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Improving Upper Basic Science Students' Retention in Ecology through Outdoor Activities in Kwande Metropolis, Benue State, Nigeria

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Abstract

The poor achievement of students in Ecology propelled this study on improving upper basic science students' retention in Ecology through outdoor activities in Kwande Metropolis, Benue State, Nigeria. Two research questions and two hypotheses guided the study. A quasi experimental design of non-equivalent pre-test, post and retention test was adopted. A sample of 217 students from six selected government grant aided secondary schools out of a population of 16105 Upper Basic Science students participated in the study. The instrument for data collection in the study was Ecology Retention Test (ERT). The ERT was validated by three experts. The reliability coefficient of ERT yielded 0.84 using Kuder-Richardson formula 20 (KR-20). Three intact classes were randomly assigned to experimental and control group. The experimental group was taught Ecology using

outdoor activities while the control group was taught using lecture method. Mean and standard deviation were used to answer the research questions and Analysis of Covariance (ANCOVA) was used to test the null hypothesis at 0.05 level of significance. The study revealed that there is a significant difference in the mean retention scores of students taught Ecology using outdoor activities compared to their counterparts who were taught using lecture method; furthermore, no significant difference was found in the mean retention scores between male and female students taught Ecology using outdoor activities. Based on the findings, it was recommended among others that outdoor activities should be adopted by teachers while teaching Ecology since it enhance students retention regardless of their gender.

Keywords: Ecology, Outdoor Activities, Lecture Method, Retention, Gender, Basic Education

Introduction

Basic Science, formerly known as Integrated Science is the first form of science students encounters at the secondary school level. This prepares students at the upper basic level for the study of core science subjects such as Biology, Chemistry and Physics at the Senior Secondary level. The door way to the survival of a nation scientifically and technologically is scientific literacy which can be achieved through Basic Science. This means that, for a student to be able to study science at the Senior Secondary level successfully, such a student has to be well grounded in Basic Science at the upper basic level.

Retention plays a significant role in the teaching and learning of Ecology. The most important thing about learning is retaining the acquired knowledge for future use which must be encouraged by teachers through the instructional strategies employed. Mohammed (2019) defines retention as the act or power of remembering things. Similarly, Yemi and Adebimpe (2017) conceptualize retention as the ability to retain or remember facts and figures in the memory. In the same vein, Eka (2015) opines that retention is the ability of an individual to retrieve stored information from memory. Imoko and Anyagh (2008) assert that retention of a learnt material is a direct correlate of positive learning which the primary essence of education is. Retention therefore can be seen as the ability to recall things learnt by an individual and subsequent application of such knowledge at the appropriate time.

The relationship among living organisms with one another and their environment is an aspect of Biology called Ecology. Ecology is simply seen as the study of plants and animals in relation to their environment. Ecology is derived from a Greek word 'Oikos' which means home or dwelling place. In other words, ecology can be defined as a field of study which deals with the relationship of living organisms with one another and with the environment in which they live. Ecology is often described as environmental Biology (Micheal, 2008). Upper Basic Science students' retention in Ecology therefore means the output in terms of scores obtained from the students through answering questions in the Ecology Retention Test (ERT) constructed by the researcher and administered.

Ecology provides basic information on conservation, pollution, waste management and interrelationships in the environment, laying the foundation for the attainment of the

Sustainable Development Goals (SDGs). It is also important in dealing with nature and the environment in a responsible way. According to Zumyil (2019), understanding Ecology does not only enable students to pass the Biology examination well, but to also aim at maintaining a healthier and more productive biosphere for the life of humans.

According to Atomatofa (2013), retention depends on several factors; prominent amongst them is the instructional strategies adopted by the teacher. Similarly, Yemi and Adebimpe (2017) argue that students' poor retention is as a result of ineffective teaching strategy. In this regard, inappropriate teaching method use by teachers invariable translates to students' inability to retain and put into practice what is learnt. This has become a problem to stake holders in education. Supporting this, Zumyil (2019) submit that the rate of high failure of students in Biology has been attributed to inappropriate methods or strategies of teaching Ecology that are obsolete such as lecture method.

The lecture method is the oldest method of teaching. It is one of the conventional methods of teaching. It is otherwise known as talk and chalk or textbook method (Joda, 2018). In the lecture method of teaching, the teacher dominates the teaching with little participation on the part of the learners. Here the teacher is seen as the repository of all knowledge while the students are passive recipients of knowledge transmitted by the teacher in the teaching and learning process (Mohammed, 2019). Joda (2018) observe that the lecture method is a one-way traffic flow of ideas. The teacher spends most of the time on talking and writing on the chalkboard. The students on their part, sit silently, listen attentively and try to catch the points. This teaching method does not expose the students to first-hand information regarding their environment. In most cases what is taught cannot be translated into real life situation by students (Oluwatosin & Angura, 2017). There is therefore, the need to explore innovative methods for effective teaching of Biology specifically Ecology so as to enhance students' retention in the subject

One of the innovative methods is the outdoor activity. It requires direct observation of organisms in natural habitat. Ajaja (2010) defined outdoor activities as a method of teaching and learning process for exploration and discovery about the environment using the first-hand experience involving all sources of study. Supporting this, Yau (2010) relates that outdoor activities are taking students out of the classroom to places where they can see concrete illustration of classroom theories. It could be in a nearby school farm, national park, zoo, industry, forest or game reserve. This offers direct observation and interpretation of the substance in their natural surroundings and the use of basic scientific skills such as observation, identification, classification, and manipulation of substance in the natural environment. Similarly Edarho (2020) maintain that outdoor activities reduce abstraction, enhances lesson clarity, captivate students' attention and interest, encourage students' active participation and improve students' ability to remember learnt concept by providing the student with real-life experiences. It is the kind of education in which the learner is naturally and actively engaged in having the first-hand experience in constructing his/her knowledge from resources or materials outside the normal school classroom and laboratory, mostly under instructional guide by a teacher or educator. To Obeka (2010), outdoor activities are type of laboratory activity or field work

or learning exercise undertaken by teachers and students in certain aspects of a subject, to give students the opportunity to acquire knowledge.

Gender and students' retention has been linked. Gender is ascribed attitude which differentiate feminine from masculine (Ajimbola, 2014). Ezeugwu, Nji, Ngozi, Chinwe, and Remigius (2016) refer to gender as social attributes and opportunities associated with being a male or female. Ezeugwu *et al.* (2016) observe that some teaching strategies favour male students more than their female counterparts. The disparity in retention by male and female students is of great concern to science educators, particularly Biology teachers. For instance, Okoro (2011) reports that female students performed better than male students when co-operative learning is used. On the other hand, when individual learning strategy is used male students did better than female students. Some studies indicate that boys have higher retention than girls (Bala, 2011; Ajibola, 2014). Thus, teachers' instructional strategy may create a gap between the male and female retention in Ecology hence the need to examine male and female students' retention in Ecology using outdoor activities becomes pertinent.

Adejoh, Ochu, Egbe-Okpenge and Ejeh (2021) and Ejeh, Adejoh, Ochu and Egbe-Okpenge (2021) studied effects of field- trip on retention and academic achievement in biology among secondary school students in Zaria, Nigeria. The findings of the studies among others showed that the field trip teaching strategy favoured the experimental group in biology concept. Okolocha and Nwaukwa (2020) examined the effect of think-pair-share instructional strategy on secondary school students' academic achievement and retention in financial accounting. The study found that think-pair-share instructional strategy is more effective in enhancing students' academic achievement and retention ability of students in financial accounting when compared to the conventional teaching method. Oluwatosin and Angura (2017) investigated improving upper Basic Science students' retention in Electrolysis using collaborative concept mapping instructional (CCMIS). The study discovered that there is no significant difference in the mean retention of male and female students taught electrolysis using CCMIS.

In the light of all these findings, this present study seeks to determine if outdoor activities in ecology can bring about improvement in upper basic science students' retention in ecology.

Statement of the Problem

Ecology is a branch of biology that deals with the study of organisms in relation to their environment. The interdependency of man with living and non-living things within the ecosystem is fundamental to human existence thus the significance of ecology cannot be over stated. Upper Basic Science ecology provides basic information on conservation, pollution, waste management, erosion, deforestation, climate change and global warming and provides ways of mitigating them laying the foundation for the attainment of Sustainable Development goals (SDGs). Understanding ecology does not only enable students to pass the Basic Education Certificate Examination (BECE) well, but to also realize its useful applications aimed at maintaining a healthier and more productive

biosphere for the life of humans and other living organisms. Despite the aforementioned importance of Basic Science Ecology, there is poor retention arising from misconceptions which students hold about some ecology concepts consequently affecting their overall achievement in BECE (Nenshi, Anyagh and Adeniran, 2021, Edarho, 2021, Adejoh, Ochu, Ogbe-Okpenge and Ejeh, 2021, Ajangem, Okwara and Jirgba, 2021 and Zumyil, 2019). This means that Ecology should be meaningfully taught to students in real life and practical situations instead of the lecture method. It is against this background that the study sought to improve upper Basic Science students' retention in Ecology through outdoor activities in Kwande Metropolis, Nigeria.

Objectives of the Study

The main purpose of this study was improving upper Basic Science students' retention in Ecology through outdoor activities in Kwande Metropolis, Benue State. Specifically, the study sought to:

- i. Find out the mean retention scores of upper Basic Science students taught Ecology using outdoor activities and those taught with lecture method.
- ii. Find out if male and female upper Basic Science students mean retention scores will differ after being taught Ecology using outdoor activities.

Research Questions

The following research questions were asked to guide the study:

- i. What are the mean retention scores of upper Basic Science students taught Ecology using outdoor activities and those taught with lecture method?
- ii. What are the mean retention scores of male and female upper Basic Science students taught Ecology using?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance guided the study:

- i. There is no significant difference between the mean retention scores of upper Basic Science students taught Ecology using outdoor activities and those taught with lecture method.
- ii. There is no significant difference between the mean retention scores of male and female upper Basic Science students taught Ecology using outdoor activities.

Methodology

The study adopted a quasi-experimental design of non-equivalent pre-test, post and retention test. The design was considered suitable because intact classes were used. The study area was Kwande local government area of Benue State. The target population of the study comprised of 217 upper Basic Science students in government schools. One intact class from each of the six sampled schools was selected using simple random sampling.

They were assigned randomly to experimental and control groups. The experimental and control groups, each comprised three intact classes totaling six intact classes. The experimental group was taught Ecology using outdoor activities while the control group was taught Ecology using lecture method in line with lessons procedure prepared by the researcher respectively.

The instrument for data collection was Basic Science Ecology Retention Test (BSERT) validated by three experts from science education/measurement and evaluation. The BSERT contained two sections. Section “A” contains demographic information of the respondents, while section “B” contained a 40 multiple choice items with options A-D drawn from the 9-year Basic Education Curriculum. The topics covered include environmental pollution and habitat. After trial-testing on 50 students outside the study area but with similar characteristic with the study area, the reliability coefficient of BSERT using Kuder Richardson (KR-20) yielded 0.84 which shows a high internal consistency hence adjudged suitable for data collection in this study.

Before the commencement of the treatment, BSERT was administered by the research assistants (Biology teachers) on the students as pre-test. After the treatment which lasted for four weeks, BSERT was administered as post-test. The instrument was reshuffled and administered after a gap of another two weeks to measure the retention test to find out if the knowledge gained is retained. The research questions were answered using mean and standard deviation scores while the hypotheses were tested at 0.05 level of significance.

Results

The presentation of the data for this study is done according to the research questions and research hypotheses.

Research Question One

What are the mean retention scores of upper Basic Science students taught Ecology using outdoor activities and those taught with lecture method?

The answer to research question one is contained in Table 1.

Table 1: Mean Retention Scores, Standard Deviations and Mean Difference of Upper Basic Science Students of the Experimental and Control Groups in BSERT

Groups	N	Pre-test		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Experimental	104	20.09	5.76	27.77	5.60	7.68
Control	113	13.23	4.53	16.76	4.11	3.53
Mean Difference		6.86		11.01		4.15
Total	217					

Table 1 revealed that, the mean difference between the two groups was 4.15 in favour of outdoor activities outdoor activities group. It implies that the outdoor activities group had higher retention than the lecture method group.

Research Hypothesis One

There is no significant difference between the mean retention scores of upper Basic Science students taught Ecology using outdoor activities and those taught with lecture method.

The ANCOVA test to hypothesis 1 is presented in Table 2

Table 2: Summary of ANCOVA for Mean Retention Scores of Upper Basic Science Students of the Experimental and Control Groups in BSERT

Source of Variance	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	7808.063 ^a	2	3904.032	214.190	.000
Intercept	2509.451	1	2509.451	137.678	.000
Ach pretest	1233.899	1	1233.899	67.696	.000
Group	1805.561	1	1805.561	99.060	.000
Error	3900.563	214	18.227		
Total	117133.000	217			
Corrected Total	11708.627	216			

Table 2 revealed that there is a significant difference between the mean retention of students taught Ecology using outdoor activities and lecture method; $F_{1, 216} = 99.060$, $p = 0.000 < 0.05$. The null hypothesis is therefore rejected. This implies that outdoor activities significantly enhanced retention in Ecology when compared to lecture method.

Research Question Two

What are the mean retention scores of male and female upper Basic Science students taught Ecology using?

The answer to research question two is contained in Table 3.

Table 3: Mean Retention Scores, Standard Deviations and Mean Difference of Male and Female Upper Basic Science Students of the Experimental Group in BSERT

Groups	N	Pre-test		Retention-Test	
		Mean	SD	Mean	SD
Male	45	19.60	7.37	27.80	6.41
Female	59	20.47	4.21	27.76	4.95
Mean Difference		-0.87		0.04	
Total	104				

Table 3 revealed that, the mean retention scores of male students taught Ecology using outdoor activities is 19.60 and 27.80 respectively while the mean retention of female students taught using outdoor activities is 20.47 and 27.76 respectively. This implies that male retain slightly more than female.

Research Hypothesis Two

There is no significant difference between the mean retention scores of male and female upper Basic Science students taught Ecology using outdoor activities.

The ANCOVA test to hypothesis 2 is presented in Table 4

Table 4: Summary of ANCOVA for Mean Retention Scores of Male and Female Upper Basic Science Students of the Experimental Group in BSERT

Source of Variance	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	351.949 ^a	2	175.974	6.163	.109
Intercept	2808.472	1	2808.472	98.356	.493
Achpretest	351.913	1	351.913	12.324	.109
Gender	3.046	1	3.046	.107	.001
Error	2883.965	101	28.554		
Total	83489.000	104			
Corrected Total	3235.913	103			

Table 4 revealed that there is no significant difference between the mean retention of male and female students taught Ecology using outdoor activities [$F_{1=103}=0.107$, $p = 0.001 < 0.05$]. The null hypothesis is therefore not rejected. This implies that outdoor activities enhanced both male and female retention in Ecology.

Discussion of Findings

The study discovered that the mean retention of students taught Ecology using outdoor activities differed significantly from those taught using lecture method. These finding tallies with Adejoh, Ochu, Egbe-Okpenge and Ejeh (2021), Okolocha and Nwaukwam (2020) and Ejeh, Adejoh, Ochu and Egbe-Okpenge (2021). Furthermore, the study discovered that the mean retention scores of male and female upper Basic Science students' taught Ecology using outdoor activities do not differ significantly. the finding lends support to the study of Edarho (2021), Okolocha and Nwaukwa (2020), Zumyil (2019), and Oluwatosin and Angura (2017) however, the result is at variance with Okoro (2011) who found that male students' achievement was better than that of their female counterparts when taught using cooperative learning strategy. The significant difference in the achievements between the experimental and control group is because outdoor activities reduce abstraction, enhances lesson clarity, captivate students' attention and interest, encourage students' active participation and improve students' ability to remember learnt concept by providing the student with real-life experiences.

Conclusion

This study has provided empirical evidence that outdoor activities improved upper Basic Science students' retention in Ecology in Kwande Metropolis. The retention was not influenced by gender.

Recommendations

Based on the findings, it is therefore recommended that:

- i. Teachers should adopt outdoor activities in teaching and learning of Ecology to enhance retention.
- ii. The Ministry of education should organize workshops, seminars and conference for Biology teachers on the use of instructional scaffolding strategy for effective teaching and learning of the subject.

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