching and learning of scientific concepts.
- (2) Teachers should be trained on the use of information communication devices to enhance the efficacy of teaching and learning of Science, especially Chemistry in schools.

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