Journal of Education

Vol. 4, No. 1 September, 2011

Published by the Faculty of Education,
University of Uyo, P. M. B. 1017, Uyo.

EMPLOYING TECHNOLOGICAL RESOURCES TO ENHANCE STUDENTS' PERFORMANCE IN CHEMISTRY

REBECCA U. ETIUBON (Ph.D)
Science Education Department,
University of Uyo, Uyo
e-mail: etiubon@yahoo.com

Abstract

The study investigated the employment of technological resources to enhance students' performance in Senior Secondary Two (SS2) chemistry. The population consisted all 1,102 SS2 chemistry students in Uyo Local Government Area of Akwa Ibom State. A random sample of 80 students from two secondary schools out of 16 public schools formed the sample for the study. Three hypotheses guided the study. Chemistry Achievement Test (CAT) was the instrument used to gather data. CAT had a reliability coefficient of 0.89 determined using Kuder-Richardson Formula-21. Data collected were analysed using Analysis of covariance (ANCOVA). Results of the study showed that students achievement were high using simulation technique and video-compact disc taped instruction. Male students performed better using simulation technique than their female counterparts, while the female students performed better than the male students using video-compact disc taped instruction. Recommendations among others were that; given the opportunity both male and female students can achieve if they have access to technological resources. Educational stakeholders in the states and Federal Government should therefore equip schools with technological resources to enhance students' performance in chemistry.

Introduction

Nigeria as a developing country needs to catch up with the changing face of education globally. It requires a well planned curriculum implementation for its sustainable growth. This implies that appropriate curriculum materials, texts, real objects and situations as well as audio-visual resources and other instructional devices should be prepared and integrated into curriculum implementation at all levels of education (Anulobi, 2009). Reforms in achieving educational

objectives of the National policy on education is a priority and emerging technological resources that meet the need. Instructional resources of which technological resources are a part, are highly valued in the learning process because they perform various functions which, according to (Okwo, 2007) concretize learning experience; stimulate and motivate the learners, promote interaction, promote hands-on and minds-on activities, compensate for learners inadequacies, models learning more appropriately for the learners, promote retention and transfer of learning.

The National Policy on Information Technology (FRN, 2004) promotes the integration of ICT resources at every level of education for all to play leading roles in contributing to national development through high level manpower training and individual's intellectual capabilities development. This will help bridge gaps in course appraisals of contents, enrich existing curriculum and replace teacher-dominated instruction. These laudable goals need to be incorporated in the curriculum using different technological resources for meaningful attainment of educational objectives.

Emerging technologies are posing great challenges to students study habits. Providing a safe and rich learning environment that provides access to various technological resources (Onuma, 2008) will to a large extent, impact on the quality content and structure of lesson dissemination during instruction. New technologies such as computer simulators and video-compact disc taped instruction hold promise for learners (Davies, 2003) as they help to shape environments that will allow children to create, explore and learn by doing. These technologies have the potential to change educational practices for the better in significant ways. Learners need these technologies to develop skills that will influence learning experiences positively as this will help them function effectively in and out of classroom environment.

Most learners today preoccupy their minds and time with browsing through cellphones for calls and text messages to their colleagues, watching movies on television through video/video-taped appliances, chatting on internet via facebooks, twitters, blogs, e-mails and other forms of information website links. They find reading their textbooks, obtaining information from library sources like science journals, magazines, encyclopedia and dictionaries quite boring in the face of changing technology.

Ekukinam and Udosen (2010) found that communication via the phone is becoming popular as students install browsing and chatting devices such as Yamee and Opera on their handsets. They possess most of these technological resources as cell phones equipped with digital devices that aid browsing for learning benefits but seldom know the benefits of such. Dodge (1997) observed that technologies open new horizons for individual learning, enabling access to information resources, learning tools, environments and services. Technological resources can therefore become tutors for students and provide relevant informative materials for creative ideas, skill acquisition and knowledge sharing

Ellis and Railshack (2001) suggested the use of appropriate and effective technology in early learning that provide guidance in selecting tools and creating environments essential for learners' achievement in the sciences. Access and ability to use technological resources will help students to visualize concepts in science which are difficult to understand. This pulls learners out of their usual setting and encourages them to apply other rich options in developing their research and improving study skills. Nwosu (2006) found that effective learning in science occurs when learners develop the ability to purposefully access information from a variety of sources, analyze and evaluate the information and then integrate it to construct a personal knowledge – base from which to make intelligent decisions. Video compact disc is the communication channel for instruction and is a useful teaching strategy that facilitates students learning experiences. Akunde, (2005) and Anulobi (2009) found that video-taped instruction can serve as alternative face-to-face teaching mode which increases students' cognitive, affective and psychomotor abilities. Koksal (2004) opined that video compact-disc taped instruction can be used for developing listening comprehension and competency as well as present new materials for consolidating what has already been presented. Video compact disc taped materials can then be an easy access for learners' interaction without the teacher's involvement.

Simulation technique is a technological resource employed to sustain interest in science. It is the initiation of some real thing representing certain key characteristics or behaviours of a selected physical or abstract system.

It could be used to show the eventual real effects of alternative conditions and courses of action involved in an activity.

Computer simulation permit science teacher to bring rich learning experiences into the classroom. Simulations often permit the learner to see in black and white or colour, concepts and principles in action, which would not be possible through lecture, laboratory experiences, demonstration or picture.

Abe (2010) opined that computer simulations provide a more effective and innovative teaching technique required for tackling the complex models and symbols that have been introduced into present day classrooms. It allows high motivation value for students to project themselves into new classroom roles and help improve dialogue, active participation and transfer of learning.

Researches on gender related differences are varied. Some researches show male subjects performing better than the females while others show that females perform better than the males. Still, others show that no significant differences exist.

Unfortunately, with the wealth of knowledge that technological resources bring, most Nigerian science teaching classrooms, do not use appropriate technological resources in teaching as modern science education requires. Most students are ignorant of their uses and cannot apply them effectively for beneficial academic gains and achievement. Chemistry is considered a difficult subject by most students and this hampers their knowledge acquisition of its concepts. They find it difficult using technological devices to improve their achievement in chemistry. It is hoped that in the face of the use of these options on technological resources, students' energies could be channeled and harnessed into discovering ways of applying technological resources for achievement in chemistry. The study therefore investigated students' achievement in chemistry using simulation technique and video-compact disc instruction.

Objectives of the Study

The purpose of this study is to determine the performance of chemistry students using simulation technique and video compact disc taped instruction. Specifically, the objectives are:

1. To find out the differences in performance between chemistry students taught

with simulation technique and those taught with video-compact disc taped instruction.

2. To determine if gender influences the achievement of chemistry students taught with simulation technique.
3. To determine if gender influences the achievement of chemistry students taught with video-compact disc taped instruction.

Research Hypotheses

Ho_1: The mean scores of students taught chemistry using simulation technique and video-compact disc taped instruction do not differ significantly.

Ho_2: There is no significant difference between the mean scores of male and female chemistry students taught using simulation technique.

Ho3: There is no significant difference between the mean scores of male and female chemistry students taught using video-compact disc instruction.

Treatment Design

The quasi- experimental design was adopted for this study. The quasi-experimental research design is a design where the independent variable is not manipulated to create a treatment condition to be compared. The researcher compared groups that are defined by a naturally occurring non-manipulated variable which involved comparing two groups that were not created by manipulating variable.

Population

The population of the study was all the SS2 students in all the 16 public secondary schools in Uyo Local Education Authority of Akwa Ibom State. The population was one thousand one hundred and two (1,102).

Sample and Sampling Technique

A sample of 80 students were selected for this study. These 80 students were randomly selected from the SS2 chemistry students in two public secondary schools that were randomly sampled from the 16 public secondary schools. They were randomly assigned into two classes of 40 students each taught with simulation and video-compact disc taped instruction respectively.

Instrumentation

Instrument used for gathering data for the study was a researcher-developed 50-item-4 option multiple choice test designed

to measure students' achievement in the area of carbohydrate chemistry and chemical Reaction Kinetics. The test had a reliability index of 0.89 determined using Kuder-Richardson Formula – 21. Each correct answer was scored 2 marks, and incorrect answers scored 0 (zero). Hence 100 was the maximum score and zero was the minimum.

Treatment Procedure

The subject teachers in the selected schools were trained as research assistants with the use of simulation and video-compact disc taped instruction on the software package of lesson notes on carbohydrate chemistry and chemical reaction kinetics, using validated instructional packages developed by the researcher. CAT was administered by the research assistants as pretest, then students were taught in their respective groups using the prepared instructional packages from the researcher during chemistry class periods. They were taught in their intact class settings.

Simulation software package and video-compact disc taped instruction were used to teach the concepts of carbohydrate chemistry and chemical reaction kinetics in both groups. After the treatment, the research assistants administered the reshuffled version of CAT as post-test. The exercise lasted for 2 weeks. Pretest and posttest administration and the teaching of the concepts were strictly supervised by the researcher. Scripts were immediately collected after each administration of the pretest and posttest test items by the research assistants and handed over to the researcher for marking. The data obtained were analyzed using analysis of covariance (ANCOVA).

Data Analysis Results

Hypothesis I: The mean scores of students taught chemistry using simulation technique and video-compact disc taped instruction do not differ significantly.

Table 1: Analysis of covariance (ANCOVA) of students' achievement in chemistry taught using simulation technique and video-compact disc instruction

Teaching Method	N	X	SD
Simulation	40	58.10	2.59
Video-compact disc taped	40	61.42	3.78
Total	80	59.76	3.63

Source	sum of squares	df	mean square	F_{cal}	Sig.
Corrected model	226.84	2	113.42	10.70	
Intercept	6390.62	1	6390.62	603.30	
Pretest	5.73	1	5.73	.542	
Teaching method	222.46	1	222.46	21.00	*
Error	816.63	77	10.59		
Total	286767.00	80			
Corrected total	1042.48	79			

*significant at 0.05, F_{crit}, $F_{1,77} = 4.00$

Results in Table 1 shows that student taught concepts in carbohydrate chemistry and chemical kinetics reaction using simulation technique had a mean score of 58.10 and those taught with video-compact-disc instruction had 61.42 respectively. This shows that students taught the concepts using video-compact disc taped instruction achieved higher than those taught with simulation technique. The table shows the $F_{cal.}$ Value of 21.00 and an F_{crit} value at a $df_{1,77}$ and 0.05 alpha is 4.00 indicating a significant difference between the two. Thus, the null hypothesis 1 is rejected at $p<0.05$ level of significance. This implies that there is a significant difference in the achievement of chemistry students taught using simulation technique and those taught using video-compact disc taped instruction.

Hypothesis 2

Table 2: Analysis of covariance (ANCOVA) of male and female students' achievement taught using simulation technique

Gender	N	X	SD		
Male	19	60.13	2.39		
Female	21	58.00	2.84		
Total	40	58.06	3.63		
Source	sum of squares	df	mean square	F_{cal}	Sig.
Corrected model	.90	2	.450	0.64	
Intercept	3782.44	1	3782.44	540.56	
simulation	.718	1	.718	.103	
Gender	.21	1	.120	2.01	*
Error	279.89	40	6.99		
Total	145281.00	43			
Corrected total	280.79	42			

*significant at 0.05, F_{crit}, $F_{1, 37} = 4.10$

Table 2 shows that male and female chemistry students taught using simulation technique had mean scores of 60.13 and 58.00 respectively. This shows that male students taught the concepts using simulation technique achieved higher than their female counterparts. The table show the $F_{calculated}$ value of 2.01 and an F_{crit} value at a $df_{1,37}$ and 0.05 alpha is 4.10 indicating no significant difference between the two. The

null hypothesis is therefore, retained at p = 0.05 level of significance. This showed that male students taught with simulation technique do not perform better than their female counterparts.

Hypothesis 3

0.05 alpha is 4.10 indicating a significant difference between the two. The null hypothesis is therefore rejected at $p < 0.05$ level of significance. This shows that female students taught the concepts using video-compact disc taped instruction performed better than their male counterparts.

Table 3: Analysis of covariance (ANCOVA) of male and female students' achievement taught using video-compact disc taped instruction

Gender	N	X	SD		
Male	17	59.94	3.47		
Female	23	63.39	2.91		
Total	40	61.92	3.63		
Source	sum of squares	df	mean square	F_{cal}	Sig.
Corrected model	148.16	2	74.08	7.86	
Intercept	2310.93	1	2310.93	245.27	
Video-compact disc taped	31.81	1	31.81	3.37	
Gender	136.28	1	136.28	14.46	*
Error	348607	37	9.4		
Total	153885.00	40			
Corrected total	496.77	39			

*significant at 0.05, F_{crit}, $F_{1, 37} = 4.10$

Table 3 shows that male and female chemistry students taught the concepts using video-taped compact disc instruction had mean scores of 59.94 and 63.39 respectively. This show that the female students taught the concept using video-compact disc taped instruction achieved higher than their male counterparts. The table shows the $F_{calculated}$ value of 14.46 and an $F_{critical}$ value at $df_{1,37}$ and

Discussion of Results

The findings of the study in Table 1 show that chemistry students taught using video-compact disc taped instruction had high mean scores compared to those taught using simulation technique. The students indicated high interest and responded with high enthusiasm and great motivation towards video-compact disc-taped instruction. All the same,

the students responded positively to both techniques. This may be as a result of being exposed to an area of new knowledge with greater student-to-technology resources contact. This finding is in agreement with the findings of Dodge (1997) who observed that using technologies like simulation devices open new horizons for individual learning that enable students have access to information resources, learning tools, the environment and services. Akunde (2005) and Anulobi (2009) found that video-compact disc taped instruction can serve as alternative face-to-face teaching mode which increase students' cognitive, affective and psychomotor academic abilities. The video-compact disc taped instruction could be used as a supplementary instructional package to complement teacher's teaching and also serve as an alternative self-instructional medium to students in the absence of a teacher. The findings of this study show that students taught using video-compact disc instruction achieved higher than those taught using simulation technique.

Findings in Table 2 indicate that the male students do not achieve significantly higher than their female counterparts using simulation technique. This is in agreement with (Abe, 2007) who reported that male students taught with simulation technique were shown to have higher motivational value than their female counterparts as they were allowed to project into new classroom roles to improve classroom dialogue and participation. Manipulating simulation technique in this way may be more favourable to the male students.

Findings in Table 3 show that the female students achieved significantly higher than the male students when taught using video-compact disc taped instruction. This finding is in disagreement with (Anulobi, 2009) who found that gender does not influence the study of fine arts. This finding in chemistry concepts may be due to the influence of female students who adapt more to video-film watching such as movies than their male counterparts who may be more interested in watching the game of football. However, both male and female chemistry students can equally achieve when they are given equal opportunities to access technological instructional resources that can stimulate their interest in learning.

Conclusion

For quality educational reforms, technological instructional techniques should be used as supplementary instructional resources

to complement classroom chemistry teaching. Both simulation and video-compact disc instructional techniques helped the students to achieve higher in the chemistry concepts taught. These techniques could be used to improve the teaching-learning processes.

Recommendations

The following recommendations are made as a result of the findings:

1. Chemistry teachers should update information on access to technological instructional resources that will improve their classroom teaching.
2. Teacher training colleges should include technological teaching resources in teachers' training programmes that will inculcate skills for teaching chemistry to students.
3. It is imperative for conferences, workshops and seminars to be constantly mounted by educational stakeholders in ministries and institutions of learning to update chemistry teachers knowledge on current pedagogical trends on technological advancement.
4. The government and school administrators should partner with private organizations and institutions to bring in funds and creative ideas to equip ICT laboratories in their various schools.
5. Use of software packages should be encouraged in teaching of chemistry concepts where technological devices are available.

References

Abe, E. A. (2010). Effects of simulation technique on students' achievement in Language learning. *International Journal of Electrical Engineering*, 36, 4, 287 – 297.

Akunde, I. (2005). *The use of video-taped lesson as alternative to face-to-face approach in teaching of senior secondary school Geography* (an unpublished Thesis), Faculty of Education. Imo State University, Owerri.

Anulobi, J. C. (2009). Effect of the use of video-compact disc instructional package on Academic Performance of Junior Secondary School Fine Arts Students in Owerri. *Journal of Nigeria Association for Educational Media and Technology*, 1(1), 31 – 37.

Davis, G. (2003). Perspectives on Offline and online training initiatives. *In*: U. Felix (Ed.) *Language Learning Online: Towards Best Practice*. Lisse, The Netherlands: Swets and Zeitlinger.

Dodge, K. (1997). Socialization mediators of the relation between socio-economic status and child conduct problems. *Child Development*, 65, 649 – 665.

Ekukinam, T. U. & Udosen, I. N. (2010). Targeting teachers on teacher-made CAI-Package and their perception on integration of ICT in education.

Ellis, D. & Railsback, J. (2001). *Technology in Early Childhood Education. Finding the Balance*. Northwest Regional Educational Laboratory. London: Rouledge.

Federal Republic of Nigeria (2004). *National Policy on education* (4th ed.) Yaba, Lagos: NERDC Press.

Israel, O. O. (2008). Effects of video-taped instruction on secondary schools students' achievement in History. *International Journal of African and Africa-American Studies*, 6(1), 38 - 45. May 28, 2011.

Koksal, D. (2004). Technology in Language teaching and learning in the *Turkish Online Journal of Educational Technology*, 3 (3), Issue 4, 2 htt//www.tojet.net/articles/3300 html.

Nwosu, S. N. (2006). Learning style and chemistry instruction in secondary schools in Akwa Ibom State. *African Journal of Education and Information Management*, 8(2), 82 – 90.

Okwo, F. A. (2007). *Improvisation and use of instructional materials*. A paper present at a workshop and roundtable on back to basic. Skills course on pedagogy organized by the Teacher's Registration Council of Nigeria (TRCN) for South-South Zone at Danube Hotels. July 3 - 5.

Onuma, N. (2008). *Enhancing quality education in secondary schools through information and communication technology in Ebonyi State: Obstacles, prospects and the way forward*, Lagos, NAEAP.