

Effects of Laboratory and Lecture Teaching Methods on Cognitive Achievement in Biology

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Abstract: A sample of 120 Senior Secondary school Class Three Biology students from four randomly selected schools in Ekiti State, Nigeria was divided into two – experimental and control groups. Teaching package from two chapters in College Biology were used in teaching the experimental group by a laboratory method while the control group was taught by the lecture method. Data was collected using an Achievement Test for Nutrition and Ecology (ATNE) designed by the researcher. Means, standard deviation and t-test statistics were used in analysing the results.

The two methods were effective in teaching biology, the experimental group performed better than their counterparts in the control group. The study also revealed that male students prefer lecture method to laboratory method when compared with their female counterparts. On the other hand, the females in the control group performed better than males of the same group.

Keywords: Laboratory, Lecture, Cognitive Achievement, Nutrition and Ecology.

1. Introduction

The search and pursuit of teachers or educationists worldwide appears to be how to find the best ways to bring about effective teachings and learning in our schools. In the light of this statement, the Science Teachers Association of Nigeria (STAN) issued out the Curriculum Development Newsletter No. 1 in 1970 where the strategies to be used in teaching science was stressed. The following strategies were suggested – (i) the use of discovery teaching tactics, (ii) the inclusion of problem solving activities and (iii) the involvement of students in open-ended laboratory exercises.

It was the believe of STAN that by using the above strategies students should be able to –

- (1) observe carefully and thoroughly
- (2) report completely and thoroughly what was observed
- (3) organise information acquired by the above processes.
- (4) generalize on the basis of acquired information
- (5) predict as a result of these generalizations
- (6) design experiments to check these predictions
- (7) use models to explain phenomena where appropriate
- (8) continue the process of inquiry when new data do not conform to predictions.

Results from previous researches have shown that teachers are not employing the strategies envisaged by Science Teachers' Association of Nigeria to help students to acquire the above skills, Odebunmi (1986) and Olarewaju (1982) found that most teachers used lecture or talk and chalk method where notes are given to the students where necessary.

The main purpose of this study was to investigate the effects of laboratory and lecture teaching methods on cognitive achievement in biology. A good understanding of biology can be achieved through laboratory method. Seweje (2005) asserted that laboratory method helps to carry out experiments and hypotheses that can be tested under controlled conditions. In practice, laboratory work is just a collection of directions for the students to follow, often without thought and with little evidence of controlled experimentation.

According to Ogunniyi (1981) lecture method is an efficient means of conveying factual information; it is time saving and

as much learning materials can be covered within a short period of time.

Adediran (1993) compared lecture method with laboratory (inductive) method and found no significant difference as they affect retention and sequent transfer of scientific principles.

2. Purpose of the Study

The purpose of this study was to find out the effects of laboratory and lecture teaching methods on cognitive achievement of students in Biology. The study also examined the influence of sex on the students' achievement when taught with the two methods.

3. Statement of the Problem

The problem of under achievement of students in Biology (particularly in ecology and nutrition) in the Senior Secondary School has generated a lot of debate. On the whole, it is certain that there is an urgent need for researches to concentrate on finding solutions to the pedagogical aspects so as to prevent students developing negative attitudes to that aspect of Biology at Senior Secondary School level.

4. Research Questions

The following research questions were raised to guide the study:

1. Which of the laboratory and lecture methods leads to achievement in Biology?
2. Which of the laboratory and lecture methods leads to better achievement for male students in Biology?
3. Which of laboratory and lecture methods leads to better achievement for female students in Biology?

5. Research Hypotheses

Based on the questions raised above, the following null hypotheses were generated for the study

HO₁: There is no significant difference in the mean-scores of students exposed to laboratory method and those exposed to the lecture method in the teaching of Biology.

HO₂: There is no significant difference in the mean-score of male and female biology students taught with laboratory method.

HO₃: There is no significant difference in the mean-scores of male and female biology students taught with the lecture method.

6. Materials and Method

The population consisted of all Biology Students in Senior Secondary Schools in Ekiti State. The sample consisted of 120 students who were drawn from four schools who were randomly selected from two local government areas in Ekiti State Nigeria.

A total of 120 Senior Secondary School year (III) Biology students were randomly selected with 30 students each from the four schools used for the study.

The research instrument used for the study was Achievement Test for Nutrition and Ecology (ATNE). It consisted of 30 multiple choice items based on the topics treated under nutrition and ecology in Biology. The items were constructed by the researcher and were used as both pre test and post test for data collections.

7. Validity and Reliability of the Instrument

Copies of the Achievement Test for Nutrition and Ecology (ATNE) were given to two Biology teachers from one of the Secondary Schools in Ekiti State. This was done to ensure face and content validity as well as suitability for the target sample.

The reliability coefficient of the instrument was found to be 0.73 by using the split-half method of finding reliability coefficient. Data collected were analysed using frequency counts, means, standard deviations and t-test.

8. Results and Discussion

HO₁: There is no significant difference in the mean-scores of students exposed to laboratory method and those exposed to the lecture method in the teaching of Biology.

This hypothesis was tested by subjecting the post treatment scores for both laboratory and lecture groups to t-test statistics. The result is shown in Table 1.

Table 1: t-test on Laboratory Method and Lecture Method Group Performance.

Group	N	X	S.D	df.	t _{cal}	t _{tab}
Laboratory method	60	15.47	3.82	118	0.32	1.68
Lecture method	60	15.25	3.49			

Not significant at 0.05 level.

The result indicates that there is no significant difference ($p > 0.05$) in the mean-scores of students taught biology (nutrition and ecology) with laboratory method and those exposed to lecture method. This is so because the calculated value 0.32 is less than the table value 1.68. It is not significant at 0.05 level. Therefore hypothesis 1 is upheld.

Hypothesis 2: There is no significant difference in the mean-scores of male and female Biology students taught with laboratory method.

In order to test this hypothesis, the means, standard deviation and t-test statistics were carried out on data for both male and female who were taught with laboratory method of teaching. The result is shown on table 2.

Table 2: t-test Analysis for Male and Female in Laboratory Method Group.

Groups	N	X	S.D	df.	t _{cal}	t _{tab}
Male laboratory method	38	15.00	2.51	58	1.27	1.68
Female laboratory method	22	16.27	4.20			

Not significant at 0.05 level.

The result indicates that there is no significant difference ($p > 0.05$) in the mean-scores of male and female students who were taught nutrition and ecology (Biology) with Laboratory Method. This is so because the calculated value 1.27 is less than the table value 1.68. Therefore, hypothesis 2 is accepted.

Hypothesis 3: There is no significant difference in the mean-scores of male and female Biology students taught with lecture method.

This hypothesis was verified by subjecting the post treatment scores of male and female students who were taught with lecture method to t-test statistics. The result of the analysis is shown in table 3.

Table 3: t-test Analysis for Male and Female in Lecture Method.

Groups	N	X	S.D	df.	t _{cal}	t _{tab}
Male Lecture Method	36	12.96	3.59	58	*1.83	1.68
Female Lecture Method	24	11.38	2.94			

*Significant at 0.05 level.

The result shows that there is significant difference ($p < 0.05$) in the mean-scores of male and female who were taught nutrition and ecology with lecture method. The calculated value 1.83 is greater than the table value 1.68 at 0.05 level of significance. Hypothesis 3 is therefore rejected.

Based on the results obtained as indicated in Table 1 to 3, the following discussions were made. It was found that there is no significant difference in students' performances when laboratory and lecture methods were used separately.

Based on the result of data analysis as indicated in Table 1, it can be said that both laboratory and lecture methods are equally effective in the teaching of Biology among the secondary school male and female. This result however disagrees with those obtained in other studies which involved the effectiveness of laboratory and lecture methods. For instance Nwachukwu (2001), Nowak, Watt & Walther (2004) and Duyilemi (2004) concluded that laboratory method is more effective than lecture method in biological taxonomy and science. The result is also at variance to the findings of Malmfors., Garnsworthy and Grossman (2004) and Olarinoye

(1989) who concluded that lecture method is more effective than other methods. The disagreement in the findings may be due to the natures of the concepts taught with the methods. For example taxonomy is different from Nutrition and Ecology in Biology.

The results of analysis of male and female students taught with lecture method discriminated between male and female cognitive achievement. The result as it is displayed in Table 3 showed that there is significant difference in the performance of male and female who were taught Nutrition and Ecology in Biology with lecture method.

Male performed better than female in lecture method is in agreement with the finding of Fatoba (2008) and Fidelia (2012).

9. Conclusion and Recommendations

In conclusion, both lecture and laboratory methods are equally effective in the teaching of nutrition and ecology in Biology since the performance of students were statistically not different for the two groups. But male students in lecture method group had higher cognitive achievement than their female counterparts under the same conditions.

Based on the findings of this research the following recommendations are hereby made

- Teachers in secondary schools should make use of all the available teaching methods and diversify them to effect maximum understanding of the concepts being taught.
- More studies should be carried out to cover more schools in many local government areas or states to determine the universal efficacy of both laboratory and lecture methods of teaching.
- The short period of treatment was not enough to bring out an appreciable difference between the two teaching methods. For further researches, extended periods of about four to seven months should be used to carry out the research.
- Girls should be motivated to improve their attitudes toward science.

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