

EFFICACY OF COOPERATIVE AND INQUIRY FIELD- BASED INSTRUCTIONAL STRATEGIES ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN ECOLOGY CONCEPTS IN SOUTHERN BORNO, BORNO STATE, NIGERIA

ISA SAGIRU (PhD)

Gmail: sagiru5604@gmail.com

Phone Number: 0803 3552 886

HALIMA MAIGARI

Gmail: sadiyanmama69@gmail.com

Phone Number: 0816 0907 569

Abstract

The study investigated the efficacy of cooperative and inquiry field based instructional strategies on secondary school students' achievement in ecological concepts, in southern Borno, Borno state, Nigeria. Pre-test-Post-test quasi- experimental design was adopted. The population of the study consisted of 42978 senior secondary student (SSII) students from fourteen (14) public schools in Borno State for 2023 academic session. Three classes were purposively sampled. Two classes were used as experimental and one as a control group respectively. The experimental group 1 and 2 were taught using cooperative and inquiry field based instructional strategy respectively and the control group was taught using lecture method. The instrument used for this study was Student Achievement Test in Biology (SATB) with reliability value of 0.84 which aimed at determining the achievement of the biology students. One research question and one null hypothesis were used in the study. The Null hypothesis was formulated and tested at 0.05 level of significance. Data collected were analyzed with descriptive statistic (mean and standard deviation) to answer the research question. The null hypothesis was tested using ANCOVA inferential statistics. The findings of the study showed that significant differences among the achievement scores of students exposed to ecological concepts using cooperative field based, inquiry field based and lecture methods exist. In addition, no significant difference exists between the performance of students exposed to inquiry field based and cooperative field based instructional strategies. It was therefore concluded that cooperative field- based and inquiry- field- based improves students' achievement in biology. Based on the findings of this study it was recommended that government and school administrators should encourage the use of field based instructional strategy for teaching ecological concept in biology.

Key words: cooperative field based, inquiry field based, academic performance

Introduction

The importance of Biology to man cannot be over emphasized. Biology is a science of life concerned with the characteristics of living things, their forms, functions and relationship with one another and with their environment among others (Apawu, Samuel, Ruthhools, 2020). Biology plays a vital role in the economic development of a nation. This is because recent advances recorded in the field of biology, chemistry, physiology, ecology, genetics and molecular biology, have made the subject a central focus in most human activities including solutions to the problem of food scarcity, pollution, population explosion, radiation, disease, health, hygiene, family life, poverty eradication, management and conservation of natural resources as well as biotechnology and ethics.

Due to immense benefits of the subject to both individual and societal development, the Federal Government of Nigeria, in the National Policy on Education (FRN, 2014), made biology one of the core science subject at the Senior Secondary School (SSS) level. The objectives of biology curriculum are: learning development, adequate laboratory and field skills in biology; acquisition of meaningful and relevant knowledge in biology; ability to apply scientific knowledge to everyday life in matters of personal and community health, agriculture and reasonable functional scientific attitudes among others emphasis on content (FRN, 2014). So many instructional techniques were recommended for teaching science subjects such techniques include field based, guided inquiry and inquiry based method as reported by Nigerian Educational Research and Development Council (NERDC, 2014).

The Federal Republic of Nigeria, through NERDC (2016) recommended outdoor learning strategies such as field based for effective biology curriculum implementation, especially for the concept that have field work in the curriculum. The compulsory part covers a range of content that enables students to develop understanding of fundamental biological principles and concepts, and the scientific process skills. There are five topics in the compulsory part. These are; Cells and molecules of life, ecological concept genetics and evolution, organisms and environment as well as health and Diseases (FRN, 2014).

NERDC (2016), revealed that the aim and objective of the biology curriculum is preparation of students to acquire adequate laboratory and field skills in biology with a view to developing and maintaining students' interest in biology. In addition, the objective aims at developing a sense of wonder and curiosity about the living world, and a respect for all living things and the environment that construct and apply knowledge of biology. Similarly, the objective seeks to promote understanding the nature of science in biology-related contexts, as well as appreciating the relationships between biological science and other disciplines. Besides it is aimed at developing the ability to make scientific inquiries, think scientifically, critically and creatively; and solve biology-related problems individually and collaboratively. In addition, the curriculum is geared towards understanding the language of science and communicate ideas and views on biology-related issues and develop an attitude of responsible citizenship, and a commitment to promote personal and community health. In the same vein, Apawau (2020), stressed that a good number of steps have been taken by educators, non-governmental organizations and professional bodies to enhance the quality of teaching and learning biology in senior secondary schools in Nigeria and in Africa at large. These include inauguration of programmes for science development particularly biology, teaching biology in SSS, college of education and universities where qualified personnel are being trained to cater for the affairs of science teaching, particularly biology, provision of resource materials for effective teaching and learning of biology in schools among others.

Instead of experiencing good outcome in biology, the report from different scientific researches in Nigeria particularly in Borno State have not been encouraging as reported by

Information Resource Center Ministry of Education, Borno state (IRCMEB, 2021). The report shows decline in the overall performance of biology students in West African Examinations Council (WAEC) from 2015 to 2024. Reason for such low performance in Biology has been highlighted among which are the shortage of qualified teachers that possess high quality of instruction (Badau, 2018). This trend calls for serious attention of all stakeholders. Table 1.1 shows the students' performance from 2015 -2024 in Biology all over

Biu zone Borno. The percentage of students that passed at credit level and those that failed in biology were clearly indicated. The table shows that for 3 years, the percentage failure is higher than 50% and only in 2015, 2016, and 2017 percentage pass is higher than 50%. This high level of failure may be due to poor performance in ecology concepts because WAEC/NECO biology questions shows that students cannot escape answering questions on ecology (Ahmad 2014). This is indicated from the analysis of question paper from 2006 to 2021 WAEC as provided in appendix ii indicated that, WAEC always ask more questions on ecological concepts and coupled with the number of questions appears every year, it shows that, students cannot escape answering questions in ecology concepts.

In view of these, science educators have acknowledged the need for research efforts to be geared towards improving the quality of science teaching in Nigeria secondary schools more especially biology, such efforts include NERDC (2014) which recommended learning centered approaches, such as: discovery teaching strategy, use of cooperative learning, problem solving activities among others.

Statement of the Problem

It has been observed for the past few years (2015- 2024) that the dwindling achievement of learners in Senior Secondary Schools Certificate Examination in biology has not been encouraging, report from different scientific researches in Nigeria particularly in Borno State have not been encouraging as Reported by Information Resource Center Ministry of Education, Borno state (IRCMEB, 2021) shows decline in the overall performance of biology students in West African Examinations Council (WAEC) from 2015 to 2024. Reason for such low achievement might be due to poor performance in ecology concepts as WAEC/NECO biology questions shows that students cannot escape answering questions on ecology because it comes out every year (Ahmad 2014). This is indicated from the analysis of question paper from 2006 to 2024 WAEC and also attributes to the teacher's method of teaching. This trend calls for serious attention of all stakeholders on more effective strategies which can enhance the study of science where the students will be active participants. The need to redress this academic problem might be by using appropriate instructional strategies that could assist in enhancing students' achievement in ecological concepts. Therefore, this study aimed at investigating whether cooperative field based and inquiry field based instructional strategies might enhance student achievement in ecological concepts.

Aim and Objective of the Study

The objective of the study is to:

1. Determine the differences among the achievement of students exposed to ecological concepts using cooperative field based, inquiry field based conventional teaching strategy.

Research Questions

1. What are the differences among the achievement scores of students taught ecological concepts using cooperative field based, inquiry field based and conventional teaching strategy?

Research Hypothesis

1. There are no significant differences among the achievement scores of students exposed to ecological concepts using cooperative field based, inquiry field based and conventional teaching strategy.

Methodology

Pre-test, post-test and control group, quasi experimental design using 3×2 factorial matrix was employed in this study. The intact classes and the rigid school timetable did not allow the researcher to fully randomize the subjects. However, the research participants were successfully assigned to experimental and control groups based on their intact classes. It is non- equivalent control group design involving three intact groups of two experimental and one control groups. This design is in consonance with (Thermos 2020), who observes that quasi-experimental design permits deliberate control and manipulation of the learning conditions to some extent.

The study adopts three independent variables, Inquiry field based instructional strategy (IFB), Cooperative field based instructional strategy (CFB), Conventional lecture instructional strategy (CLIS) and one dependent variable Students' academic achievement.

The target population of this study were all SSII biology students in Southern Borno, Borno State of Nigeria. There are total of 14 secondary schools in the five local government area of Biu Education Zone and also there are 42978 SS11 biology students.

Purposive sampling was used due to the insurgency in the area of the study. Report by President Buhari (2021) in Nigerian Event Newspaper, stressed that Northern Boko Haram conflict entered its tenth year with renewed fighting between security force and Boko Haram. As such so many areas in Borno state are not safe to conduct study due to persistent insurgency that compelled students to stop schooling. Three senior secondary schools that are insurgency free area were purposively sampled for the study. The schools were randomly assigned into experimental and control groups.

The instrument used in the study is Students' Achievement Test In Biology (SATB) with reliability index of 0.84 using test retest. The instrument was also validated by expert in science education department and department of biological sciences federal university of Kashere. Students in the 3 groups (students exposed to inquiry field based instructional strategy, cooperative field based instructional strategy and those exposed to lecture method) were pre tested after which The three groups were taught for three weeks, after which posttests were administered to the three groups using SATB at the end of which comparisons were made to answer research question and test null hypothesis. The data obtained from the results of SATB were computed and presented by using descriptive statistics of mean and standard deviation to answer research question while One way Analysis of Variance (ANCOVA) was used to test null hypothesis.

Results

Research Question One

1. What are the differences among the achievement scores of students taught ecological concepts using cooperative field based, inquiry field based and lecture method?

The results is presented in Table1.

Table 4.1: Mean and Standard Deviation of Post Test Score of Students Taught Using Cooperative Field Based, Inquiry Field Based Instructional Strategy and Lecture Method.

Source	Type III Sum of Squares	Df	Mean Square	F	P value.	Remark
Corrected Model	778.587 ^a	3	259.529	56.154	0.001	
Intercept	538.060	1	538.060	116.419	0.001	
Pretest	4.490	1	4.490	0.971	0.328	
Group	498.255	2	249.128	53.903	0.001	Sig
Error	272.683	59	4.622			
Total	22410.000	63				
Corrected Total	1051.270	62				

P=0.05 level of significance

Table 4.2 indicates that $F(2, 59) = 53.90$, $P = 0.001$. This suggests that, at $P \leq 0.05$ significant differences exist between the three groups. As such the null hypothesis which says there are no significant differences among the achievement scores of students exposed to ecological concepts using cooperative field based, inquiry field based and conventional teaching strategy was rejected. This shows that cooperative field based instructional strategy and inquiry field based instructional strategy significantly improved students' achievement more than lecture method.

To determine where the significant differences exist among the three groups, a post hoc named Bonferroni Post-hoc test was used to determine where the significant difference exist between each two groups from the total of the three groups

Table 3: Bonferroni Posthoc Test Multiple Comparisons of Scores of Students Taught with Cooperative Field Based Instructional Strategy, Inquiry Field Based Instructional Strategy and Those Taught with Lecture Method.

Variables		Std. error	Mean Difference	P	Remark
Cooperative field based instructional strategy	Inquiry field based instructional strategy	0.63	0.96	0.90	NS
cooperative field based instructional strategy	Lecture method	0.86	8.06*	0.001	Sig
inquiry field based instructional strategy	Lecture method	0.81	7.96*	0.001	Sig

Table 4.3: reveals that at $P \leq 0.05$, no significant difference exists between the mean scores of academic achievements of students taught with cooperative instructional strategy and those taught with inquiry field based instructional strategy ($p = 0.90$). But significant difference exists between the mean scores of students with cooperative instructional strategy and those taught with lecture method ($p = 0.001$). Similarly, significant difference exists between students taught with inquiry instructional strategy and those taught with lecture method ($p = 0.001$). This implies that cooperative field based instructional strategy and inquiry field based instructional strategy do not significantly differ in improving the performance of students.

Discussion

The study reveals that significant difference between mean score of the experimental and control groups in ecology concept. This suggested that the cooperative field based instructional strategy and inquiry field based have significantly performed better than control group. This is in line with Ahmad (2014) who found that cooperative field based instructional strategy favoured the experimental group in ecological concept.

It is also in line with Opawau (2020), Eudy and Mecheal (2016) who reported that knowledge gains were significant with the experimental group (cooperative field based) more than their counter part that were strictly taught in the class using lecture method in ecology concept.

Based on the findings of the study, it was concluded that cooperative field based instruction significantly impacts students' achievement in biology, inquiry field based instruction significantly impacts students' achievement in biology

Recommendations

Based on the findings of this study; the following recommendations are made;

1. Government should make the use of cooperative field based instructional strategy and inquiry field based instructional strategy compulsory particularly in the teaching and learning of the ecology concept at SS level. This will enhance students gain firsthand information, and provide opportunity for them to see, possibly touch and feel what they have heard about certain organism and situations.

Seminars and workshops should be organized for biology teachers of secondary school teachers on cooperative field based instructional strategy and inquiry field based instructional strategies with a view to enriching them with the two strategies

References

- Ahmad. Y. (2024). *Effects of field- trip on retention and academic achievement in ecology among secondary school students in Zaria, Nigeria*. A thesis submitted to the school of postgraduate studies Ahmadu Bello University, Zaria, Kaduna State.
- Apawu (2020) Effect of Field Trip Instructional Strategy on Students' Interest and Achievement in Ecology in Nasarawa State. *International Journal of Innovative Education Research* 8(2):27-33,© SEAHIPUB
- Etobro A. B., &Fabinu, O. E. (2017). Students' Perceptions of Difficult Concepts in Biology in Senior Secondary Schools in Lagos State. *Global Journal of Educational Research*, 16, 139-147.
- Eromosele, O.Ekholuenetale, M. (2016). *Effect of Field-Based Instructions on Students' Understanding of Ecological Concepts in Public Secondary School OKA*.
- Nigerian Educational Research and Development Council (NERDC, 2007). Biology Curriculum for Senior Secondary School. Abuja: NERDC Press.
- Nigerian Educational Research and Development Council (NERDC, 2014). *Biology curriculum For Senior Secondary School*. Abuja: NERDC Press.
- West African Examination Council Chief Examiner's report (2018)
- West African Examination Council Chief Examiner's report (2019)
- West African Examination Council Examiner's report, (2014)
- West African Examinational Council (WAEC), (2018). Chief examiner's report. May/June, (2018).
- West African Examinational Council (WAEC). (2014). Chief examiner's report. May/June, (2014).
- West African Examinational Council (WAEC). (2015). Chief examiner's report. May/June, (2015).
- West African Examinational Council (WAEC). (2016). Chief examiner's report. May/June, (2016).
- West African Examinational Council (WAEC). (2017). Chief examiner's report. May/June, (2017).
- West African Examinations Council (WAEC) chef examiners report, (2021) Ministry of Education Borno, Borno State.
- West African Senior School Certificate Examination (2014 - 2018). Surulere, Lagos: Daniel
- Wirkala, C., & Kuhn, D. (2011). Problem-Based Learning in k-12 Education: Is it Effective and does it Achieve its Effects? *American Educational Research Journal* (Vol. 48).doi:10.3102/0002831211419491