



## The Effects of Problem-Based Learning on Academic Achievement in Ecology Concepts among Science Education Students in Gusau

Halima Yahaya(Ph.D)<sup>1\*</sup>

<sup>1</sup>Department of Science Education, Faculty of Education, Federal University Gusau, Zamfara State, Nigeria

### \*Corresponding Author

Halima Yahaya(Ph.D)

Department of Science Education, Faculty of Education, Federal University Gusau, Zamfara State, Nigeria

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**Abstract:** The study investigated Effect of Problem-Based Learning on academic achievement in Ecology Concepts among Science Education Students in Gusau. Quasi-experimental pretest, post test control group design. The population comprised of one thousand two hundred and twenty five Biology SS11 students from 11 public Senior Secondary Schools in Zaria metropolis. A sample of 137 students from two schools was randomly selected. The study involves two groups- experimental and a control group. The experimental group was taught Ecology concept using Problem-based learning while the control group was exposed to the same concept using Conventional Method. One instrument was used for data collection Namely Ecology Achievement Test. The instrument was duly validated and have reliability coefficient of 0.87, using Pearson Product Moment Correlation statistic. Two research questions and two null hypotheses were formulated and answered using Mean and Standard deviation statistics and Independent Samples t-test at alpha 0.05 level of significance. The major findings reveals a significant difference between mean academic achievement scores in favor of the experimental group. Based on the findings, it was recommended among others, that workshops, seminars and conferences should be organised for Biology teachers on the use of Problem-Based learning among science education students in Gusau.

**Keywords:** Problem-based Learning, Academic achievement, Ecology concept, Lecture method.

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## INTRODUCTION

Science is a very important aspect in the development of any nation and is regarded as instrument per excellence for solving socio-economic problems of various kinds (Ghumdia, 2017). Science has helped to meet the minimum needs of human in the society in terms of food, shelter, clothing, water, unemployment, basic education, transportation, communication and healthcare (Ongowo, 2017). Despite the roles played by science in the society, some students still display negative attitudes towards the study of nature of some topics in science subjects (Adegboye, Ganiyu and Isaac, 2017). As a

science subject, biology serves as a prerequisite to the study of medicine, pharmacy, agriculture among others. Biology concepts according to Oyarole, (2023) can sometimes be difficult particularly when describing ideas that are abstract or cannot be fully comprehended by learners for the first time. Research finding by Oyarole (2015); West African Examination Council (2018) have also shown that a number of concepts in biology which include Ecology, Evolution and Ecology contains topics that pose difficulty for biology students to understand. Ecology is an aspect of the biology syllabus that senior secondary students at SS2 must study. However, it is considered as abstract in nature and difficult to

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understand which has resulted in poor performance among students (Etobro & Fabinu, 2017). Despite the importance of Biology as a science subject, empirical studies such as those of Etobro and Fabinu (2017) and Adegboye, Ganiyu and Isaac (2017) have shown that students still perform poorly in Biology at Senior Secondary level. Umar (2015) reported that Biology is one of the science subjects having downward trend in the performance of students at Senior Secondary Certificate Examination (SSCE). Timothy (2018) noted that a review of students' enrollment in science subjects at senior secondary schools in Nigeria shows that more students register Biology than any other subject but their academic performance in the subject is comparatively lower at SSCE. The poor performance has been attributed to the method of instruction.

The predominant instructional method used in teaching at all levels of education, is through the use of lecture method (Oyarole, 2023). Lecture method on the other hand has been reported by Umar (2016) and Wada (2016), to be passive mode of instruction. The use of lecture method entails one way flow of communication from the teacher to the students. It is teacher-centre or teacher dominated apt of the talking is carried out by the teacher while the students remain as passive. Any teaching method that does not encourage positive interaction between the students and the teacher and amongst the students is incomplete (Muokwe and Okeke, 2021). One of such innovative teaching methods is problem based strategy. Problem based is an instructional strategy and a type of blended learning, which aims to increase students engagement and leaning by having students complete reading at home and work on problem-solving during class time (Alvarez, 2011). In a problem based, students watch online lectures, collaborate in online discussions, or carry out research at home while engaging in concepts in the classroom with the guidance of a teacher. Jacoub (2019). The problem based intentionally shifts instruction to a learner-centered model in which time in the classroom is used to explore topics in greater depth and create meaningful learning opportunities while students are initially introduced to new topics outside the classroom. This type of instructional strategy content delivery may take a variety of forms, often video lessons prepared by teacher although online collaborative discussions, digital research, and text reading may be used (Nwagbo, & Onah, (2017)). A teacher's interaction with students in a problem based can be more personalized and less didactic, especially when males and female students are actively involved in knowledge acquisition and construction as they participate in and evaluate their learning (Sen, Sezen-Vekli, 2016). Another variable that has been of concern to researcher in science education his gender. Many researchers in science

education have conducted studies on gender-related differences with a view to improving science instruction for boy and girls in the secondary schools. Researchers such Sarac (2017) and Musa (2017) in their separate studies reported great concern that girls are not achieving as much as their male counterpart in science education.

### **Statement of the Problem**

Over the years, there has been an upsurge in the number of candidates sitting for public examinations such as Senior Secondary Certificate Examination (SSCE) and particularly biology papers. This is because of the stipulation that students must offer one of the basic science subjects (Biology, Chemistry and Physics) and biology it is preferred by most students. The results obtained by candidates have been abysmal and do not justify the popularity as observed by researchers (Maikano, Bichi & Shuaibu, 2016) and Jack, (2017) The statistics of performance in Biology in the May/June Senior Secondary Certificate Examination (SSCE) revealed a poor percentage pass at credit level.

### **Objective of the Study**

The objectives of this study was to:

- 1) Determine the effects of problem based instructional strategy and those taught using conventional teaching method on senior secondary school students' performance in Ecology concept.
- 2) Determine the effect of problem based model of instruction on male and female students' performance in Ecology concept.

### **Research Questions**

The study attempted to formulate two research questions for answering:

1. What is the difference between the mean performance scores of students taught Ecology concept using problem based instructional strategy and those taught same concept using conventional lecture method?
2. What is the difference between the mean performance scores of male and female students taught Ecology concepts using problem based instructional strategy?

### **Null Hypotheses**

On the basis of the research questions, the following null hypotheses were stated for testing at  $p \leq 0.05$  level of significant:

HO<sub>1</sub>: There is no significant difference between the mean performance scores of students taught Ecology concepts using problem based instructional strategy and those taught same concepts using conventional teaching method.

H0<sub>2</sub>: There is no significant difference between the mean performance scores of male and female students taught using Ecology concepts using problem based instructional strategy.

## METHODOLOGY

The study was quasi-experimental-control group design employing pretest, posttest. Two groups of students were used for data collection; the experimental (EG) and the control groups (CG). A pretest was administered to the two groups in order to determine the equivalence in ability of the two groups. The experimental group was taught Ecology concept using problem based instructional strategy. The control group was taught same concept using Lecture Method (LM). At the end of the six weeks treatment, a posttest was administered to both groups of students to evaluate the effectiveness of the treatment in enhancing students' academic performance in Ecology.

### Population of the Study

The population for the study was made up of all the Senior Secondary II student in Offa Metropolis, with a total number of 1225 students comprising males and females.

### Sample and Sampling Procedure

In selecting the sample used for the study, the names of the twelve (12) schools in the metropolis were written on pieces of paper and two pieces of paper were picked once at a time. The content were reshuffled each time a piece of paper was picked to ensure equal chance off picking each of the piece of paper. The two schools whose names were coded on the pieces of paper picked were used as sample schools. Hence the total number of subjects in the two schools was 135 students. This is in accordance with central limit theorem Tuckman (1975); Gay, Mills and Airasian (2009) who proposed

30 as minimum sample size for an experimental study.

### Instrumentation

Ecology Performance Test (CPPT) was the instrument used to collect data for the study. Ecology Performance Test (CPPT) is a forty (40) items objective test involving multiple choice (a,b,c and d) developed by the researcher.

### Validation of the Instruments (CPPT)

The content validation of the Ecology Performance Test (CPPT) was carried out by a panel of experts comprising the following: Two senior lecturers from Biology department Ahmadu Bello University Zaria and two senior lecturers from science education of the department of education Ahmadu Bello University Zaria. One Biology teacher at the secondary school level and a specialist in Educational Statistics

### Reliability of CPPT

In order to ascertain the level to which CPPT was reliable Test-retest method was used to statistically estimate the internal consistency of the items in the instrument. Tuckman (1975), who proposed the minimum interval of two or more weeks between the first and second administration, recommended the use of two weeks interval. Data thus collected from the pilot study were analysed using the Pearson Product Moment Correlation Coefficient statistic. The results showed a reliability coefficient of 0.85 which was considered reasonably reliable for this study.

### Data Analysis

#### Research Question 1

What is the difference between the mean performance scores of students taught Ecology concepts using problem based instructional strategy and those taught same concept using conventional lecture method?

**Table 1: Data collected for answering research question one was analysed using mean and standard deviation descriptive statistics**

Group	N	Mean	Std. Deviation	Mean Diff
Experimental	73	21.17	5.89	
Control	64	11.89	3.46	9.28

Results from Table 1 shows that the academic performance means scores for the experimental and control group were 21.17 and 11.89 respectively. The standard deviation for the experimental and control group were 5.89 and 3.46 respectively. The mean difference was 9.28. This means the experimental group achieved higher than the control group.

### Hypotheses Testing

The state null hypotheses were tested at  $p \leq 0.05$  Level of significance.

**H0<sub>1</sub>**: There is no significant difference between the mean performance scores of students taught Ecology concepts using problem based instructional strategy and those taught using conventional teaching method.

The  $H_{01}$ : was analysed using t-test at  $p \leq 0.05$  level of significance. The result is presented in Table 2.

**Table 2: Summary of independent t-test analysis, of academic performance mean scores of experimental and control group**

Gender	N	$\bar{X}_1$	SD	t-CAL	DF	P	Remark
EXP	73	21.17	5.89				
				11.04	135	0.00	S
CONRT	64	11.89	3.46				

Significant at  $P \leq 0.05$

Table 3 result shows experimental group has higher mean scores of 21.17 as compared to that of control group with mean scores of 11.89. The p-value is 0.00 which is less than 0.05 level of significance. Hence, the null hypothesis was rejected. This means flip classroom instructional strategy is effective in enhancing student's performance in Ecology concepts

**Research Question 2**

What is the difference between the mean performance scores of male and female students taught Ecology concepts using problem based instructional strategy?

**Table 3: Means and standard deviation of post scores for male and female in experimental group**

Gender	N	Mean	Std. Dev	Mean Diff
Female	73	19.61	5.91	
Male	64	9.48	2.65	10.13

Result in Table 3 Showed the mean scores for male and female students were 19.61 and 9.48 respectively, with mean difference of 10.13 and the standard deviation for the females group achieved higher than the males

**Hypothesis 2:** There is no significant difference between retention of ecology concepts between male and female students taught using Problem based strategy.

The  $H_{02}$ : was analysed using t-test at  $p \leq 0.05$  level of significance. The result is presented in Table 4.

**Table 4: t-test analysis of post-posttest mean scores of male and female students in experimental group**

Gender	N	$\bar{X}_1$	SD	t-CAL	DF	P	Remark
Female	73	19.62	5.95				
				12.54	135	0.26	NS
Male	64	9.48	9.48				

Significant at  $P \leq 0.05$

Table 4 5shows that there is no significant difference between male and female students academic performance scores when exposed to flip classroom strategy i.e treatment. They female and male recorded a mean of 19.62 and 9.48 respectively. The calculated p value of 0.26 is higher than the 0.05 alpha level of significance. Therefore, the null hypothesis which stated that there is no significant difference between male and female students exposed to flip classroom instructional strategy is hereby retained.

**DISCUSSION**

The result of analysis showed that the students taught Ecology concept with clip classroom instructional strategy had a higher mean score than the students taught using lecture method. This result is in agreement with the findings of Oyarole, (2015)

and whose works found that problem based instructional strategy enhanced students academic performance in science subjects. The findings of this study are also in agreement with that of Talam & Gulsecen (2019) that the use of flip classroom teaching strategy results in higher achievement of students in Biology concepts. However, the finding is not in agreement with the findings of Arwa, Din & Hussin (2017) who found no significant difference in performance of flip classroom on the concept of physics education Female were significantly different from the male, flip classroom learning strategy had impact on performance of the female than the male students who were exposed to it. This findings agree with the findings of Oyarole, (2023) who reported a significant difference in the academic performance girls than boys who were exposed to flip classroom learning strategy. No significant difference between

males and females students exposed to flip classroom learning strategy as revealed by the result of this study may be due to the fact that in flip classroom strategy encourage students to work on the same task, share ideas and experiences freely. This equal opportunity for the students to learn together irrespective of their gender differences.

## CONCLUSION

In the light of the findings of the study, the researcher concluded that:

1. Problem based instructional strategy enhances students performance in Ecology concepts.
2. The findings in this study revealed that problem based model of instruction is efficacious in eliminating gender related differences in science learning, indicating that the strategy is gender friendly.

## RECOMMENDATIONS

Based on the findings in the study, the researcher wished to make the following recommendations:

1. Biology teachers should adopt the use of flip classroom instructional strategy in teaching various concepts in Biology.
2. Seminars/Workshops should be organized by ministry of education for Biology teachers to appraise them with the use of problem based model of instruction.

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