



Impact of Outdoor and Indoor Laboratory Experiences on Secondary School Students Retention Ability in Ecology

Maikano Stanley
Department of Science Education,
Faculty of Education,
Ahmadu Bello University, Zaria-Nigeria.

ABSTRACT

This study investigated the impact of two instructional strategies on the retention of learnt ecological concepts among senior secondary school biology students in Giwa education zone of Kaduna, Nigeria. A sample of 126 SS 2 students was randomly selected, pre-tested and categorized into experimental and control groups. The subjects in the experimental group were taught ecological concepts using the outdoor laboratory teaching strategy and their retention ability was compared with those of the control group who were taught the same ecological concepts using the indoor laboratory facilities. Pre-test and Post test data were analyzed using the t-test statistics at $P \leq 0.05$ level of significant to determine the equivalence and the retention ability of the students in the experimental and the control groups. One null hypothesis was tested using the t-test statistics and the following major findings were made; Students exposed to outdoor laboratory instructional strategy retained the learnt concepts significantly better than their counterparts exposed to the indoor laboratory instructional strategy and the use of outdoor laboratory is better than the use of indoor laboratory in the teaching of ecology because it enhances better retention ability among the secondary school students.

ARTICLE INFO

Article History

Received: April, 2019

Received in revised form: May, 2019

Accepted: June, 2019

Published online: November, 2019

KEYWORDS

Outdoor and Indoor Laboratory,
Retention, Ecology

INTRODUCTION

The driving force to conduct this research is the dwindling poor performance of students in Biology examinations as confirmed by the West African Examination Council (WAEC) 2016, Chief Examiner's Report. Moreover, the statistics of students' performance in WAEC (Biology) examinations in Kaduna State indicated an average yearly rate of failure of over 60% (Maikano, 2016).

Science as a concept is a process that is geared towards problem solving in order to enhance the living standard of man. Different scientists defined science differently according to their own perception and understanding of the subject matter. Some of these definitions are outlined below:

Crompton, G. (2013) defined science as intellectual activity that is carried on by humans that are designed to discover information about the natural world in which we live and to discover the ways in which this information can be organized and utilized to benefit the human race. The primary aim of science according to him is to collect facts (data) and the ultimate purpose is to discern the order that exists between and among the various facts.

Similarly, the Microsoft Encarta Reference Library (2011), defined science to consists of the following:

1. The systematic observation of natural events and conditions in order to discover the facts about them and to formulate laws and principles based on these facts.
2. As the organized body of knowledge that is derived from such observations and that can be verified or tested by further investigation.
3. Any specific branch of the general body of knowledge, such as biology, chemistry, physics, geology or astronomy.

Barker et al (2012) observed that one of the reasons why young people lose interest in science appears to be the way in which it is taught, science curricular tend to be packed full of facts that young people are expected to memorize. More emphasis needs to be placed on the context and practical application so that learning science becomes more relevant to the needs and aspiration of the society.

Fisher (2010) felt that science suffered from something of an image and presentation problem. Most people cannot see the connection between



scientific subjects and daily life (John, E. 2005). John further sees science as occupying a parallel world. The image of science has to be totally refocused to address the direct needs of the society, most especially in the developing countries like Nigeria.

This research focused on the use of outdoor laboratory in the teaching of ecology in biology. Outdoor laboratory is the natural environment of living organisms such as fields, riverside, ponds, trees among others where living things can best be studied from the ecological point of view. Outdoor laboratory seems to have some advantages in the teaching of ecology in many ways, some of these ways are:

1. It is best to study organisms in their habitat (natural environment) than in the artificial environment like the zoo.
2. It does not seem to cost much to harness the resources of such laboratory, especially in the schools that are located in the rural and semi-rural areas.
3. Students are always intrinsically motivated when outdoor laboratory is used in giving the learning instruction to them.

According to Nwagbo (2015) cited in Maikano (2016) outdoor laboratory experiences enable the science teacher to:

1. Teach for the acquisition of science process skills (basic or integrated) which is a major goal in science education.
2. Apply scientific concepts, ideas and principles properly.
3. Communicate effectively in science.
4. Use science in explaining naturally occurring phenomena.
5. Use science daily for his actions, thoughts and utterances.
6. Have more confidence in teaching.
7. Teach using the constructivist approaches like problem solving, discovery strategy among others.
8. Teach science for effective functioning in the society.
9. Concretize science through meaningful explanation and activity.
10. Have the skill resourcefulness and improvisation among others.

The indoor laboratory is a forum for science teachers and their students within a building which allows the interaction with apparatus under

controlled conditions when seeking answers to problems in nature. Science is concerned with finding answers to problems in a bid to understand and interpret natural phenomena. It is often necessary to try out our 'wise guesses' or hypotheses through experimentation. The students or the teachers of science find the indoor laboratory a unique place for this. As a result of high rate of students' enrolment in science subjects and the economic problem faced by the government and the science teachers, the indoor laboratory has some limitations. Maikano (2007) observed the following limitations, among others that are associated with the usage of indoor laboratory for instructional purposes:

1. The apparatus needed for the indoor laboratory use are not always adequate to cater for the students' population and their needs.
2. In some schools, different science subjects, that is biology, chemistry and physics do not have separate laboratories but are grouped under one laboratory called multipurpose laboratory. This is not equipped adequately to service the individual subject requirements/needs.
3. Materials are not always supplied on time until the SSCE examination is about to start, this goes not give the students room to undergo real practical lessons at the secondary school level.
4. The government always finds it difficult to employ a laboratory technologist and attendance because of scarce resources.
5. Some safety measures that need to be put in place like fire extinguishers, first aid box, fume chamber among others are not always there, as a result of this, teachers and students are exposed to indoor laboratory risk.

Retention is the ability to learn, retain and later remember the information or knowledge gained after learning (Bichi, 2002). It takes place when learning is coded into memory. Thus, appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane Oyedokun (1998) in Bichi (2002). The nature of the materials to be coded contributes to the level of retention. Materials are related to the quality of retention in terms of their meaningfulness,



familiarity, concreteness and image evolving characteristics, Adeniyi (1997) in Bichi (2002).

Purpose of the Study

The outdoor instructional strategy is an innovation to the teaching of ecology by making use of the natural environment. Therefore, this research work was conducted to find out the followings:

1. Whether the retention ability of students taught some ecological concepts using the outdoor laboratory approach is higher than those students taught the same concepts using the indoor laboratory.
2. Whether the use of outdoor laboratory is better than the use of indoor laboratory in the teaching of ecology.

Research Question

1. What is the impact of the outdoor and indoor laboratory teaching strategies on the retention of learnt ecological concepts among SS 2 biology students?

Research Hypothesis

The following null hypothesis was tested using the t-test statistics at $P \leq 0.05$ level of significant.

HO: there is no significant difference between the level of retention of learnt ecological concepts of SS 2 biology students exposed to outdoor laboratory experiences and their counterpart exposed to indoor laboratory experiences.

RESEARCH METHODOLOGY

This study was a quasi-experimental type of the pre-test, posttest, non-equivalent control group design. The design is a 2x2 factorial design. This design represents two levels of treatment, that is, the outdoor laboratory (experimental group), the indoor laboratory (control group) and two levels of gender (male and female). The target population for this research work was the second year secondary biology students in Giwa education zone of Kaduna, Nigeria. A total sample of 126 students was selected from a total population of 1483 for this study. This sample was divided into two groups (EG 63 & CG 63), the students in the EG were taught using an open field (ODL) while the students in the CG were taught using the conventional laboratory (IDL).

The instrument used for this research work was an Achievement Test called the 'Ecology Achievement Test' (EAT). The 40 items EAT were drawn from the ecology in the past question papers of the West African Senior Secondary School Certificate Examination which is known to have high validity and reliability.

RESULTS

The retention test data generated through the EAT were subjected to t-test statistics at $P \leq 0.05$ level of significant to determine if there is any significant difference between the retention level of the experimental group and the control group. The summary of this is presented below:

Table 1: t-test comparison of the posttest mean scores of the experimental group and the control group.

Group	N	\bar{x}	SD	t-cal	t-critical	df	P
Experimental	49	34.16	2.59	39.77	2.58	126	0.001
Control	77	18.71	1.77				

- Remark: Significant at $P \leq 0.05$

From the above Table, the calculated t-value is 39.77; this value is greater than the t-value critical which is 2.58 at $P \leq 0.05$ with df 126. This means that there is a significant difference between the retention test scores of the experimental and the control groups. This difference is in favour of the experimental group. Thus, the hypothesis is rejected.

SUMMARY OF FINDINGS

In this study, the following finding was made:

1. There is a significant difference between the retention test mean scores of the experimental and the control groups in favour of the experimental group. This implies that the experimental group taught ecological concepts using the outdoor laboratory approach retained the learnt concept higher than the control group



taught the same ecological concept using the indoor laboratory approach.

CONCLUSION

Teaching strategies that the teachers employ in science teaching have significant effect on students' retention. Thus, students that were taught ecological concepts using the outdoor laboratory strategy retained the learnt concepts significantly better than those taught the same concepts using the conventional indoor laboratory strategy. Consequently, outdoor laboratory teaching strategy facilitates effective learning of ecological concepts due to its activity based and students' centeredness.

RECOMMENDATIONS

On the basis of the findings and conclusions reached in this study, the following recommendations were made:

1. The general teaching of biology and ecology in particular should be conducted in such a way that students effectively learn and retain the concepts presented to them. The use of the outdoor laboratory instructional strategy seems to be relevant in achieving this noble goal. It should therefore be incorporated into the teaching of ecology at the secondary school level.
2. In-service programmes for science teachers in form of seminars, workshops and conferences should focus more on how to use the outdoor laboratory instructional strategy in teaching of ecological concepts instead of the conventional indoor laboratory method that is currently being used.

REFERENCES

- Barker, S. (2012): Teaching Biology outside the Classroom: Is it heading for Extinction. FSC Occasional Publication 72, Strewsbury: *Field Studies Council/British Ecological Society*.
- Bichi, S. (2002): Effects of Problems Solving Strategy and Enriched Curriculum on Students Achievement in Evolution Concepts Among Secondary School Students. *An Unpublished PhD Dissertation, Faculty of Education, A.B.U. Zaria, Nigeria*.
- Crompton, G. (2013): Outdoor Experiences have the Potential to Impact Students in both the Cognitive and Affective domains. *University*

of Tasmania, Faculty of Education, Launceston, Tasmania 7250, Australia.

- Fisher, J.A. (2010): The Demise of Fieldwork as an Integral part of Science Education in Schools; A Victim of Cultural Change and Political Pressure. *Pedagogy, Culture and Society 9 (1), 75-96*.
- John, E. (2015): Green School Ground as Sites for Outdoor Learning; Barriers and Opportunities. *University of Tasmania, Faculty of Education, Launceston, Tasmania 7250, Australia*.
- Maikano, S. (2007): Effects of Outdoor and Indoor Laboratory Experiences on Secondary School Students Academic Achievement and Retention in Ecology. *An Unpublished M.Ed. Thesis, Faculty of Education, A.B.U. Zaria, Nigeria*.
- Maikano, S. (2016). Impact of Computer-Assisted and Science Process Instruction on Retention and Performance in Biology among Varied Abilities Secondary School Students in Kaduna, Nigeria. *An Unpublished PhD Dissertation Department of Science Education, Ahmadu Bello University, Zaria*.
- Microsoft (2011): Encarta Reference Library.
- Nwagbo, C. (2015): Effect of Guided Inquiry and Expository Teaching Method on the Achievement in and Attitude to Biology Students of Different Ability Levels. *Department of Science Education, University of Nigeria, Nsukka*.
- WAEC, (2016). West African Examination Council Reports.