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EFFECTS OF STUDY TECHNOLOGY LEARNING STRATEGIES ON SENIOR SCHOOL STUDENTS' ACHIEVEMENT IN ECOLOGY IN ILORIN, NIGERIA

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Abstract

Study Technology is an activity-based strategy that could be used as panacea for any learning difficulties in any subject because it can enhance efficient learning with full mastery. Studies have established that senior school students experience difficulties in learning some basic concepts in Biology. Such concepts are Genetics, Embryology, Evolution and Ecology among many others. This study, therefore, investigated the effects of Study Technology Learning Strategies on Senior School Students' Achievement in Ecology in Ilorin, Nigeria. The study adopted a quasi-experimental design involving pre-test, post-test control groups, with a 3x3 matrix. The sample was made up of purposively selected 399 Senior School 1 Students, comprising 171 males and 228 females from three schools. Content validated Teacher Training Package; Systematic Lesson Plans and Ecology Achievement Test were used as instruments. A reliability coefficient of 0.71 was obtained for EAT with Pearson Product-moment Correlation involving SPSS Statistical package of version 22. Three hypotheses were tested with ANCOVA at 0.05 level of significance. The findings of the study were that: learning with Demo kit combined with learning on a gradient had a significant effect on the students' achievement ($F(1,175) = 50.30, p < 0.05$); (ii) learning with Demo kit combined with word clearing had a significant effect on the students' achievement ($F(1,140) = 92.98, p < 0.05$); there was a significant effect of the combined variables on students' achievement in Ecology based on score level ($F(1,157) = 8.308, p < 0.05$). The study concluded that when students learnt with Demo kit combined with learning on a gradient and word clearing, they achieved better. It was therefore recommended that Biology students should be assisted to learn Ecology by using many Study Technology learning strategies to improve their achievement.

Keywords: Study technology, Barriers to study, Strategies, Learning, Ecology and Biology

Introduction

Biology occupies a Centre point in Nigerian Secondary School Curriculum. This is as a result of its enormous importance to the development of the nation. Without biology, many professional studies like medicine, pharmacy and others would not have learnt successfully. Biology has two main branches namely, Botany and zoology. Other branches of Biology are Ecology, Evolution, Genetics among many others. Just as Biology is important as a subject, so are the other branches. For instance, one of the important of studying Ecology is to know the distribution as well as the relationship of living organism with one another and with their environment. The knowledge derived from it has being useful in preventing pollution, environmental degradation, conservation among others. Despite enormous importance of Biology and it's other fields, poor performance of it at the secondary school level in Nigeria is still persistent. Many factors have been identified to cause the persistent poor performance, among which are the teaching approach, the learning and study habits, student attitude,

parental background, the school Environment, among many others. Hence, in this study, one of the identified causes of poor performance of students at all levels and generally in all subjects is "Barrier to study". The identified three major barriers to study are: Lack of Mass, Skipped a gradient and The Misunderstood Word.

The 3 Barriers to Study are demonstrated in the Figure 1

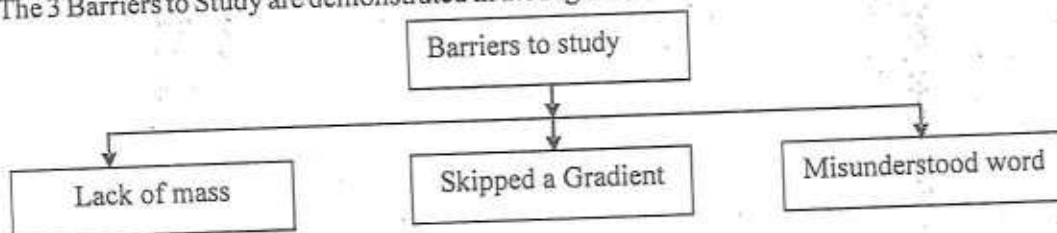


Figure 1: Barriers to Study

Attempts had been made in previous studies conducted by several science educators to find a lasting solution to students' poor performance in Biology. Such Studies include the Research conducted by Alabi (2016), Cimer (2012) among many others. In those studies how to overcome difficulties faced by students in learning were much dealt with. It was recommended that teachers should adopt innovative teaching and students to learn with different learning approach. Despite that, poor performance is still persistent in Biology when compared to other science subjects. The implication of this persistent poor performance of students in Biology is that a great number of such students' percentage fails to get grades that would make them to be admitted into higher institutions for higher studies. The poor performance of students in Biology could still depend to a great extent on the mastery of Biology content which is achievable if barriers to study are eliminated. Hence, this paper focuses on how Study Technology strategies could be used to solve students' learning difficulties in order to improve their performance.

Few researchers had worked on Study Technology in Nigeria when compared with other teaching and learning innovations. Among such few researchers are Ahmed (2018) paper on how to promote Study Technology. Adeoye and Abimbola (2016) on the use of Demokit to enhance students' achievement in Biology. Despite that, with the age of Study Technology (since 1972), there is need for more researches in this area since those previous researches have revealed that strategies involved in Study Technology could enhance better achievement for the students.

Statement of the Problem

The persistent poor performance of students in the Senior Secondary Certificate Examinations (SSCE) calls for concern among educators and other stakeholders. For instance, with the enormous importance of Biology, students' performance in it is still poor when it is compared to other science subjects. Adewale, Nzewuihe and Ogunshola (2016). Also, in the last ten years (2007-2016), there was generally poor performance of students in Biology except from the year 2013 to 2016. Many factors might have contributed to this, that is, from the Biology teachers, Biology students, the economy situation in Nigeria, parental factors, among many others. But the major problems could be caused from the student related factors, among which could be "Barriers to Study". Also, studies conducted by Abidoye

(2017) and Ayanda, Abimbola and Ahmed (2012) revealed that a lot of candidates usually avoid questions on Ecology in their external examinations while those that attempted it also performed poorly. This might equally be as a result of how some Biology topics are perceived difficult to learn. Hence, this study identified how students could learn Ecology with the use of "Demo kit", "on a gradient" and "word clearing" learning strategies that could eliminate barriers to study in order to improve students' Achievement.

Research Questions

The following Research Questions were formulated to guide the study

1. Is there any significant difference in the effect of learning with Demo kit combined with learning on a gradient on students' achievement in Ecology?
2. Is there any significant difference in the effect of learning with Demo kit combined with word clearing on students' achievement in Ecology?
3. Is there any significant difference in the effect of learning with Demo kit combined with learning on a gradient and word clearing on students' achievement in Ecology based on score level?

Research Hypotheses

The following Research Hypotheses were generated from the Research Questions for the study and were tested:

- H_{01} : There is no significant difference in the effect of learning with Demo kit combined with learning on a gradient on students' achievement in Ecology.
- H_{02} : There is no significant difference in the effect of learning with Demo kit combined with word clearing on students' achievement in Ecology.
- H_{03} : There is no significant difference in the effect of learning with Demo kit combined with learning on gradient and word clearing on students' achievement in Ecology based on score level

Methodology

This study adapted the quasi-experimental research of the pre-test, post-test control group design. Specifically, it is a 3x3 experimental design. This research design was adapted from Johnson and Christensen (2014). In this design, 3 groups are represented in 3 levels. Two (2) of the groups were exposed to the treatments while one (1) group served as a control group. The Experimental Group 1 learnt with "Demo kit" and "on a Gradient". The Experimental Group 2 learnt with "Demo kit" and "word clearing". The control group learnt conventionally, after being taught by their biology teacher. The moderating variable is score level that was at three (3) levels of low, medium and high. So the layout for this design is expressed in Table 1

Table 1 Layout of the Design

Groups	Pre-test	Treatment	Post-test
Experimental group 1	Ya ₁	X ₁	Ya ₂
Experimental group 2	Ya ₁	X ₂	Ya ₂
Control group	Ya ₁		Ya ₂

Y_{a1} is the Pre-test for the two experimental groups

X₁ is the treatment (learning with Demo kit and learning on a gradient) for Group One

Y_{a2} is the Post-test for the two experimental groups

X₂ is the treatment (learning with Demo kit and word clearing) for Group Two

The population for this study consists of all Senior Secondary School One (SS1) Students in all Senior Public Secondary Schools in Ilorin, Kwara State, Nigeria. The choice of SS1 students was considered appropriate because it was assumed that the learning of Basic Ecological Concepts in SS1 could be a determining factor for proper understanding of other topics of Ecology at SSII and SSIII. Biology students from three purposely selected schools constituted the sample. To ensure that these sampled schools are equivalent, the criteria used were: the schools have the same admission (entry) requirements by the Kwara State Government. This was achieved through information from the State Ministry of Education; schools have basic facilities that can enhance effective learning using Study Technology Strategies and schools have qualified Biology teachers who voluntarily accepted to be involved in the study. Although, Purposive Sampling Techniques were used to select the three schools, all the Biology students in the selected schools were involved in study, in their intact classes.

Three research instruments were used for this study. They are: Study Technology Training Manual (STTM) for the Biology Teachers, Ecology Achievement Test (EAT) and Systematic Lesson Plans. The Study Technology Training Manual (STTM), designed by researcher, was used for training the Biology Teachers on how to make students learn with Study Technology Principles. The manual consists of 2 Sections, (A&B). While Section A items was on the Knowledge of Study Technology, Section B consisted of Check Sheet that served as Study Guide on how to learn. The EAT consisted of 70 Multiple Choice Test adapted from past questions of the West African Senior School Certificate Examinations (WASSCE) and National Examinations Council (NECO) that were partially modified. It consists of multiple choice tests with four options where the students chose the correct options. Moreover, the Systematic Lesson Plans, equally designed by researcher, were used by the researcher and the Research Assistants that were trained on how to teach and learn with Study Technology. The Systematic Lesson Plans were lesson plans with some Study Technology Techniques used by the trained Biology teachers, during the experimental procedures. All the instruments were validated by experts, while the reliability of the instrument was tested on sixty (60) students from non-participating schools. The data collected was analyzed using Pearson Product Moment Correlation. A reliability coefficient of 0.71 was obtained at 0.05 level of significance.

The descriptive statistics involving percentages were used to describe the Demographics data of the respondents which were collected from pre-test and post-test for the control and experimental groups. The mean and standard deviation were used to answer the Research Question One, while other Research Questions were transform into hypotheses and tested using inferential Statistics of Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

As revealed in Table 2, out of 80 (100%) of the students that formed the Experimental Group I, 18 (22.50%) of them were at the low score level; 46 (57.50%) were of medium score level, while 16 (20.00%) were in the high score level. In addition, 45 (100%) students constituted the Experimental Group II, out of which 3 (6.60%) of them were in the low score levels; 30 (66.70%) were of the medium score level while 12 (26.70%) were of high score level. More so, out of 98 (100%) of the students that formed the Control Group, 26 (26.50%) of the students were of the low score level; 68 (69.40%) were of the medium score level, while 4 (4.10%) were in the high score level.

Table 2: Distribution of the Students Sampled based on Score Level

Groups	Score levels	Frequency	Percentage
Experimental Group I	Low	18	22.50%
	Medium	46	57.50%
	High	16	20.00%
	Total	80	100.00%
Experimental Group II	Low	3	6.60%
	Medium	30	66.70%
	High	12	26.70%
	Total	45	100.00%
Control Group	Low	26	26.50%
	Medium	68	69.40%
	High	4	4.10%
	Total	98	100.00%

Results in Table 3 showed the mean gain scores of the students in Ecology after the treatments. Students that learnt with Demo kit and on a Gradient had the mean gain score of 24.58. Students that learnt with Demo kit and Word Clearing had the mean gain score of 25.13, while students that learnt with conventional method had the mean gain score of 18.64.

Table 3 Mean Gain Scores of the Students in Ecology after the Treatment

Groups	Pretest	Post-test	Mean Gain Score
Experimental I (Demo kit and On a Gradient)	33.90	58.48	24.58
Experimental II (Demo kit and Word Clearing)	35.67	60.80	25.13
Control (Conventional Method)	34.09	52.73	18.64

Hypotheses Testing

Hypothesis One: There is no significant difference in the effect of learning with Demokit combined with learning on a Gradient on students' achievement in Ecology.

Results in Table 4 revealed that the F-value 50.299 was obtained with a *p*-Value of 0.000 significant at 0.05 alpha level of significance. Since the *p*-Value (0.00) is less than alpha level (0.05), the Null Hypothesis One was rejected and thus, there was a statistically significant difference in the effect of learning with Demo kit combined with learning on a gradient strategy on the achievement of students in Ecology ($F_{(1,175)} = 50.299, P < 0.05$).

Table 4: Analysis of Covariance Showing the Effect of Learning with Demo kit and on a gradient Strategies Combined on the Achievement of Students in Ecology

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1231.757 ^a	2	615.878	27.670	.000
Intercept	9446.676	1	9446.676	424.412	.000
Pretest	96.097	1	96.097	4.317	.039
Demo kit and on a Gradient	1119.569	1	1119.569	50.299	.000
Error	3895.193	175	22.258		
Total	543907.000	178			
Corrected Total	5126.949	177			

a. R Squared = .240 (Adjusted R Squared = .232)

^aSignificant at $p < 0.05$

Again, results in Table 5 showed that students that learnt Ecology with Demokit and on a Gradient (Experimental Group I) had a higher mean score of 58.48 than those who learnt Ecology without the strategies combined (Control Group) with the mean score of 52.73. Thus, the effect of learning with Demokit and on a Gradient on students' achievement in Ecology was shown by the mean difference 5.75.

Table 5 Pairwise Comparison Analysis Showing the Effect of the Treatment on Students' Achievement in Ecology

Treatment	Mean	Mean Diff. (I-J)	Std. Error	Sig. ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Demo kit and On a gradient(I)	58.48 ^a	5.75 [*]	.59	.00	3.64	6.45
Control (J)	52.73 ^a	-5.75 [*]	.59	.00	-6.45	-3.64
Grand Mean = 55.61						

The mean difference is significant at 0.05 level

b. Adjustment for Multiple Comparison: Bonferroni

Hypothesis Two: There is no significant effect of learning with Demokit, combined with learning with word clearing strategy on the achievement of students in Ecology.

Results in Table 6 revealed that the F-value 92.981 is obtained with a p-value of 0.000 computed at 0.05 alpha level. Since p-value (0.00) was less than alpha level (0.05), the null Hypothesis Two was rejected and thus, there is a statistically significant effect of learning with Demokit and Word Clearing strategies on the achievement of students in Ecology ($F_{(1, 140)} = 92.981, p < 0.05$).

Table 6: Analysis of Covariance Showing the Effect of Learning with Demo kit and Word Clearing Strategies Combined on the Achievement of Students in Ecology

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2099.708 ^a	2	1049.854	46.532	.000
Intercept	7396.362	1	7396.362	327.826	.000
Pretest	93.646	1	93.646	4.151	.044
Demo kit and Word Clearing	2097.829	1	2097.829	92.981	.000
Error	3158.656	140	22.562		
Total	442134.000	143			
Corrected Total	5258.364	142			

a. R Squared = .399 (Adjusted R Squared = .391)

^aSignificant at $p < 0.05$

The Multiple Comparison Analysis was depicted in Table 7 to show the actual effect of the treatment on students' achievement). Also, results in Table 7, showed that students that learnt Ecology in Experimental Group II (treatment I) had a higher mean score of 60.80% while those in Experimental Group IV (Control J) had the mean score of 52.73%. Thus, the effect of learning with Demokit and word clearing on students' achievement in Ecology was shown by the mean difference 8.07.

Table 7 Pairwise Comparison Analysis Showing the Effect of the Treatment on Students' Achievement in Ecology

Treatment	Mean	Mean Diff. (I-J)	Std. Error	Sig. ^a	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Demo kit and Word Clearing (I)	60.80 ^a	8.07 [*]	.870	.00	6.668	10.107
Control (J)	52.73 ^a	-8.07 [*]	.870	.00	-10.107	-6.668
Grand Mean = 56.76						

^a the mean difference is significant at 0.05 level

b. Adjustment for Multiple Comparison: Bonferroni

Discussion

Effect of Learning with Demo kit and Learning on a Gradient Strategy on Students' Achievement in Ecology

There was a statistically significant difference in the effect of learning with demo kit combined with learning on a gradient strategy on the achievement of students in ecology. The results could be predicated on the fact that the combined methods of learning with demo kit and learning on a gradient had the opportunity of better achievement of the content of Basic Ecological Concepts. Thus, the students in the experimental group were better placed in the explanation of the concepts. There are basic terms in Ecology that cannot be explained in details by the use of conventional method, that is teacher dominated and the students might have little or no adequate opportunity to learn cooperatively. More so, in the conventional method the contents are not well structured during the study. On the other hand, if students had no relevant biology textbooks that treated these concepts, the students taught with conventional method might be limited in reading further on the topic. But with the use of combining two strategies as one (learning with Demo kit and learning on a Gradient), the students even without textbooks would be placed on having detail content analysis of those basic terms. It is therefore not a surprise that the Experimental Group One performed than the Control Group. This finding is similar to the findings of Adeoye (2016) who reported that the achievement of students exposed to Demo kit for learning was better than those that were not exposed to it. It is equally similar with the view of Gonzalez (2016) Report on Six Powerful Learning Strategies, when shared with students result to meaningful learning. This is also an indication that education system in Nigeria could be improved with shifting from rote-memorization to meaningful learning, thereby improving students' achievement in public examinations. Also, this is in agreement with Alabi (2016) findings that when students learnt with well-structured text, which is part of learning on a gradient, it makes student learn meaningfully.

Effects of Learning with Demo kit and Word Clearing Strategy on the Achievement of Students in Ecology

The second finding revealed that students that learnt with Demo kit combined with Word Clearing as one strategy achieved significantly better than their counterparts in the control group. The finding is furthermore a reinforcement of the first finding as reported above. Students at whatever level would be better with word clearing in this strategy, difficult terms were cleared and their misconceptions were erased and understanding improved. It seems therefore to be that poor performance of the control group is a confirmation that not all that the students are low in intelligence or in academic ability, as it is currently observed in the Nigeria's Education System. The students not knowing how to learn might be a significant factor that causes poor performance. Thus, if secondary students are properly taught and efficiently too, their performance might not be poor. This finding is also in agreement with the findings of Gbigbadua, Abimbola and Ahmed, (2014) on the effects of pre-instructional word clearing strategy on achievement in biology. Their findings equally included, among many others, that that utilization of pre-instructional word-clearing as an instructional technique could bring about better grades in students' achievement in biology. Also, learning with Demo kit combined with word clearing is also an implication that using better study habit for learning would lead to better achievement. This is also in agreement with Ebele and Olofu (2017). The findings of that study revealed that there was a significant relationship between the students' study habits and Biology achievement.

Conclusion

The results of this study showed that learning with Demo kit and learning on a gradient and word clearing enhanced students' achievement in Ecology. This is because they achieved better than the control group that did not learn with these strategies.

Recommendations

Based on the findings of this study, it was recommended that:

1. Biology students need to be taught with different study technology learning strategies that could make them to be actively engaged in order to learn with full mastery and avoidance of just rote-memorization.
2. Biology students should be given real objects as learning materials that will facilitate their understanding of various concepts. Some other alternatives like demo kit could be used.
3. The contents of abstract concepts should be structured in order to avoid skipped gradient that could constitute study barrier.
4. Students should possess standard dictionaries or subject dictionaries to facilitate their understandings and clear their misconceptions

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