EFFECT OF INTEGRATED TEACHING METHOD ON SENIOR SECONDARY SCHOOL ACHIEVEMENT AND RETENTION IN CHEMISTRY

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Abstract
The study sought to measure the effect of integrated approach on academic achievement of senior secondary school Chemistry students. Two (2) research questions and 2 research hypotheses guided the study. The study employed quasi–experimental design. The sample comprised 160 SS 72 males and 77 females chemistry students drawn from 1062 population (563 male and 499 female) in 60 public co-educational school in Nsukka education zone of Enugu State Nigeria. The experimental groups were exposed to integrated approach while control group were expose to lecture. Data was collected using electrochemistry achievement test which was validated by three experts and reliability index of 0.707 were obtained using Kuder-Richardson's formula 20. The research questions were answered using mean and standard deviation while the hypotheses were tested at 5% level of significance, using analysis by covariance. The findings revealed that integrated approach was more effective in enhancing students' achievement and retention in chemistry than lecture method. Also, there was no significance different in male and female student's achievement in chemistry. Based on the findings the research recommends, among others, that chemistry teachers should teach chemistry with integrated approach to encourage active engagement, self-motivation and retention among learners to enhanced academic achievement.

Keywords: Integral Instructional Approach, Achievement, Retention and Gender.

Introduction

The fast growing accessibility and capability of today's educational development complied with the global scientific scenario have given rise to the need for designing and implementing innovative teaching methods for effective teaching and learning of science subjects. At the moment, the West African Examination Council's Chief Examiners' yearly reports (2015-2020) have shown inconsistence achievement in science subject especially chemistry. The poor and inconsistence achievement has been attributed to many factors, one of which is the use of in appropriate teaching methods like conventional lecture method, stressing further the authors explained that this method is usually the theoretical and it may hinder meaningful learning thereby lending to poor achievement (Mbajiorgu 2022, Udu 2018, Liu 2015, Nweze & Uzochukwu, 2019). Predominate on these note, Nwagbo and Ngwanyi (2017), and Ndubuizu (2016) asserted

that science teaching especially chemistry showed entails theory as well as practical to enable the learners to have the understanding of basic concepts acquire laboratory skills, be aware of the interrelationship between chemistry and other disciplines and be aware of the link age between chemistry and in study/environment/everyday life in terms of benefits and hazards, and skill of critical and logical thinking as stipulated in chemistry curriculum (2016). Ndubuizu (2016) further explained that the teaching of chemistry has been reduced to descriptive exercised through the use of lecture method and that teaching of chemistry should be practical – based activity while Gabriel, Osuafor, Cornelius, Obinna and Francis (2018) were of the view that the use of lecture method in teaching chemistry without combining it with other methods might not be suitable for effective learning by the students and positive retain ability. The search for teaching methods capable of ensuring students understanding and appreciation of science concepts is largely imminence by the fact that conventional (lecture) teaching method has failed to enable student achieve the objectives of chemistry, hence Smith, A., & Johnson, B. (2020). opined that lecture method is descriptive and the teacher does all talking, rarely does he/she uses another resources thus, there is little or room for enhance of ideas, so it said to be teacher centred while Miller (2017) noted that in teacher-centered environment learners usually have phobia and find it difficult to understand the subject matter which lead to poor retention and poor achievement but approaches such as integrated approach like demonstration and practical laboratory work because theoretical teaching without practical at the same time is then major reason why student have phobia and perceive chemistry as being difficult.

Udu (2018) observed that lecture method us theoretical teaching is like a valley of dry bones, but as soon the theory is exemplified with practical, the dry bones put on flesh and blood and come to life hence, a call for renewed teachers effort at using integrated approach in Secondary School chemistry teaching to enhance retention and achievement. Integrated instructional approach is bring different teaching method/different style of teaching to teach a particular concept at a time. Integrated approach could be defined as the method of teaching where various styles are used at a time with relevant and related practical laboratory work for effective understanding of science concept that's bring different teaching method in order to deliver a lesson at a particular time in order to enhance learning. Integrated instructional approach of demonstration and laboratory practical work is a student-centered because its activity oriented teaching strategy where the teachers act as a facilitator of learning after demonstrating for the students' and then watch and the students carry out the experiment while he/she guide their activities.

The basis of integrating demonstration and laboratory practical work while teaching chemistry is to make it a fun equally practical experience constituent integral part of chemistry because the subject consists of many topics that can be verified experimentally with an objective to create and enabling environment to stimulate student learning about chemistry that is commonly presumed as abstract, quantitative and boring when practical work is not properly integrated in teaching of chemistry, it will surely

show in their academic achievement due to poor retention. Moreso, the choice of integrating demonstration and practical method is informed by their high engagement of the student in hand on learning which boosts interest, retention and achievement in the teaching activities, thus integration instructional approach is the act of combining two teaching method to teach simultaneously.

It is evident that conventional method (lecture) or demonstration method can be useful in teaching but they all fall into traditional method in teaching science, for demonstrating, the teacher can focus the pupils attention on the relevant facts and introduce scientific principles and concepts but learners are not allowed to ask questions or start discussions, during the demonstration there by the training skills on path of the student is lacking. Based on this, Shehzard and Aziz (2019) was of the view that the use of traditional method (lecture and demonstration) in teaching chemistry without combining it with other method might not be suitable for effective learning by the students. The argument being that telling or snoring is not learning because both makes learners passive recipient of information, adding that there is no learner-teacher interaction during lecture hence, it is teacher-centered.

The concept of teacher-centered is often associated with low participation in class room by student, lack discussion, exchange of ideals, lack questioning etc. between the teacher and students or among the students in a classroom. However, Dave-ugwu, Ogugu and Dike (2019) noted that needed for proper understanding of chemistry principles concepts and facts, there should be participation between the teacher and the students' thus, environment and poorly managed participation of students in any teaching environment involves unidirectional flow of information/knowledge from teacher to the student and do not encourage process skills acquisition in classroom activities which can lead to instruction frustration, phobia, confusion and tagging a particular subject very difficult. On this note Umar (2019), Ezedimma (2016), Olorundare (2014) and Orji (2015) anticipated from a shift of emphasis from the teacher-centred (traditional method) less effective predominantly students understanding and appreciation of science concept in order to increase retention and achievement.

Retention means the act of keeping and recalling something rather than losing Eramus (2019) viewed retention as the repeat performance by a leaner of the behaviours that an acquired piece knowledge is always intended to elicit in the learner (with practice) after an interval of time Whie Bamiro (2015) saw retention as the ability to retain and later recall information or knowledge gained after learning. The author stated that anything that aid learning should improve retention while things that lead to confusion, or interference among learning materials decrease the speed and efficiency of learning and accelerates forgetting that leads to poor achievement

Achievement according to Adzape (2015) is something done successfully, typically by effort, courage or still, an act that has been performed successfully while Ezedimma (2016) opined that academic achievement is the represents learning outcomes

that indicates the extent to which a person has accomplished special goals that were the focus activities in instructional environments.

However, there are several factors responsible for students' poor performance in chemistry but many researchers hinged it to lack of teaching method which leads to poor retention and poor achievement in considering the efficiency of integrated approach of teaching, gender was considered as a variable because influences of gender on students' retention and achievement has for a long time been of concern to many researchers but no consistent result has been established Njoku and Attah (2019) Okotcha (2018) asserts that male students retain and achieve better than their female counterparts in science subject while Nnamani and Oyibo (2016), Nzekwe (2018) and Ezeano (2013) found that female students achieved significantly higher than their male counterparts while other researchers are of the view that there's no significant differences between them. It can deduced from the foregoing that the issue of gender in chemistry retention and achievement has no yet been resolved. Hence the need for this present study is justified.

Purpose of the Study

The purpose of this study was to determine the effectiveness of integrated approach in enhancing students' academic achievement and retention in electro-chemistry. Specifically, the study sought to:

1. Determine the mean achievement scores of SS II chemistry students taught electrochemistry with integrated approach and those taught using conventional (lecture) method.
2. Determine the mean retention scores of SS II students taught electrochemistry with integrated approach and those taught with conventional method (lecture).

Research Questions

In order to achieve the purpose of this research work, the study sought answers to the following research questions:

1. What are the mean achievement scores of SS II chemistry students taught electrochemistry with integrated approach and those taught using conventional (lecture) method?
2. What are the mean retention scores of SS II students taught electrochemistry with integrated approach and those taught with conventional method (lecture)?

Hypotheses

The following null hypotheses tested at 5% level of significance guided the study.

Ho_1: There is no significant difference between mean achievement scores of SS II chemistry students taught electrochemistry with integrated approach and those taught using conventional (lecture) method.

Ho_2: There is no significant difference in mean retention scores of SS II students taught electrochemistry with integrated approach and those taught with conventional method (lecture)

Method

The research adopted the pre-test, post-test, non-equivalent, control group, quasi-experimental design. The population of the study comprised 1062 (563 male and 499) of all he SS II student in Nsukka Education zone of Enugu State. A sample size of 160 (77 males and 83 females) of SS II chemistry students was used for the study. The sample was obtained using multistage procedures. The instrument used for data collection was electrochemistry achievement test (EAT) developed by the researcher. Test blue print or table of specification was used in preparing the test which was based on the six levels of cognitive domain of Bloom's taxonomy of education to ensure proper cover. The test contain fifty questions with four options ranging from A-D for students to select their best answers. The instrument developed was validated by three experts drawn from department of science education (measurement and evaluation, and chemistry units) and table of specification was used to ascertain the content validity of the instrument was established by administering 30 copies of the instrument to 30 SS II chemistry students in Obollo Education zone of Enugu State who are not part of the study but share the same characteristics with the students under investigation. The reliability index of 0. 707 was obtained using Kuder-Richardson's formula 20 (K-R-20) formula. The instrument for collection of data (EAT) was administered to chemistry students in sample schools before the commencement of the experiment which serve as pretest score. After the pretest, the actual experiment commenced, which started with the training of chemistry teachers who were used for the study. The subjects were randomly assigned to two groups. One group were taught with integrated approach and another group with conventional lecture method. After which EAT was administered a gain for post test and re-shuffled to serve for post-posttest or post-retest to measure retention and the scored obtained deviation used in answering all the questions while analysis of covariance (ANCOVA) was used in testing the formulated hypotheses at 0.05 level of significance.

Results

The results of the study are organized based on the research questions and hypotheses that were formulated for the study.

Research Question 1

What are the mean achievement scores of SS II chemistry students taught electrochemistry with integrated approach and those taught using conventional (lecture) method

Table 1:
Mean achievement scores of experimental and control groups

Treatment	N	Pretest		Posttest		*Mean Gain/Loss*
			SD		*SD*	
Experimental Group	81	15.53	5.34	35.91	7.52	20.38
Control Group	79	15.62	3.91	20.43	5.17	4.81

Table 1 shows that the students in experimental ( ) and control group ( ) had almost the same pretest mean scores. Their standard deviation scores show that their scores are close to each and not widely spread. This thus, means that the students in both groups were in the same academic baseline before the instructional treatment (integrated approach). However, after the treatment, the group taught chemistry using integrated approach achieved ( ) higher than their counterpart in the control group ( ) evident in their posttest scores and mean gains.

Hypothesis 1
There is no significant difference in the mean achievement and standard deviation scores of SS II students taught electrochemistry using integrated approach and those taught using conventional lecture method

Table 2:
Analysis of covariance (ANCOVA) of students' mean achievement scores by treatment and gender

Tests of Between-Subjects Effects

Dependent Variable: posttest Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9789.888[a]	4	2447.472	59.242	.000	.605
Intercept	7850.298	1	7850.298	190.019	.000	.551
Pretest	191.573	1	191.573	4.637	.033	.029
Method	9203.322	1	9203.322	222.769	.000	.590
Gender	.015	1	.015	.000	.985	.000
method * gender	4.336	1	4.336	.105	.746	.001
Error	6403.556	155	41.313			
Total	144053.000	160				
Corrected Total	16193.444	159				

a. R Squared = .605 (Adjusted R Squared = .594)

From Table 2, $F_{(1, 155)}=222.769$, $P=0.000<0.05$ showing that the associate probability (sig.) is less than the probability value of 0.05. Thus, the null hypothesis is not accepted, but the alternative upheld. The Table also reveals an effect size (partial Eta square) of 0.5900 indicating that the treatment contributed 59% to students' achievement in chemistry indicating high effect of treatment on the achievement. Thus, there is a significant difference in the mean achievement
and standard deviation scores of SS II students taught electrochemistry using integrated approach and those taught using conventional lecture method in favour of students taught using integrated approach.

Research Question 2

What are the mean retention scores of SS II students taught electrochemistry with integrated approach and those taught with conventional method (lecture)?

Table 3:

Mean and standard deviation retention scores of experimental and control groups

Treatment	**N**	**Posttest**		**Retention**		***Mean Gain/Loss***
			SD		***SD***	
Experimental Group		35.91	7.52	36.12	7.18	0.21
Control Group		20.43	5.19	19.84	6.64	-0.59

Table 3 shows the mean achievement and standard deviation scores of the experimental group ( ) and control group ( ). Also, the mean and standard deviation retention scores of experimental group ( ) with mean gain of 0.21 and control group ( ) with mean loss of 0.59 were shown. This means that integrated approach helped the students to retain the chemistry content taught.

Hypothesis 2

There is no significant difference in the mean retention scores of SS II students taught electrochemistry using integrated approach and those taught using conventional lecture method

Table 4:
ANCOVA analysis of mean scores of students' retention by treatment and gender

Tests of Between-Subjects Effects

Dependent Variable: retention

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12598.790[a]	4	3149.697	87.505	.000	.693
Intercept	1287.250	1	1287.250	35.762	.000	.187
Posttest	1948.852	1	1948.852	54.143	.000	.259
Method	1052.686	1	1052.686	29.246	.000	.159
Gender	36.827	1	36.827	1.023	.313	.007
method * gender	20.843	1	20.843	.579	.448	.004
Error	5579.154	155	35.995			
Total	144347.000	160				
Corrected Total	18177.944	159				

a. R Squared = .693 (Adjusted R Squared = .685)

From Table 4, $F_{(1, 155)}=29.246$, $P=0.000<0.05$ showing that the associate probability (sig.) is less than the probability value of 0.05. Thus, the null hypothesis is not accepted, but the alternative is upheld. The Table also reveals an effect size (partial Eta square) of 0.159 indicating that the treatment contributed 15.9% to students' retention in electrochemistry. Thus, there is a significant difference in the mean retention and standard deviation scores of SS II students taught electrochemistry using integrated approach and those taught using conventional lecture method in favour of students in treatment group.

Discussion of the Findings

Findings also reveal that students taught electrochemistry using integrated approach retained electrochemical content more than their counterpart taught using lecture method. Thus, there is a significant effect of integrated approach on students' retention in electrochemistry. Also, Chemistry teaching requires the use of integrated approaches since without proper experiment/demonstration to show the 'how' of the concept being taught, its learning will be hampered. Thus, when students are taught using integrated approach, the students will not just achieve well but the information learnt will be retained. Findings of Eze (2013) who found that discussion method improves students' achievement than lecture method also agreed with the findings of the present study. Also, findings of Ezema (2013) who investigate the effect of practical activities and found that experimentation method promotes students achievement equally agreed with the findings of the present study.

Similarly, the study of Ezeudu (2013) investigated the effects of Lecture Method Supplemented with Music (LMM) and Computer Animation (LMC) on senior secondary school students' retention in electrochemistry. Ezeudu emphasis that in any learning environment that the teacher should place retention at centre because ability to achieve depends mainly on ability to recall.

Conclusion

On the basis of this study, the following conclusions have been made;

1. The use of integrated approach enhances academic achievement in chemistry when compared with conventional lecture method
2. Integrated approach proved superior to conventional method in promoting students retention in electrochemistry
3. Integrated approach were gender friendly

Educational Implications of the Findings

The implication of the findings to teachers is that it is better to use different teaching methods in the course of teaching than just use one which could be monotonous and so may not improve achievement and retention. Moreso, at the stage of chosen methods to adopt in a given teaching, methods that are gender friendly like integrated approaches should be given priority.

This basically will promote their achievement and retention. For curriculum planners, the findings have implications to them by pointing at the effectiveness of integrated approach on students' achievement and retention. So they should take note of this and do the needful. The findings of this study to government is that findings from studies should be collated by her different school agencies and ensure that they are implemented in the schools. For future researchers, the findings of the studies have given them direction to following for similar investigation in the future and thus should check the effectiveness of other integrated methods on students' achievement and retention.

Recommendations

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

1. integrated approaches should be adopted by chemistry and indeed other science teachers because it promotes students' achievement and retention
2. practical apparati should be made available in our schools by the government to enable teachers use them in teaching the students using integrated approaches
3. based on the gender friendly nature of the instructional approach, it should be used in teaching mixed and single sex students
4. school authorities should ensure that no teacher, teaches chemistry and other sciences without exploring laboratory and demonstration methods

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