

EFFECT OF LEARNING ACTIVITY PACKAGE INSTRUCTIONAL STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN CHEMISTRY

Omeje Cynthia Onyinye¹, Eya, Ngozi M². & Onovo. Nonso Emmanuel³

¹Department of Science Education, Enugu State University of Science and Technology,

²Department of Science Educations, Faculty of Education, University of Nigeria, Nsukka

³Department of Mathematics and Computer Science Education, Enugu State University of Science and Technology

Abstract

The study examined the effect of learning activity package instructional strategy on senior secondary school students' achievement in chemistry. Two research questions and two null hypotheses guided the study. The researcher adopted a quasi-experimental research design for this study. This study was conducted in Enugu State which is one of the states in the South East Geopolitical zone in Nigeria. The population for the study comprised all public co-education Senior Secondary School One (SS 1) students in Enugu Education Zone of Enugu, in 2017/2018 academic session. Altogether, they were 6,907 (six thousand, nine hundred and seven) SS 1 students who offered chemistry in all the government owned co-education senior secondary schools in Enugu State at the time of this study. Altogether, they were 6,907 (six thousand, nine hundred and seven) SS 1 students who offered chemistry in all the government owned co-education senior secondary schools in Enugu State at the time of this study. The sample for the study consisted of a total of 366 SS1 Chemistry Students (243 males and 123 females). However, the number of chemistry students in the experimental group was 258, while there were 108 chemistry students in the control group drawn from 4 schools out of twenty-three co-education secondary schools in Enugu Education Zone. The 23 co-education schools were purposively sampled from the 31 secondary schools in the zone. From the 23 co-education schools, four schools that had up to three or more SS1 classes were purposively selected. There were three intact classes in each sampled schools. The instrument for data collection for the study was Basic Chemistry Achievement Test (BCAT) developed by the researcher. The instrument was subjected to both content and face validations. The instrument was validated by three experts: two experts in chemistry education one in measurement and evaluation, all from the Department of Science and Computer Education, Enugu State University of Science and Technology Enugu (ESUT), Agbani. For the reliability, BCAT was administered to the students and the scores obtained were used to determine the internal consistency of the instrument using Kuder-Richardson's formula-20 (K-R20). Using Kuder-Richardson formula (K-R20), an internal consistency co-efficient of 0.82 was obtained for the BCAT. BCAT was administered to both groups as pre-test and post-test with the help of three research assistants. Mean and standard deviation were used to analyze data generated to provide answers to the researcher questions. This result indicates that chemistry students that were taught Basic Chemistry using LAP recorded higher achievement more than those taught with lecture method. Based on the findings, the study recommended that the curriculum planners should incorporate and emphasize the use of LAP in the Senior Secondary Schools Chemistry.

Keywords: Learning activity package, lecture method, chemistry, achievement

Introduction

Science has been the dominant factor for initiating and accelerating human progress and development. The influence of science on a nation and her citizens could be seen from the production of basic human needs, to social, political, educational, technological and economic advancement. The steps scientists take during scientific investigations (science process) and scientific products draw the attention of the society to the fact that science makes life comfortable. This is because man needs science, especially chemistry, for self-preservation and survival. Chemistry is a branch of science that deals with the composition, properties and reaction of matter in its different forms. Chemistry is a very important science subject in Nigerian Senior Secondary School curriculum. It is an important aspect of science, since it provides mankind with knowledge, skills, principles and facts that find applications in virtually

all aspects of human endeavours. Mastery of it facilitates candidates' chance of enrollment in many professional courses such as agriculture, engineering, medicine, pharmacy, nursing, among others.

Furthermore, chemistry is a core subject for the medical sciences, textile technology, agricultural science, synthetic industry, printing technology, pharmacy, chemical engineering, to mention just a few (Jegede, 2013). According to the National Policy on Education (Federal Republic of Nigeria, 2013), the objectives of chemistry in the senior secondary school level of education in Nigeria include among other things, to:

1. facilitate a transition in the use of scientific concepts, and techniques acquired in integrated science and chemistry;
2. show chemistry in its interrelationship with other subjects;
3. show chemistry and its link with industry, everyday life benefits and hazards;
4. provide the students with basic knowledge in chemical concepts and principles through efficient selection of content and sequencing and
5. provide a course which is complete for pupils not proceeding for high education which it is at the same time, a reasonable and adequate foundation for a post-secondary chemistry course.

The above objectives are laudable and chemistry teaching should be geared towards their attainment to make for a better scientifically literate society. Also, students will not only be highly knowledgeable in Chemistry but will also acquire the necessary skills and competencies needed. This will in turn result to increase scientific and technological advancement of the individual and society at large. As important as chemistry is, in spite of the efforts of both federal and state governments to encourage the teaching of chemistry, students still shun the subject (Jegede, 2013). It has been observed that most students fear chemistry and; hence, they see chemistry as a difficult subject to understand, which may be as a result of the abstract nature of chemistry and the method (lecture method) being used by most of the chemistry teachers in Nigerian secondary schools.

Lecture method is teacher controlled and information centered approach in which teacher works as a role resource in classroom instruction. According to Neboh (2012), the lecture method is mainly teacher-centred, with the students being consistently passive and contents are taught as absolute knowledge. This method does not facilitate the development of reasoning skills and process skills in the students. According to Ezugwu (2010), the dominant method of teaching and learning of various subjects in secondary schools today is the lecture method. The researcher observed that lecture method has failed to recognize the Chemistry students' individuality, hence, the continuous poor performance of students in Chemistry. The dismal performance of students in chemistry over the years necessitated the search for alternative instructional methods and strategies that could ensure better students' achievement in chemistry. Such learner-centred and activity-oriented methods include Target Task Approach, Guided-Inquiry, Co-operative learning, Learning Activity package and programmed instruction strategy. Despite the importance of Chemistry as observed by the researcher, students still perform poorly in Senior Secondary School (SSS 1). This gives an indication that meaningful learning has not been taking place, hence the need to try out the Learning Activity Package (LAP). The reason for comparing LAP and lecture method is because of the students' continuous failure in Chemistry in both internal and external examinations as observed by the researcher.

Learning activity package (LAP) is a student-centred and activity-oriented teaching strategy where the teacher acts as a facilitator of learning, guiding the students through a series of activities and problems which may help learners to achieve highly (Abu, 2001 in Njoku & Akamobi, 2011). In LAP, learning materials are broken into small steps that are arranged sequentially from known to unknown and in an increasing order of difficulty. LAP is a learner-centred activity that leads to individualization of instruction, but apart from individualized instruction methods of teaching, learning may also effectively occur by cooperation among students, hence, the need to ascertain the effect of LAP on students' academic achievement in Chemistry.

Academic achievement is the extent to which a student has achieved his short or long-term educational goals. Students' poor achievement can be attributed to their perceived difficult nature of chemistry; involvement of multitude of facts; and its disconnection from reality (Dori, 2015). One related factor

that is confronting the use of learner centred method to teaching is its ability to have the same impact on both male and female students. Influence of gender on students' academic achievement has for a long time been of concern to many researchers. Aderogba and Aanu (2012) reported that students' gender influences their academic achievement and retention in some subject areas. On the other hand, Ajaja (2010) noted that there was no significant difference in the academic achievement of male and female students in chemistry.

Meanwhile, studies already carried out in Nigeria on Learning Activity Package known to the researcher appeared scanty. The closest studies to the knowledge of the researcher are Udu (2013) who ascertained the effect of learning activity package and cooperative learning instructional strategy on students' achievement and retention in senior secondary school chemistry. One wonders whether LAP can equally be effective in teaching other science subjects and their influence on gender. This necessitated the present study which investigated the effect of LAP on senior secondary school students' achievement in chemistry in Enugu State, Nigeria.

Statement of the Problem

The overall achievement of Nigerian senior secondary school students in the Senior School Certification Examinations in chemistry over the years has not been encouraging. West African Senior Secondary Certificate Examination (WASSCE) examiner's report (2015-2017) shows the dismal achievement of students which has been partly attributed to ineffective and unproductive strategies used by chemistry teachers. Consequently, there is a felt need to improve on the teaching and learning of chemistry by exploring the use of some innovative learner-centred teaching methods, since it is believed that meaningful learning occurs as a result of students' active participation in the lesson. Although many studies carried out on some innovative methods revealed that they were effective in improving students' achievement, there is still a need to investigate other learner-centred methods which will enable the teachers to easily identify the problems of individual learners and allow such learners to evaluate themselves. Among such innovative instructional strategy is Learning Activity Package (LAP). Thus, the problem of this study, posed as a question is; what is the effect of LAP on secondary school students' achievement in chemistry in Enugu State, Nigeria?

Purpose of the Study

The main purpose of this study was to investigate the effect of LAP on secondary school students' achievement in chemistry in Enugu State, Nigeria. Specifically, the study examined the:

1. effect of teaching method (LAP) on students' achievement in chemistry when taught basic chemistry (Gas laws);
2. influence of gender (male and female) on students' achievement in chemistry when taught basic chemistry using (LAP).

Research Questions

The following research questions guided this study:

- What are the mean achievement scores of SS1 students in Chemistry when taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group) in both pre-test and post-test?
- What are the mean achievement scores of SS1 male and female chemistry students when taught Basic Chemistry using LAP (Experimental group)?

Research Hypotheses

The following hypotheses were tested at .05 level of significance:

H₀₁: There is no significant difference between the mean achievement scores of students taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group).

H₀2: There is no significant difference between the mean achievement scores of male and female chemistry students when taught Basic Chemistry using LAP (Experimental group).

Research Method

The researcher adopted a quasi-experimental research design for this study. This design was appropriate because the study involved the use of intact classes in which there was no random assignment of the subjects to experimental and control groups (Nworgu, 2015). The experimental design is represented schematically as follows:

Randomization	Grouping	Pre-test	Treatment	Post-test
	EG	O1	X1	O2
	CG	O1	X2	O2

EG = **Experimental Group (LAP)**

CG=Control Group

O₁=Pre achievement test

O₂=Post achievement test

X₁= Experimental group (**LAP**)= *E*

X₂= **Control group (lecture method)** $x_2 = Cc$

The sample for the study consisted of a total of three hundred and sixty-six (366) SS1 Chemistry Students (243 males and 123 females). However, the number of chemistry students in the experimental group was 258, while there were 108 chemistry students in the control group drawn from 4 schools out of twenty-three co-education secondary schools in Enugu Education Zone. The 23 co-education schools were purposively sampled from the 31 secondary schools in the zone. From the 23 co-education schools, four schools that had up to three or more SS1 classes were purposively selected. There were three intact classes in each sampled school. The instrument for data collection for the study was Basic Chemistry Achievement Test (BCAT) developed by the researcher. The instrument was subjected to both content and faced validations. The instrument was face validated by three experts: two (2) experts in chemistry education one in measurement and evaluation, all from the Department of Science and Computer Education, Enugu State University of Science and Technology Enugu (ESUT), Agbani.

Reliability of the instrument (BCAT) was established through a trial test on a group of 50 SS1 students from four co-education schools in Awka Education zone in Anambra State. The data generated were analyzed using the Kuder-Richardson formula (K-R20) and an internal consistency co-efficient of 0.82 was obtained for the BCAT, showing that the instrument was reliable for the study.

The Basic Chemistry Achievement Test (BCAT) was administered to both groups as pre-test, post-test with the help of three research assistants. Mean scores and standard deviation were used to analyse data and provide answers to the research questions. This is because it is the most reliable measure of central tendency while standard deviation is the most reliable estimate of variability. The hypotheses formulated for the study were tested at 0.05 level of significance, using Analysis of Covariance (ANCOVA).

Research Question 1: What are the mean achievement scores of SS1 students in Chemistry when taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group) in both pre-test and post-test?

Table 1: Mean Achievement Scores and Standard Deviations of SS I Chemistry Students taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group) in both pre-test and post-test

Groups	Number	Pre-test		Post-test	
		Mean(x)	Standard Deviation(s)	Mean (x)	Standard Deviation (s)
Experimental Group	258	35.83	16.44	40.26	19.78
Control Group	108	33.43	15.11	35.38	17.08

Table 1 above shows the results of mean achievement scores and standard deviations of SS I Chemistry students taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group) in both pre-test and post-test. From the results of the analyses, the pre-test mean achievement score and standard deviations for the experimental group were 35.83 and 16.44 respectively, while the post-test mean achievement score and standard deviation were 40.26 and 19.78 respectively. The results for the control group showed that pre-test mean achievement score and standard deviation were 33.43 and 15.11 respectively, while post-test mean achievement score and standard deviation were 35.38 and 17.08 respectively.

The analyses revealed that there was an improved achievement by both groups. The analyses done on Table 1 showed that the two groups achieved higher mean scores in their posttests than their pretests. Thus, the posttest mean achievement score of the experimental group was higher than that of the control group. This is an indication that chemistry students who were taught Basic Chemistry using LAP recorded higher achievement more than those taught with lecture method.

Research Question 2: What are the mean achievement scores of SS1 male and female chemistry students when taught Basic Chemistry using LAP (Experimental group)?

Table 2: Mean Achievement Scores and Standard Deviations of male and female SS I chemistry Students in Experimental Group in both Pretest and Posttest

Group	N	Pre-test mean	SD	Post-test mean	SD
Male (Experimental)	243	40.76	16.89	45.06	20.09
Female (Experimental)	123	36.06	13.36	39.95	18.11

From the results presented on Table 2 above, male students in the experimental group had pre-test mean achievement score and standard deviation of 40.76 and 16.89 respectively, while their post-test mean achievement score and standard deviation were 45.06 and 20.09 respectively. Female students in the experimental group had pre-test mean achievement score and standard deviation of 36.06 and 13.36 respectively, while their post-test mean achievement score and standard deviation were 39.95 and 18.11 respectively. The results indicate that male students recorded higher achievement than their female counterparts in the experimental group when taught chemistry using LAP.

Hypotheses

Ho1: There is no significant difference between the mean achievement scores of SS1 students taught Basic Chemistry using LAP (Experimental group) and those taught using the lecture method (Control group).

Table 3: Analysis of Covariance (ANCOVA) between the difference in the mean achievement scores of students taught Basic Chemistry using LAP and those taught using lecture method

Source	Type III Squares	Sum of df	Mean Square	F	Sig.	Decision
Corrected Model	4325.54	2	2162.77	46.119	.000	Rejected
Intercept	6422.88	1	6422.88	162.56	.000	
GROUP	2928.44	1	2928.44	24.891	.000	
Error	16436.784	364	45.156			
Total	30113.644	366				
Corrected Total	10899.88	365				

Table 3 shows the Analysis of Covariance (ANCOVA) on the mean achievement scores of students taught chemistry using LAP as the main effect gave an F-value of 46.119 and was significant at 0.000. Since 0.007 is less than 0.05, it means that at 0.05 significant level, the F-value was significant. Hypothesis 1 was rejected as stated on the table above. Thus, there is a significant difference between the mean achievement scores of students taught chemistry using LAP and those taught using lecture method.

Ho2: There is no significant difference between the mean achievement scores of male and female chemistry students taught Basic Chemistry using LAP (Experimental group).

Table 4: Analysis of Covariance (ANCOVA) between the difference in the mean achievement scores of SS1 male and female chemistry students taught Basic Chemistry using LAP (Experimental group)

Source	Type III Squares	Sum of df	Mean Square	F	Sig.
Corrected Model	130.842	2	65.421	6.181	.038
Intercept	50251.033	1	50251.033	1528.101	.000
GENDER	85.298	1	85.298	2.181	.038
Error	15296.736	364	42.054		
Total	40119.050	366			
Corrected Total	19038.109	365			

Table 4 shows the Analysis of Covariance (ANCOVA) on the mean achievement scores of male and female chemistry students taught basic chemistry using LAP as the main effect gave an F-value of 6.181 and was significant at 0.038. Since 0.038 is less than 0.05, it means that at 0.05 significant level, the F-value was significant. Hypothesis 2 was rejected as stated on the table above. Thus, there is significant difference between the mean achievement scores of male and female chemistry students taught Basic chemistry using LAP.

Discussion of Findings

The findings of the study revealed that students taught basic chemistry using LAP recorded higher achievement scores than those taught with lecture method. This finding is in agreement with Udu (2016) who posited that LAP allows or permits the student to move through the curriculum at his/her own pace commensurate with the students' ability and needs. Aanu (2011) was also of the view that, chemistry students taught using LAP achieve higher than those taught using lecture method. Further analysis revealed that there was a significant difference between the mean achievement scores of students taught

chemistry using LAP and those taught using lecture method. This difference is in favour of the experimental group. This agrees with the findings of Aanu (2011), which showed significant statistical differences in the average academic achievement of the experimental LAP and control groups in the test conducted after the experiment in favour of experimental group.

The findings of the study also revealed that male students recorded higher achievement than their female counterparts in the experimental when taught chemistry using LAP. The findings agree with Kissau (2006) and Bosede (2010) who asserted that gender of the students influence their academic achievement and retention in some subject areas, especially chemistry. The finding of this study was not in accordance with Udousoro (2003) who stated that there is no significant difference in the academic achievement of male and female students in chemistry. This was further supported by Inyang & Jegede (1991) and Okeke (2011) who reported that gender has no effect on students' achievement and retention in chemistry.

Conclusion

The study centred on the effect of learning activity package and cooperative learning instructional strategy on senior secondary school students' achievement in chemistry. In view of the findings of this study, the following conclusion were drawn; there is no significant difference in the achievement of SS1 students taught basic chemistry using LAP and those taught with lecture method. There is gender disparity in the achievement of concept learnt by those students taught basic chemistry with LAP. The LAP method is a student-centered, activity based and innovative. The use of LAP in teaching and learning basic chemistry should be encouraged since most concepts are termed abstract in nature. LAP reduces tension and lack of interest but generates fun in the classroom, thereby, making the lesson interesting.

Recommendations

Based on the findings and conclusion of the study, the following recommendations were made:

- In view of the learning effectiveness of the model and the fact that the serving chemistry teachers may not be familiar with its use, seminars and workshops should be organized by the relevant professional bodies such as National Teachers Institute (NTI) and Science Teachers Association of Nigeria (STAN) to educate and sensitize the teachers on the use of LAP in teaching basic chemistry.
- The curriculum planners should incorporate and emphasize the use of LAP in the Senior Secondary Schools Chemistry.
- Authors of Chemistry books should develop books which reflect LAP with teachers guide.
- Government and relevant professional associations should sponsor further research on the effectiveness of LAP in enhancing achievement and interest in other aspects of chemistry.

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