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Ethnobiology Instructional Approach: Effect on Secondary School Students Retention of Biology Concepts in Onitsha Education Zone

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ABSTRACT

The study determined the effect of ethnobiology instructional approach on secondary school students' retention of biology concepts in Onitsha Education Zone of Anambra state. Two research questions and three hypotheses guided the study. The study adopted the quasi-experimental design. The population of the study comprised 5,322 senior secondary two (SS2) students offering biology in Onitsha Education Zone. The sample for the study was 184 students obtained using a multi-stage sampling procedure. Biology Achievement Test (BAT) validated by three experts and which had Kuder-Richardson Formula 20 reliability of 0.91 was used as instrument for data collection. Data obtained from the study was analysed using mean, standard deviation and analysis of covariance. The result of the study showed that students taught using EIA had higher mean gain retention scores in biology than those taught using lecture instructional approach. The findings of the study revealed that there was a significant difference between mean retention scores of students taught biology using EIA and lecture instructional approach in favour of EIA. It was therefore recommended among others that secondary school biology teacher should adopt the use of EIA in teaching biology as a way of helping students connect what they are learning to already existing knowledge and realities around them.

KEYWORDS: *ethnobiology, retention, biology, academic, secondary*

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INTRODUCTION

One of the most serious issues in science education is students' perceptions that many of their secondary science classes are boring, uninteresting, lack connection with reality and irrelevant. This is consistent with Okoli and Osuafor (2020), who stated that science study is viewed as irrelevant by students and hence becomes uninteresting to them. This lack of interest in science learning often arises from the inability of students to connect science teaching to the realities of their everyday life. The inability to connect what is learnt in science education to everyday realities and to apply simple scientific knowledge in the day to day activities further reduces retention of learnt material and the level of enrolment of science students including the number of those registering for popular subjects like biology.

Biology according to Udegbe and Okoli (2022) deals with the study of living organisms and the interaction between them and their environment. Researchers and authors are in agreement that teachers need to use creative teaching strategies that put the students at the centre of education in order to increase student retention. Such instructional approach as Chinweuba-Eze (2021) noted, provides sufficient and varied learning experiences for students which facilitate easy retention or recall of learning materials. Retention in the view of Ejiofor and Osuafor (2018) refers to a student's ability to store learned materials in a meaningful fashion that allows for easy recall. It entails storing information in an organized manner so that it may be retrieved later (Nwanze *et al.*, 2018). Retention according to Mbaegbu (2017) is the student's capacity to remember what they have been taught after a certain amount of time has passed. One reliable ways of improving the retention of learning according to Makinde and Yusuf (2018) is to make learning material more relevant and connecting learning with realities common with the students' day to day living and their already existing knowledge. Ethno-science, primarily ethnobiology-based instruction, is one of the most popular methods of instruction used to help teachers connect what

students are learning to reality and what they already know. Ethnobiology is the scientific study of the way living things are treated or used by different human cultures (Acar, 2015). It studies the dynamic relationships between people, biota, and environments, from the distant past to the immediate present. Ethnobiology as Fagundes (2016) noted, encompasses a wide range of sub-disciplines such as ethnozoology, ethnoecology, ethnopharmacology, ethnomedicine, ethnomycology, and ethnoveterinary, with often-amorphous boundaries. Ethnobiology according to International Society of Ethnobiology (ISE, 2018), targets investigating socially based natural and environmental data, social acknowledgment and perception of the ordinary world, and related practices and practices.

Ethnoscience deals simply with the cultural system of classifying knowledge (Adekunle, 2017). In the view of Suciyati, Suryadarma and Paidi (2021), it is an important field of inquiry, topic, and research method because of the contributions it has to make not only to understanding traditional and folk knowledge systems but also to articulating these with modern science. Ethnoscience deals more specifically with indigenous knowledge about nature and science which generally differs from the traditional and dominant Western modern view of science and its technical applications (Ugwuanyi, 2015). It provides a different, alternative perspective on nature and the human in nature on its own right and therefore becomes authentic to persons having an indigenous background. Ethno-science based instruction generally adopts indigenous knowledge and instructional materials or resources in the teaching of conventional science concepts (Konyefa and Okigbo, 2021). The use of ethnosience based instruction in teaching Biology therefore, is referred to in this study as Ethnobiology instructional approach

Ethnobiology instructional approach therefore is a teaching approach in which the teacher delivers instruction and engages the students by employing traditional knowledge practices, and cultural beliefs about the relationships of living beings (including humans) with one another and with the environment. It is also understood as the use of locally sourced or traditional instructional resources whether material or human in immediate community of the students for the teaching of biological concept. In this study therefore, ethnobiological instructional approach implies teaching the students by using indigenous knowledge, cultural practices and traditional resources common in rural areas.

A common impression of rural students' comparative inferiority has existed for a long period. This viewpoint encompasses not only academic performance gaps between rural and urban students, but also, some other socially desired outcomes such as aspiration, intelligence, and aptitude. The concern over rural and urban students' academic performance does not appear to be limited to one country, but rather appears to be a global issue. Previous studies by Awodun and Oyeniyi (2018) and Owoeye and Yara, (2011) have shown that achievement of rural students in Biology with their urban counterparts showed mixed fashion in results. Recent educational research has established however, that there exist certain differences in the achievements, retention and interest of rural and urban students (Bizimana, Mutangana and Mwesigye, 2022; Inyang, 2022; Yohanna and Muhammad, 2022). The necessity arises therefore to further explore not just the academic achievement gaps but also the retention of biology among students from urban and rural location given that Ethnobiology deals with indigenous knowledge common in rural settings.

Purpose of the Study

The purpose of the study was to determine the effect of Ethnobiology instructional approach on academic retention of secondary school students in Biology in Onitsha Education Zone of Anambra state. Specifically, the study determined the:

1. difference between the mean retention scores of students taught Biology using Ethnobiology instructional approach (EIA) and those taught using lecture method (LM).
2. difference between the mean retention scores of urban and rural students taught Biology using EIA and LM.
3. interaction effect of instructional approaches (EIA and LM) and location on students' retention in Biology.

Research Questions

The following research questions guided the study:

1. What is the difference between the mean retention scores of students taught Biology using Ethnobiology instructional approach (EIA) and those taught using lecture method?
2. What is the difference between the mean retention scores urban and rural students taught Biology using EIA and LM?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean retention scores of students taught Biology using Ethnobiology instructional approach (EIA) and those taught using lecture method.

2. There is no significant difference between the mean retention scores of urban and rural students taught Biology using EIA and LM.
3. There is no interaction effect of instructional approaches and location on students' retention in Biology.

Method

The quasi-experimental research design, specifically, the pretest-posttest non-randomized control group design of 2x2x2 factorial background was used in this study. Quasi-experimental according to Nworgu (2015) is one in which intact classes are used since there is no random assignment of the research subject into experimental and control groups rather independent variables are manipulated so as to observe the effects on the dependent variables. The design therefore be adopted since the administrative setup at the secondary school level of education may not allow for random assignment of participants (students) into groups, as it may interrupt school activities. Again, students involved in the study might miss out in important school activities should they be randomly selected into groups that are not within their immediate school set-up. The design for the study is presented Figure 2.

E 0_1 X_1 0_2 0_3

C 0_1 ~X 0_2 0_3

Figure 2: Design of the Study Experiment

Where,
E = Experimental group
C = Control group
0_1 = Pre-test
0_2 = Post-test
0_3 = Retention test (Delayed Post-test)
X_1 = Treatment with Ethnobiology instructional approach
~ X = No experimental treatment (treatment with lecture Method)
…… = Non-randomized groups

The study was carried out Onitsha Education Zone of Anambra State. The Zone is made of three Local Government Areas namely; Onitsha North, Onitsha South and Ogbaru. There are 32 state owned secondary schools in Onitsha Education Zone with 16 schools in Onitsha North, six schools in Onitsha South and 10 schools in Ogbaru. Onitsha South and Onitsha North are connected with serious commercial activities whereas the Ogbaru area is inhabited by traders, farmers, artisans and civil servants. The population of the study comprised 5,322 SS2 students offering Biology in Onitsha Education Zone of Anambra state. The school in the urban areas are mainly those in Onitsha North and South whereas some of the schools in Ogbaru local government area going from Atani down are mainly rural.

The sample size for the study was 184 SS2 students offering Biology in Onitsha Education Zone of Anambra state. The sample was drawn using a multi-stage sampling procedure. The first stage involved stratifying the schools according to their location namely urban and rural. From the list, two schools were selected purposively from rural area and another two schools from the urban area. The choice of purposive sample is to ensure that location variable is taken care of since two schools situated in the urban area of Onitsha South and Onitsha North were selected and two schools situated in rural areas in Ogbaru that are situated miles apart. Again, while Onitsha North and South are in the Urban, Ogbaru has both sub-urban and mostly rural areas. Random sampling technique (balloting without replacement) was used to assign the schools in urban location to experimental and control groups and also the two schools in rural location. The urban experimental group school one has 44 students while rural experimental school group two has 47 students. The urban control group school one has 53 students while the rural control group school two has 40 students.

The instruments for data collection are Biology Achievement Test (BAT). BAT is made of 50 multiple choice objective test items with four response options lettered A-D on the concepts of classification of plants, digestive system, modification of feeding habits in organisms and transport system 1. The questions were taken from West African Examination Council (WAEC) past question papers on the selected concepts. The content coverage on each concept was drawn using a Table of Specification. BAT was used for pretest and posttest and as retention test after three weeks of administration as posttest. The treatment packages were prepared as lesson plans. The lesson plan for the experimental group involved the use of Ethnobiology instructional approach and lecture method for the control group.

BAT, BIS and lesson plans, the objectives of the study, score of the study, research questions and hypotheses were given to three experts for validation. Two of the experts are lecturers in the Departments of Science Education while the other one is from the Department of Educational Foundations, Nnamdi Azikiwe University, Awka. The validators were required to vet the items in terms of clarity, plausibility of distractors and suitability for the level of students under study. They were also requested to write 'R', 'M' or 'D' against any item(s) they wish the researcher to Retain, Modify or Delete

respectively. Their corrections, suggestions and recommendations will be on the instrument that will be used for the study. The reliability of BAT was established using Kuder-Richardson Formula 20 (KR-20) while that of BIS was established using Cronbach Alpha method. KR-20 was used for BAT because it is suitable for determining the internal consistency of dichotomously scored and multiple choice objective items while Cronbach Alpha was used for BIS because it is suitable for establishing the internal consistency of polytomously scored items. However, because BAT was used as a retention test, the temporal stability of BAT was established using test-retest method. Therefore, while BAT was administered twice at two week time interval and the scores correlated to obtain the coefficient of temporal stability. The coefficient of internal consistency obtained for BAT is 0.91 and the coefficient of the temporal stability of BAT is 0.98.

The treatment involved the use of locally sourced instructional materials that are common to the traditions of the immediate communities of the students. For the topic on classification of plants, some of the plants mentioned were provided especially those found in the community of the students or that have any traditional significance and scientific connotations. In teaching digestive systems and feeding habit, the digestive systems of animals and their set of teeth, mandibles or mouth parts, found in the community and traditional settings was used as instructional materials. The materials were provided by the students and where there is any need of financial support, the researcher provided the money for the purchase of the material.

Generally, the classes began with the introduction of the topic with in-depth review of the objectives of the instruction. In each step of the lesson, the teacher briefly explained the learning material contents using the traditional materials for illustration, demonstration or explanations. The teacher then called on the students to give a presentation of any indigenous knowledge or practices that are related to the concept explained by the teacher. The presentation constituted mainly the knowledge held by students of the uses of the plants, their spiritual significant, medicinal and nutritional values and other such traditional knowledge such as traditional stories and proverbs. After the presentation, the teacher deduced the scientific relevance and connotation of their presentation, thereby relating the indigenous knowledge held by students or their traditional practices to the science being taught. Where no particular scientific relevance can be deduced from the presentation or indigenous knowledge, the teacher can dismiss them as misconceptions while presenting the proper knowledge.

The teacher then summarized the important points in the lesson drawing their attention to contents of the lesson. At the end of the lesson, the teacher used some questions to evaluate the students' learning and understanding of the learning materials. For the first lesson, the teacher after the pretest gave students the content of learning so as to study and inquire from their parents and elders any cultural practices or indigenous knowledge held by the community that are related to the concepts. They also acquired within the time given before the lesson the necessary local instructional materials that are of scientific relevance and related to the concepts or as demanded by the teacher and their local names and uses. The same process was taken for each lesson/topic until the end of the lesson. Students were grouped for the assignments and tasked to each ensure that the group assignment is done as any student can be called to make the presentation on behalf of the group.

The lecture group was taught the same content using lecture method. It involved simple presentation using illustrations, explanations and questioning. Students were given the chance to ask questions and demand explanations to clarify their misunderstanding. Standard textbook drawing and pictures were used as instructional aids. Students were given assignments on topic.

The extraneous variables that may likely confound the outcome of the study were controlled as follows:

1. **Howthorne Effect:** This is a situation where students owing to their awareness of being used in a study, adopts unreal behaviour and disposition to classroom activities. To eliminate hawthorne, the researcher used the regular Biology teachers in the schools as research assistants.
2. **Initial group difference:** Initial group difference arise out of the non-random assignment of the research subjects into experimental and control groups. Analysis of Covariance was used in the present study to eliminate any initial group differences among the groups or within the groups.
3. **Novelty effect:** Novelty effect is the improvement in achievement that may occur as a result of the new experience in the new teaching method which may decrease over time and not out of any actual improvement in learning. The research included activities within the lesson plan that gave students a sustained but varied experiences that could interest and motivate them to continue learning and improve retention.

4. **Test knowledge:** The same instrument BAT and BIS were used as pretest and posttest while BAT will further be used as retention test and the usage could lead the students to hold a fair knowledge of the test items. To reduce test knowledge, the items were reshuffled and printed on differently coloured paper whenever the test is administered.
5. **Experimenter bias:** The lesson plan, content and instructional activities and experiences might so be planned by the researcher to enhance the achievement of one group and establish its superiority over the other leading to experimenter bias. To prevent this, the researcher ensured that the contents of the lesson plans are similar for both groups and monitored the teachers to ensure they do not include any extra activities.
6. **Teacher variable:** Teacher variables results from teachers' difference in experiences, qualification and knowledge of subject matter and instructional pedagogies. The research organised training for the regular teachers of Biology in the schools to be used as experimental and control groups. The training was used to establish a common instructional standard for all the research assistants while providing the opportunity to assess the teachers' weakness in their use of the lesson plan and corrections given accordingly.
7. **Variability of Instruction:** Teachers despite the training may adopt peculiar style and instructional strategies that could result in instructional variability. The researcher therefore monitored the instructional process to ensure that the research assistants adhere strictly to the activities outline in the lesson plans.

BAT and BIS was administered before the commencement of the treatment as pretest. The scores of the students in the prestest was not given to them and no revisions on the test or corrections was given. After the treatment, the posttest was administered on the following week, after a revision exercise has been done. After three weeks, the BAT was administered to the students as retention test (Delayed posttest) to determine their decay in knowledge of what was learnt. Students were awarded 2 marks for any correct answer in the BAT giving a total of 100marks. Positive statements in BIS are score as follows:

Strongly Agree – 4, Agree – 3, Disagree – 2, and Strongly Disagree – 1. The generated scores were collated for analysis. The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). ANCOVA was used to eliminate any initial differences among the students arising from non-randomization of the subjects into experimental and control groups. The decision rule was to reject null hypothesis where Probability value (p-value) is less than or equals the level of significance ($P \leq 0.05$) and not to reject null hypothesis where P-value is greater than 0.05 ($P > 0.05$).

Results

Research Question 1: What is the difference between the mean retention scores of students taught Biology using ethnobiology instructional approach (EIA) and those taught using lecture method (LM)?

Table 1: Mean Retention Scores of Students taught Biology using Ethnobiology Instructional Approach (EIA) and Lecture Method (LM)

Group	N	Posttest Mean	Posttest SD	Retention Mean	Retention SD	Loss in Mean
EIA	91	75.15	9.33	66.00	9.98	9.15
LM	93	62.43	7.20	57.85	5.26	4.58
Mean Difference		12.72		8.15		6.52

Table reveals that the students taught Biology using EIA has mean posttest score of 75.15 with loss in mean score of 9.15 to give a mean retention score of 66.00, while those in the control group taught with lecture method has posttest mean score of 62.42 with loss in mean score of 4.58 to give a mean retention score of 57.85. Students taught Biology using EIA had less homogeneous scores in their retention (9.98) than those taught using LM (5.20). The difference between the retention scores of the students is 8.15 in favour of EIA.

Research Question 2: What is the difference between the mean retention scores urban and rural students taught Biology using EIA and LM?

Table 2: Mean Retention Scores of Urban and Rural Students taught Biology using EIA and LM

Method	Location	N	Posttest Mean	Posttest SD	Retention Mean	Retention SD	Loss in Mean
EIA	Urban	44	74.48	11.80	68.02	6.50	6.46
	Rural	47	75.79	6.27	64.11	12.16	11.68
LM	Urban	53	62.87	6.05	57.62	4.83	5.25
	Rural	40	61.85	8.54	58.15	5.84	3.70

Table 2 reveals that urban students taught Biology using EIA has mean posttest score of 74.48 with loss in mean score of 6.46 to give a mean retention score of 68.02 while rural students taught Biology using EIA has mean posttest score of 75.79 with loss in mean score of 11.68 to give a mean retention score of 64.11. Table 6 also reveals that urban students taught Biology using LM has mean posttest score of 62.87 with loss in mean score of 5.25 to give a mean retention score of 57.62 while rural students taught Biology using LM has mean posttest score of 61.85 with loss in mean score of 3.70 to give a mean retention score of 58.15.

Hypothesis 1: There is no significant difference between the mean retention scores of students taught Biology using ethnobiology instructional approach (EIA) and those taught using lecture method.

Table 3: ANCOVA Test of Significance of Difference between the Mean Retention Scores of Students taught Biology using EIA and LM

Source	SS	df	MS	F	Sig.	Decision
Corrected Model	5330.394[a]	4	1332.598	25.824	.000	
Intercept	3217.635	1	3217.635	62.353	.000	
Pretest	1920.022	1	1920.022	37.207	.000	
Method	289.121	1	289.121	5.603	.019	Sig.
Location	139.657	1	139.657	2.706	.102	Not Sig.
Method * Location	324.693	1	324.693	6.292	.013	Not Sig.
Error	9236.976	179	51.603			
Total	719138.000	184				
Corrected Total	14567.370	183				

Table 3 shows that there is a significant main effect of the treatment on students' retention of Biology, $F(1, 179) = 5.603$, $P = 0.019 < 0.05$. Therefore, the null hypothesis is rejected meaning that there is a significant difference between the mean retention scores of students taught Biology using EIA and those taught using lecture method in favour of EIA.

Hypothesis 2: There is no significant difference between the mean retention scores of urban and rural students taught Biology using EIA and LM.

Data relating to Hypothesis 2 is contained in Table 3.

Table 3 also shows that there is no significant main influence of location on students' retention in Biology, $F(1, 179) = 2.706$, $P = 0.102 > 0.05$. Therefore, the null hypothesis is not rejected meaning that there is no significant difference between the mean retention scores of urban and rural students taught Biology using EIA and LM.

Hypothesis 3: There is no significant interaction effect of instructional approaches (EIA and LM) and location on students' retention in Biology.

Data relating to Hypothesis 3 is contained in Table 3.

Table 3 further shows that there is a significant interaction of instructional approaches and location on students' retention in Biology $F(1, 179) = 324.693$, $P = 0.013 < 0.05$. Therefore, the null hypothesis is rejected meaning that there is a significant interaction effect of instructional approaches (EIA and LM) and location on students' retention in Biology.

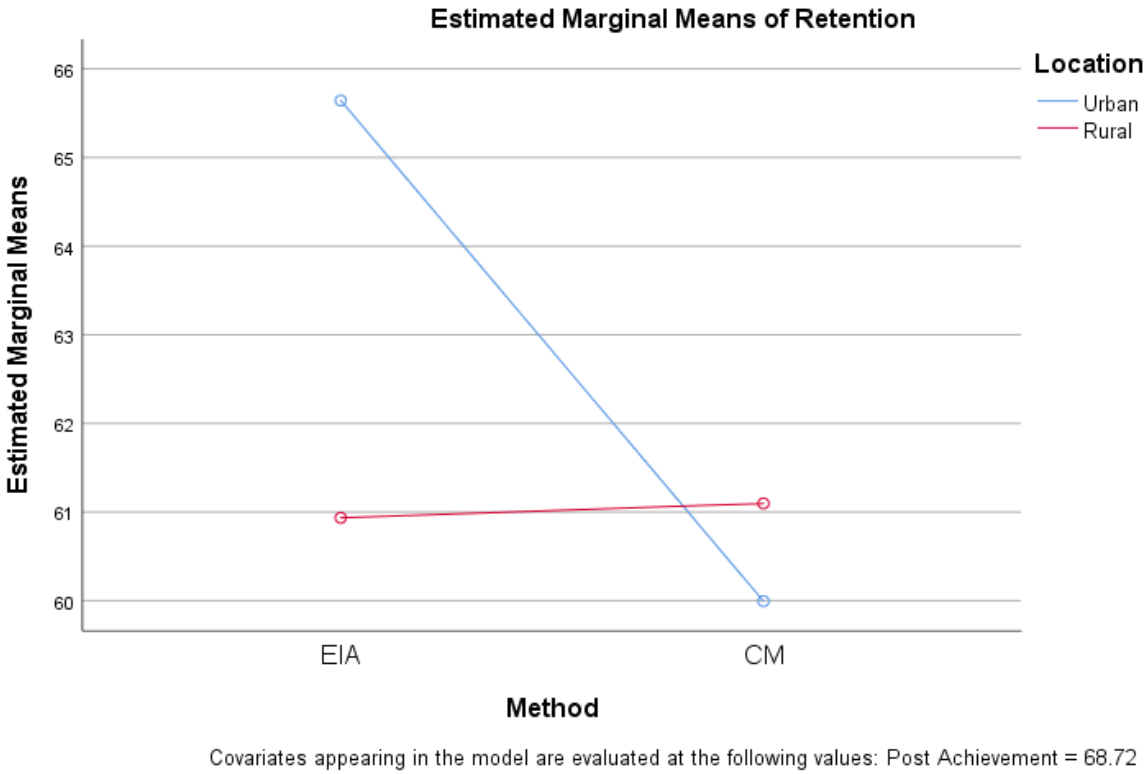

Figure 7: Plot of interaction effect of approaches (EIA and LM) and location on students' retention in Biology

The plot of interaction effect of instructional approaches and location on students' retention in Biology is significant and disordinal. This shows that the instructional approaches have different effects on retention of students on different conditions, for example, the effect of the approach on students' retention changed when location was consideration. Thus, the instructional approaches are location sensitive. Urban students taught Biology using EIA had higher mean retention score than rural students whereas rural students taught biology using LM had higher mean retention score than urban students.

Discussion

The findings of the study revealed that ethnobiology instruction significantly improved retention in biology more than lecture method. The result of the study can be attributed to the fact that ethnobiology instruction accentuated the need for integration of indigenous knowledge into school science in order to prevent a cultural clash whenever students attempt to learn meaningful school science. It therefore resulted in sustained learning and easy recall. Again, ethnobiology instruction could be said to clearly facilitates the easiness with which students cross cultural borders into school (western) science thus encouraging meaningful learning of science. Students in Onitsha education zone differ in cultures and languages from the predominant eurocentric culture and language of science and live in a non-western country like Nigeria, but are not at home with the culture of eurocentric science which permeates their school science classes. By adopting an instructional method like ethnoscience instruction, students were more able to understand the language of science and such learning reached the long term memory and facilitated retention.

Again, by integrating what is known to them in the instructional process, a rich learning experience was created for the students and such experiences were easily retained and remembered as the cognitive structure is integrated to what they already know. The findings of the study is in support of the findings of Achor, Imoko and Uloko (2009) that students exposed to of ethnomathematics teaching approach (ETA) were superior in achievement and retention than those taught with lecture approach. The finding of Peni (2011) that retention in fundamental science were greatly improved by enthoscience-enriched education than lecture method, supports the finding of the present study. The findings of the study is not in contradiction to the findings of Kurume, Onah and Mohammed (2012) that ethnomathematics teaching technique was more effective than the traditional approach in facilitating and boosting students' recall in statistics.

Conclusion

The findings of this study showed that students taught Biology using EIA had significantly higher retention scores than those taught using LM. It is concluded

that EIA is an effective instructional approach for enhancing students' retention of biology concepts.

Recommendations

The following recommendations are made based on the findings of the study:

1. Teachers should use EIA and its activities to make learning more interesting for learners.
2. Textbook writers should cite examples and design experiments that will involve the use of locally sourced instructional materials that are easily obtainable in the immediate environment of the learner.
3. Effort should be made by educational stakeholders to provide secondary school biology laboratory with ethnobiology tools need for proper and effective implementation.

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