



IMPACT OF ADVANCE ORGANIZERS ON STUDENTS ACADEMIC PERFORMANCE AND RETENTION OF ECOLOGY CONCEPTS IN PUBLIC SENIOR SECONDARY SCHOOLS IN EDU EDUCATIONAL ZONE, KWARA STATE

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Abstract

This Study investigated the influence of advance organizers on the students academic performance and retention of ecology concepts in public senior secondary schools in Edu Educational Zone, Kwara State. Two schools were sampled out of thirteen public senior secondary schools in the zone. From each of the two schools sampled seventy (n – 70) students were selected using stratified sampling which amounted to a total of one hundred and forty students as sample size of the study. Ecology topics basic ecological concepts, functioning ecosystem and components of ecosystem were assigned to experimental and control groups. Quasi-experimental of non-equivalent control group of pretest, post test and post. Post test design was used. Experimental group were taught using advance organizers method while control group were taught using lecture method for duration of 40 minutes of classroom teaching for 6 weeks. For the pretest, post test and post post-test, an Ecology Concept Achievement Test (ECAT) was administered to find out the amount of knowledge acquired and retained after treatments. The reliability coefficient of ECAT was found to be $r = 0.75$. The four research questions were answered and the four null hypotheses were tested using t-test statistics to determine the level of significance of the two groups at $p \leq 0.05$. The major findings from the study indicated the followings: there is a significant difference between mean academic performance scores of the experimental and control groups. There is a significant difference between retention ability of the students taught using advance organizers in teaching ecology concepts with those taught using lecture method. Female subject exposed to the advanced organizers method

were found to retain what was taught better than the male counterpart in experimental group. Based on the findings of this research, it was recommended that advance organizer should be used by biology teachers in teaching in schools for better retention and achievement.

Keywords: *Students, Academic Performance, Retention of Ecology Concepts, Public Senior Secondary Schools, Edu Educational Zone, Kwara State*

Background of the study

Introduction

Learning has been defined by different people in different ways, Adedoyin and Adegbija (2000) sees learning as a life-long process which takes place at all times, anywhere and through anybody.

According to Ausubel's theory (1963) meaningful learning, takes place when what is to be learnt is related to what is already known. In other words, meaningful learning occurs when there is interaction between the new concepts, ideas or knowledge with the concepts, ideas or knowledge already existing in the cognitive structure of the learner. A primary process in learning is subsumption. To subsume is therefore to incorporate new materials into one's cognitive structures. In the course of learning, rote learning can occur. Rote learning is where a student memorizes something with full understanding and does not know how the new information relates with other stored knowledge (Bransford, Brown and Cocking, 1999).

Ausubel (1963) however proposed the meaningful learning model where he advocated for the use of advance organizers. An advance organizers is seen as a cognitive instructional strategy used to promote learning and retention. Advance organizers can be effective in instruction where prior knowledge is lacking. This is because an advance organizers serves as the students prior knowledge for anchorage of new materials to be learnt. If prior knowledge is available, the use of advance organizers may not be necessary (Mayer, 2003). Literature search indicates that advance organizers are used to provide support for new information. Woolfolk (2001).

The objective aim of education and learning is to have a meaningful learning. The concern of most if not all teachers are to improve the retention o their students. The idea of forgetting cannot be completely ruled out but could be

lessened by the use of concrete objects. However, learning and forgetting in role learning are not equivalent to learning and forgetting in meaningful learning. Gender issues in science and in particular biology, have been the concern of many educators. There has been a difference in learning between males and females, some people are of the view that boys perform better in science than girls. Some researchers such as Aigbomian (2002) and Njoku (2007) reported that boys perform better than girls in science.

The use of advance organizers in the absence of prior knowledge is seen to enhance meaningful learning and when learning is meaningful, concepts learnt can be easily remembered. Thus the study focuses on finding out if the use of advance organizer enhance academic performance and retention of learnt concept or not.

Theoretical Framework

In the course of learning, the creation of new knowledge is facilitated by the availability of pre-acquired ideas in the cognitive structure. The presence of relevant, clear and stable pre-acquired ideas in the learner's cognitive structure facilitates meaningful learning (Ausubel, 1968). When current knowledge interacts with relevant background knowledge in the cognitive structure and is assimilated, it forms a new knowledge structure. This new knowledge base or cognitive structure develops through the process of meaningful learning, thereby becoming more complex and helping students to solve problems.

However in learning, it is not every time a new concept to be learnt has a point of integration to the cognitive structure. When there are no pre-acquired ideas in the cognitive structure for students to link the new concept to, this presents a learning problem. To provide a solution to this problem, Ausubel proposed the use of advance organizers. These advance organizers now serves as the prior knowledge or the pre-acquired ideas that will be the link between the new concept to be learnt.

As feasible as it may seem to provide, advance organizers to serve as prior knowledge, it is generally not easy to provide prior knowledge that will serve as well as prior knowledge in the mind of the students. This necessitates a desire to carry out this research to find out if Ausubel's organizers can theoretically and practically replace prior knowledge in the mind of the child.

Statement of the Problem

Learning is a continuous process and takes place at all times. When learning is guided as it is usually done in schools. It is based on a foundation that is built gradually from simple to complex.

Ausubel stated that when prior knowledge is lacking a bridge is required to link the incoming new knowledge with the cognitive structure, or to strategy needs to be developed to serve as surrogate concepts. This bridge is what Ausubel terms as advance organizers. This research therefore intend to find out if advance organizers can serve as prior knowledge therefore aiding meaningful learning and the influence it has on the performance of students.

Objectives of the Study

The study has the following objectives, to

1. Investigate the influence of advance organizers in promoting academic performance of students in biology.
2. Determine if the use of advance organizer enhance retention of concept or not.
3. Determine if there is gender related difference in learning when advance organizers are used or not.

Research Questions

In meeting the objectives of the study, the following research questions were raised.

1. What influence do advance organizers have on the academic performance of SS 1 students in ecology?
2. What is the effect of the use of advance organizers on retention of ecology concepts?
3. Do advance organizers influence the retention ability between male and female public secondary school students taught ecology concepts?

Null Hypotheses

The following null hypotheses were tested.

H₀₁: There is no significant difference between the mean scores of students taught advance organizers and those taught without it.

H0₂: There is no significant difference in the retention ability of students taught ecology concept using advance organizers and those taught without advance organizers.

H0₃: There is no significant difference in the retention ability between male and the female students taught ecology concepts using advance organizers.

Significance of Study

The findings of this study would hopefully be useful to the upliftment of science education in the following ways;

1. Enhance the performance of students in biology by designing advance organizers that will help link incoming new knowledge to the cognitive structure.
2. Findings will encourage teachers to ask students questions about related concepts before starting to teach a new concept, or to find out what the students know about the new concepts. Teachers can also use advance organizers to help students correct wrong assumptions about some concepts.

Scope of the Study

The scope of this study is limited to Edu educational zone of Kwara State, and to all senior secondary schools I students offering biology.

Basic Assumptions

To effectively carry out this research the researcher has made the following assumptions.

- That all students used for the research have been taught elements of ecology in their basic science in the junior secondary school.

METHODOLOGY

Research Design

The research design employed in this study is the pretest, post test quasi-experimental design. The reason the researcher employed this research design is to enable him identify variables for easy manipulation. To carry out this research work, the Ecological Concept Achievement Test (ECAT) adopted

from the West African Examinations Council (2008-2013) past question papers was used to collect data. The samples were grouped into two, the control group and the experimental group. The control group (x2) was taught with lecture method while the experimental group (x1) was taught with advance organizers. The Ecological Concept Achievement Test (ECAT) was administered to the sample as pretest, before treatment to determine their equivalence in ability. Secondly the scores from the pretest were used to place the students in the same prior knowledge range. This was to make sure that all the students used for the study had the same prior knowledge level regarding the concepts to be taught in ecology. The same test was administered as post test and post-post test. The design of the study is represented below.

Group 1 Ex → 01 → X1 → 02 → 03

Group 2 C → 01 → X2 → 03 → 03

Adopted from Kerlinger (1973)

Keys:

X₁: Use of Advance organizer (Treatment)

X₂: Use of lecture method only (control)

01: Pretest Administration

02: Post test Administration

03: Post-post test Administration

EX: Experimental

C: Control

Population of the Study

The population of the study comprises SS1 students in the public senior secondary schools in Edu Educational Zone of Kwara State. The schools were located in Lafiagi, Likpata, Efagi, Tsonga Edogi, Gbugbu, Zambufu, Tsaragi and Bacita all offering biology. All the 13 public senior secondary schools in Edu Educational zone are co-educational. 4680 of the students are males and 5310 are females which bring the total number of students to 9990. The age range of students is between 15-18 years. The description of the population is presented in table 1.

Table 1: Population of the Study

S/No.	School	Boys	Girls	Total
1.	G.S.S Lafiagi	420	350	770
2.	L.S.S Lafiagi	775	725	1500
3.	G.D.S.S Lafiagi	630	600	1330
4.	G.S.S Lakpata	520	640	160
5.	G.S.S Edogi	340	320	720
6.	GDSS Gbugbu	450	420	870
7.	CGSS Zambufu	207	323	530
8.	T.S.S Tsaragi	275	340	620
9.	EASS Tsaragi	150	220	370
10.	G.S.S Bacita	283	342	625
11.	BSSS Bacita	120	250	370
12.	G.S.S Efagi	160	230	390
13.	G.S.S Tsonga	350	550	900
	Total	4680	5310	9990

Source: Edu Inspectorate Division 2013/2014.

Sample and Sampling Technique

Sample of the study consist of 2 public senior secondary schools out of 13 public senior secondary schools in the zone. SS 1 students were selected for the study because there syllabus contains basic ecology concepts to be taught in the research.

The total population for SS1 students offering biology in the two sampled schools LSS Lafiagi and T USS Tsaragi are 1500 and 620 respectively

A sample size of one hundred and forty SS1 students offering biology from the population was used for the study. This sampling procedure is viable for this type of research (Roscoe, 1975). The technique used for sampling was stratified sampling to ensure that gender distribution is taking care of. The details of the sample is presented below.

Table 2: Sample for the Study

School	Boys	Girls	Total
L.S.S Lafiagi	23	47	70
T.U.S.S	22	48	70
Total	45	95	140

Research instrument

The instrument that was used for this study in generating data is the Ecology Concept Achievement Test (ECAT). This was adopted by the researcher from past question papers of the West African Examination Council (WAEC) 2008-2013, Schools Certificate Examinations, on some selected topics taught in ecology because of their high level of validity and reliability. The ECAT consisted of 25 multiple choice biology test items with four options from which the students will select the correct answer.

Pilot Study

To ascertain the internal consistency of the items, a pilot version for the test was administered to 30 SS1 students in a school other than the ones that was used in the study.

The ECAT items were used on three different occasions.

- First, as pre-test to determine the strength and equivalence of the sample at the beginning of the study.
- Second, as post-test to assess the performance of the students after the treatment.
- Thirdly, as post-post test, to determine the level of retention of learnt concepts.

Validation of Instruments

The Ecology Concept Achievement Test (ECAT) was validated by two Professors from Science Education Department, Faculty of Education, Ahmadu Bello University, Zaria.

Reliability of the Instrument

To determine the reliability of the instrument, a test-retest method using Pearson Product-Moment Correlation Co-efficient Statistic was used to analyze the reliability of the instrument. The reliability co-efficient was found to be $r = 0.75$. This shows that the instrument is reliable and could be used for the study.

Data Analysis and Results

For the purpose of data collection, the Ecology Concept Achievement Test (ECAT) was used to measure the subject performance in the pre test, post test

and post, post test for the experimental and control groups. The data obtained in the course of the study were used to test the stated hypotheses using t-test statistics. The results are presented below.

Null Hypothesis 1

HO₁: There is no significant difference between mean scores of students taught ecology concepts with advance organizers and those taught without advance organizers. To test this hypothesis the post test scores of the experimental and control groups were compared using t-test statistics. Table 3 shows the results obtained.

Table 3: t-test Analysis of the Mean Scores of Experimental and Control Groups in the Post Test

Variable	N	X	SD	SE	DF	t.cal	p-value	Remarks
Experimental	70	9.71	1.97	.22	143	6.32	0.00	S
Control	70	7.94	1.42	.17				

Significant at $p \leq 0.05$

From the result shown in table 3 above, the p-value is .000 at $p \leq 0.05$ level of significance, with the experimental group having a higher mean than the control group. Therefore there is a significance difference between the experimental and control group. The null hypothesis of no significant difference between the academic performance of the experimental and control groups is rejected.

The influence of Advance Organizers on Retention of concept taught in Ecology.

HO₂: There is no significant difference between the students' retention level of ecology concept taught using advance organizers and those taught without advance organizers. To test this hypothesis the post-post test mean scores of the ecology concept achievement test of the experimental and control groups were subjected to t-test statistic. The result is shown in table 4.

Table 4: t-test Analysis of the Mean Scores of Experimental and Control Groups in the Post Post-Test

Variable	N	X	SD	SE	DF	t.cal	p-value	Remarks
Experimental	70	9.08	1.98	.22	143	5.62	0.00	S
Control	70	7.54	1.32	.15				

Significant at $p \leq 0.05$

The result from table 4 above shows that there is a significant difference between the mean scores of the experimental and control groups as the calculated p-value of .000 is less than the $p \leq 0.05$ level of tolerance chosen. This shows that the retention level of the subjects taught using advance organizers is significantly higher than those taught using lecture method only. The null hypothesis of no significant difference is therefore rejected.

H₀₃: There is no significant difference in the retention scores between male and female students taught ecology concepts using advance organizers. To test this hypothesis the post post-test mean scores of the ecology concept achievement test of the experimental group was subjected to t-test statistics.

The result is presented in table 5

Table 5 t-test Analysis of Post-Post-Test Mean Scores of Male and Female Students Exposed to Advance Organizer

Variable	N	X	SD	SE	DF	t.cal	p-value	Remarks
Experimental	47	9.28	1.98	.27	73	1.12	.264	NS
Control	23	8.73	1.86	.38				

Significant at $p \leq 0.05$

The results from table 6 above shows that the p-value to be 0.264 at $p \leq 0.05$ level of significance. The result showed that there is no significant difference in

retention between boys and girls mean scores because the calculated p-value of .264 is greater than $p \leq 0.05$ level of tolerance chosen. The null hypothesis of no significant difference is therefore accepted.

Summary of Findings

The findings of the study are as follows;

- There is a significant difference in the post-test mean scores of the experimental and control groups.
- There is a significant difference in the post post-test mean scores of the experimental group.
- There is no significant difference in the mean scores of males and females of the experimental group.
- There is no significant difference in the retention mean scores of males and females of the experimental group.

Discussion of the Results

The objective of this study was to investigate the influence of the use of advance organizers on the academic performance and retention of ecology concepts in public senior secondary schools students in Edu educational zone. The data collected through the use of (ECAT) were analyzed using the t-test statistics of $p \leq 0.05$ level of significance, to test the hypotheses formulated. The results are discussed below.

Null Hypothesis One

The result of testing hypothesis one showed a significant difference in the post test performance mean scores of the experimental and control groups. The experimental group achieved significantly higher than the control group in the post test scores (table 3). The significant difference in favor of the experimental group suggests that, use of advance organizers enhance learning of biology concepts. The results is in accordance with the finding of Lin and Chen (2007) who found out that the use of different types of computer generated visuals and advance organizers enhances comprehension and retention.

The result of hypothesis two which states that there is no significant difference in the retention level of the subjects taught ecology concept using advance organizers and those taught without advance organizers shows that there is a

significant difference in the post post-test mean scores of the experimental group. The experimental group had a higher or better retention of concept taught than the control group. This showed that the advance organizers presented to the experimental group enabled them to retain the ecology concept taught. This is supported by Davis, Sluckin, Kee and Reason (1980) who noted that the way that the children learn and perceive are reflected in retention scores, and that which is imperfectly registered cannot be perfectly retained

Hypothesis four states that there is no significant difference in the retention ability between mean scores of male and female students taught ecology concepts using advance organizers for the experimental group. This result showed that there is no significant difference in the retention ability of males and females taught with advance organizers. The hypothesis of no significant difference is therefore accepted. This is in accordance with Ogunboyede (2003), who found out that in subject achievement, boys are not better than girls.

Conclusion

Based on the findings of this study, it shows that advance organizers has the potential of enhancing public senior secondary schools students academic performance in ecology concepts, particularly at helping female students catch up with their male counterparts in school. We can therefore assume that the use of advance organizer apart from enhancing performance and retention is also gender friendly.

Recommendations

From the findings of this study, the following recommendations are made.

1. Biology teachers should be encouraged to use advance organizers in teaching ecology concepts where prior knowledge is lacking.
2. Professional associations such as Science Teacher Associations of Nigeria (STAN) and research centers like Nigerian Educational and Research Development Council (NERDC) should develop advance organizers that teachers can use to bridge the gap between prior knowledge and new materials to be learnt.
3. Teacher trainers should take not and incorporate development of advance organizers into the teacher education curriculum.

Limitations of the Study

The following limitations were observed during the course of the study.

- The concepts taught were limited to only three topics in ecology, basic ecological concepts, functioning ecosystem, and components of the ecosystem. The research should involve more topics.
- The study was limited to only SS1 students of Lafiagi secondary school and Tsarage Unity secondary school out of the 13 public senior secondary schools in Edu Educational zone more schools should be involved in this research.

Suggestion for Further Studies

- This study could be extended to other institutions, colleges of education, polytechnics and universities in Nigeria.
- This study should also extend to the use of different types of advance organizers such as graphic and visual advance organizers.

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