EFFECTS OF 5E LEARNING-CYCLES INSTRUCTIONAL STRATEGY ON THE PERFORMANCE OF SENIOR SCHOOL STUDENTS IN ECOLOGY BASED ON SCORE LEVELS

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Abstract
This study examined the effect of using 5E learning-cycle strategy in teaching ecology to senior school students offering biology. The study employed quasi-experimental design of non-randomized, non-equivalent pre-test post-test group design. The sample for the study comprised 138 senior school two (SS2) students drawn from two randomly selected co-educational schools in Ilorin-south local government area of Kwara state. The instrument was a researcher designed test entitled Test on Ecology (TOE). Data collected were analyzed using mean and ANCOVA statistical tool. The study revealed a positive effect on the performance of each group of the students when exposed to 5E learning-cycle strategy. This implies that all the experimental group students' performances improved irrespective of their score levels when compared to those students in control group. It was therefore recommended among others that teachers should employ the strategy to teach biology particular ecology.

Keywords: 5E learning-cycle, instructional strategy, ecology, score levels, performance

Introduction

Biology is one of the three basic natural science subjects offered by students at the secondary school level in Nigeria; others being physics and chemistry. Biology is also regarded as the most popular of the three natural science disciplines amongst secondary school students in Nigeria (Jibril, Bello & Abimbola, 2015). Similarly, Adewale, Nzewuihe and Ogunshola (2016) opined that Biology is regarded as the simplest to understand among all the science subjects that usually attract the widest enrolment among Nigerian students. Biology subject has a wide content in the senior secondary school Biology curriculum, among is ecology which is one of the important contents in senior secondary school Biology curriculum(Jibril, , Babalola, & Abimbola, 2019).

Ecology is the scientific analysis and the study of interactions among organisms and their environment. It involves relationships between individual organism within a population and between individuals of different populations with their biotic environment (Stuart & Robert,2023). Borehrer (2011) stated that the study of ecology is important to the society because it guides an individual or persons on understanding the environment in order to live sustainably and to empower a generation to instigate change from policymakers. Ecology has been identified as one of the important but difficult aspects of Biology. It that contains topics such as environment, population, habitat, ecological succession, ecosystem and regulations of the internal environment (Parachnowitsch,2013 & Abdulrahim, 2019). According to the West African Examinations Council (WAEC) Chief Examiners' Reports (2020 and2021), students answered ecology- related questions poorly. Some of the reasons given for the poor performances from the reports were that; candidates answers reflected a shallow knowledge of the subject matter and incorrect interpretations of ecological topics.

Ajaja (2013) opined that methodology employed by teachers for the teaching of science as well as unhealthy development in the disposition of students towards science

contributed to low interest in science. There is the need for teachers to employ effective instructional strategies for effective teaching of Biology in particular and science in general. Instructional strategy is a method used in teaching and learning processes to activate students' curiosity about a topic, engage students in learning and probe critical thinking skills for the better understanding of contents of instruction (Teaching resources, 2015). Among the innovative instructional strategies is the 5E Learning-cycle which is the focus of this study.

Learning-cycle strategy is an activity-oriented method that promotes students' meaningful understanding of the scientific concept, explores and deepens that understanding in application to a new situation (Sadi & Cakiroglu, 2010). It is an active method concerned with both the entire content to be learnt and learners' cognitive structures. It deals with the selection and organization of content and experience to facilitate the materials to be learnt within learners' cognitive structures and creates new knowledge; structures to bring about cognitive development (Qarareh, 2012). The 5E Learning-cycle was developed by the Biological Science Curriculum Study in 1992. It was a modification of the existing three phases of Learning-cycle. The 5E Learning-cycle phases are: Engage, Explore, Explain, Extend and Evaluate. (Bybee, 1997; Ergin, Kanli, & Unsal, 2008 & Ajaja, 2013)

Effective teaching in classroom depends on how well the teacher manages the ability levels of the students. Students assimilate at different rates and this reflects in their performances as represented by scores. Adesoji (1992) opined that, all aspects of science could be said to be problem solving and students have varying abilities when they are confronted with problems to solve. Level of academic achievement is the capacity of students to engage in the meaningful educational task, which requires higher cognitive functioning and this depends on students' academic potentials. Based on this, the researcher intends to consider students' score levels as a variable to be studied in this work.

Artun & Costu (2012) reported that science education studies have established that students' different conceptions in science are very tenacious and that traditional instructional method is not very effective in promoting conceptual understanding. Innovative instructional method needs to be employed in teaching and learning in Science Education. Research results have supported the effectiveness of the Learning-cycle instructional strategy in encouraging students to think creatively and critically to construct knowledge and to facilitate a better understanding during the teaching and learning processes. Many of these studies were conducted outside the country (Salar & Turgut,2021 ; Asrizal, Yurnetti & Usman, 2022 & Bahardir and Dikmen, 2022). But few have been found on the use of Learning-cycle instruction in Nigeria (Jibril, Bello & Ayinde, 2021; Agbidye & Oyinlo, 2022) . However, none of these studies were on ecology. This was the gap filled by this research. To achieve this goal, this present study examined the effect of 5E Learning-cycle strategy on students' performance in ecology and their score levels was considered as variable.

Purpose of the Study

The main purpose of this study was to investigate the effects of :

1. 5E Learning-cycle and conventional instructional strategies on senior secondary school students' performance when taught ecology;
2. 5E Learning-cycle instructional strategy on senior secondary school students' performance in ecology based on score levels;

Research Questions

The following research questions were raised and answered in this study:

1. What are the differences in the performance of senior school students taught ecology using 5E Learning-cycle instructional strategy and conventional method?
2. Do senior school students with different score levels performed differently in ecology test when taught using 5E Learning-cycle instructional strategy?

Research Hypotheses

The following null hypotheses were tested in this study:

1. There is no statistically significant difference in the performance of senior school students' taught ecology using 5ELearning-cycle and those taught with conventional method.
2. There is no statistically significant difference in the performance of low, medium and high scoring senior school students when taught ecology using 5E Learning-cycle instructional strategy.

Methodology

The study was Quasi-experimental study of non-equivalent, non-randomized pretest; posttest control group design. The sample comprised of 138 students from intact classes from two public secondary schools in Ilorin city. A purposive sampling technique was used to select the schools for the study. The Senior School two (SS 2) Biology students were the target population. The target population were not preparing for WASSCE. Biology teachers' qualifications, school location, were criteria considered for the selection of schools. A researcher-designed Test on Ecology (TOE) was used for data collection. The Research instrument was given to three experienced Biology teachers and two Biology educators from the Department of Science Education, University of Ilorin, Nigeria for face and content validity. Also, the draft of the TOE was given to an expert in the field of measurement and evaluation for standard of the items. Reliability of the instrument was determined using test-retest method of three weeks' interval on the students of non-participating school. A reliability of 0.65 was obtained using Person product- moment correlation coefficient.

Procedure for Data Collection

The researcher sought the permission to conduct the study in the sampled schools by presenting an introduction letter to the Principals of the selected schools for consideration. With the permission, the researcher was introduced to Biology teachers of the schools for familiarity and arrangement was made for the study to take place. Then pretests were administered to the participating students in both experimental and control groups before the commencement of the teaching. This was used to determine the students' prerequisite knowledge on the ecology as well as the equivalence of the groups. The experimental group was taught using 5E and control group with Conventional method. Posttest was administered to all the groups at the end of the lessons.

Data Analysis and Results

Data collected from the study were analyzed with descriptive and inferential statistics. All the research questions were answered with mean and research hypotheses were tested with ANCOVA at 0.05 level of significance.

Research Question 1: What are the difference in the performance of senior school students taught ecology using 5E Learning-cycle instructional strategy and conventional method?

Table 1: The *Posttest Mean Scores of Experimental and the Control Groups.*

Groups	Mean	Std. Deviation	N
Convectional Group	18.1233	6.87375	73
Learning Cycle	35.4462	8.21209	65
Total	26.2826	11.47386	138

The result from Table 1 reveals the mean scores for the experimental group and the control group. The result reveals that experimental group has an approximate mean score of 35.45 and standard deviation of 8.21 and control group has an approximate mean of 18.12 with standard deviation of 6.87.

Hypothesis 1: There is no statistically significant difference in the performance of senior school students' taught ecology using 5E Learning-cycle and those taught with conventional method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	12404.695[a]	2	6202.348	148.690	.000
Intercept	8863.331	1	8863.331	212.483	.000
Pretest	2086.669	1	2086.669	50.024	.000
Groups	10054.387	1	10054.387	241.036	.000
Error	5631.283	135	41.713		
Total	113363.000	138			
Corrected Total	18035.978	137			

a. R Squared = .688 (Adjusted R Squared = .683)

From the result shown in Table 2, the calculated F-value is 241.036 at 2 degree of freedom computed at 0.05 level of significance. Since the calculated level of significance 0.000 is less than the level of significance 0.05, (P<0.05). Hypothesis one is hereby rejected, which means that there is a significant difference in the performance of students that were exposed to learning cycle and conventional instructional strategy. This in favour of students taught with learning-cycle strategy.

Research Question 2: Do senior school students with different score levels performed differently in ecology test when taught using 5E Learning-cycle instructional strategy?

Table 3*: The Posttest Mean Scores of Experimental Group one based on score levels*

Score level	Mean	Std. Deviation	N
low scoreing level	29.2105	6.60454	19
medium scoring level	34.2333	6.31191	30
high scoring level	45.1250	2.50000	16
Total	35.4462	8.21209	65

The result from Table 3 reveals the mean scores for the experimental group one based on score level. The result reveals that with low scorer level students an approximate mean score of 29.21 and standard deviation of 6.61, medium scorer is 34.23 at standard deviation 6.31 and high scorer with 45.12 at 2.50

Hypothesis 2: There is no statistically significant difference in the performance of low, medium and high scoring senior school students when taught ecology using 5E Learning-cycle instructional stra5tegy.

Table 4: *Result of ANCOVA on the Posttest for the Experimental Group one based on score levels*

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2425.526[a]	3	808.509	26.087	.000
Intercept	6515.279	1	6515.279	210.222	.000
Pretest	143.739	1	143.739	4.638	.035
Scoreleve	975.035	2	487.518	15.730	.000
Error	1890.536	61	30.992		
Total	85984.000	65			
Corrected Total	4316.062	64			

a. R Squared = .562 (Adjusted R Squared = .540)

From the result shown in Table 4, the calculated F-value is 157.730 at 2 degree of freedom computed at 0.05 level of significance. Since the calculated level of significant 0.000 is less than the table level of significant (0.05), ($P<0.05$). Hypothesis two is hereby rejected, which means that there is a significant difference in the achievement of male and female students taught with learning-cycle instructional strategy based on their score levels.

Discussion of Findings

This study revealed that 5E Learning-cycle as instructional strategy has a positive effect on students' performance in ecology. This as reflected in the performance of senior school students taught using the strategy as compared to students taught with conventional method. The experimental group results reflected a better performance in the TOE than the control group. This means that 5E Learning cycle strategy is an instructional strategy that can be employed by teacher to teach ecology. Hypothesis one was rejected because there was a significant difference in the performance of students exposed to learning-cycle and conventional strategy. This in favour of learning-cycle group. This finding supported the finding of Tenzin, Kinley & Wangchuk, (2021)that concluded that 5E Learning-cycle have significant effect on the academic achievement of science. This study also supported the finding from Ajaja and Eravwoke (2012) study on effect of Learning-cycle strategy on the achievement of students in Biology and Chemistry. The study also found out that learning-cycle improve the performances of different levels of scores positively. Table 4 confirmed that, there was a significant difference. This in line with the study of Joseph (2013) that concluded that 5E Learning-cycle instructional strategy had a positive effect on student's learning achievement. Also, supported the assertion of Lalla (2014) that Learning-cycle instructional strategy have effect on conceptual understanding of students of all ability levels in the lesson taught and that these students also expressed that, the strategy help them to have a better learning and understandings.

Conclusion

Learning-cycle strategy enhanced better performance of senior school students in the test compared with teachers' conventional method. Also, 5E learning-cycle strategy improve students' performance irrespective of their score levels. Therefore, based on the findings, the following recommendations were made; Science teachers should be encouraged to employ innovative instructional strategies like 5E learning-cycle to teach biology particularly ecology to improve students' performance at the Senior School Certificate Examinations; Biology teachers should be trained through workshop and seminars on how to incorporate this innovative strategy in teaching and learning of ecology.

Funding

(TETFund/DESS/COE/ILORIN/ARJ/1)
"TETFund Projects 2019-2021"

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