Global Journal of Education, Humanities and Management Sciences (GOJEHMS);
Vol.3 No.1, March 2021, pg.125 - 136; ISSN(Print): 2705-2494; ISSN(Online):2705-2486

EFFECT OF 7Es LEARNING STRATEGY ON RETENTION SECONDARY SCHOOL STUDENTS IN BIOLOGY IN BAUCHI METROPOLIS, BAUCHI STATE, NIGERIA

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ABSTRACT

The study assessed the effects of Effect of 7Es learning strategy on retention of secondary school students in biology in Bauchi metropolis, Bauchi state, Nigeria. Nigeria. The study was guided by two specific objectives, two research questions, and one null hypothesis. Sequential explanatory mixed research design was adopted for the study. The population of the study was 3328 SS II biology students in13 public secondary schools in Bauchi Metropolis. The researchers sampled two intact classes of 137 students for the study. Nine students from the experimental group were used to elicit qualitative data using Focus Group Interview. The instrument for data collection were academic achievement test and Focus Group Interview (FGI). Three experts validated the achievement test while the

interview instrument was validated by the subjects. The validated achievement test was subjected to pilot study and the data collected were analyzed using Guttman Split-Half Coefficient for achievement test. A reliability coefficient of .814, difficulty index of 87.07% and discriminating index 0.7 were obtained. The data collected from the students were analyzed using mean, standard deviation and mean difference to answer the research questions while the hypotheses were tested using independent sample t-test at 0.05 levels of significance. The result revealed that 7Es learning strategy has positive effect on the retention ability of the students. The qualitative data indicated the learning approach enhance student's curiosity and retention ability of biology students in Bauchi state. The study concluded that, using 7Es learning strategy has the potentials of improving the recalling ability of biology students. It was recommended that Bauchi state government through ministry of education should organize workshops, seminars, conferences, symposiums, in-service and retraining programme for teachers on the 7Es learning cycle teaching strategy where teachers are provided chances to be aware of the effectiveness of the teaching approach and improve their personal skills for teaching of biology science in the state.

Key words: Learning, Strategy, Retention, Biology

Introduction

Education remains a vital instrument par excellence for sound national growth and development. The quality of education determines the extent to which recipients acquired the skills, knowledge and competencies to contribute effectively in national development. This explained why Imogie (2010) posits that no nation can develop to its fullest and keep pace with modern trends in science and technology without an effective educational system. This yearning was re-emphasized in the National Policy on Education (FGN, 2014), which states that education is responsible for empowering its recipients with appropriate skills, knowledge, competencies and understanding needed for sustainable development. This therefore means that education is the pivot for national growth, global competitiveness, and sustainable development of individual and society at large.

In Nigeria, the subjects offered at secondary school level are grouped into science, social science, vocational among others. The science subjects (Biology, Physics and Chemistry) have been recognized worldwide to be the instrument for technological development. According to Olasehinde and Olatoye (2014), Science subjects are designed to promote a scientific literate society for technological advancement and development. Biology the subject under study is usually regarded as the most popular among science subjects; hence it usually attracts the widest enrolment among students. Based on the arrangement of curriculum contents of biology, the concepts to be taught are arranged in such a way that 62 units in the biology curriculum is covered within the 3 years academic program. To enhance teaching and learning, the contents of the senior secondary school biology curriculum places emphasis on field studies, guided discovery, laboratory techniques and skills (Ifeobu, 2014). Tom, Coetzee and Heyns (2014) reported that solid foundation as well as achievement in the subject will enable students to become familiar and attain competencies in related subjects such as health science, agriculture, physical and

health education, microbiology, horticulture among others. This explained why the scholars stated that, solid foundation in biology and understanding it has positive effect on academic aspiration of science students.

Despite the richness of the curriculum of biology and its importance on academic aspiration of students, empirical evidences have shown that the performance of students in the subject is worrisome. The poor performance of biology students in Bauchi State was found to be worrisome as the WAEC yearly ranking in 2014, 2015 and 2016 persistently placed Bauchi State in 31st position. Eze (2014) stated that the failure is more worrisome in science related subjects which shows Kebbi, Gombe and Bauchi state recording 6.30%, 5.68% and 5.28% pass respectively.

The cause of low performance of biology students is generally attributed to their weakness in their recalling ability of difficult concepts (Abdullahi &Zayum, 2018). Similarly, the study conducted by Abdullahi and Jibrin (2017) shows that the major problems prevailing in the academic performance and retention of students in science subjects is their recalling ability as a result of inappropriate instructional approach adopted by teachers. In an attempt to improve students' performance and retention ability in related areas, scholars have reported the effectiveness of 7Es learning cycle in related areas. For instance, Agboghoroma and Oyovwi (2015) reported that adoption of constructivism approach improves students' learning outcome and retention ability. So also, Filgona, Filgona and Sababa (2017) reported that 7Es teaching strategies has the potentials to improve students' learning outcomes, achievement and retention in all spheres of cognitive domain in Physics and Geography. Similarly, Muhammad, Efeand Salisu (2021) established that 5Es based teaching approach enhances science students' retention in Mole Concept. The effectiveness of the learning approach inspired the researchers to specifically (1) determine the differential effect of 7Es learning cycle on the retention ability mean achievement score of secondary school students in biology; (2) and explore the views of students on the effects of 7Es learning cycle instruction on their retention in biology in Bauchi state.

Research Questions

In line with the research objectives, the following research questions were raised to guide the study

1. What is the difference between the retention ability mean achievement score of secondary school biology students exposed to 7Es learning cycle and those exposed to conventional teaching method in Bauchi state?
2. What are the views of students on the effects of 7Es learning cycle instruction on their retention in biology in Bauchi state?

Research Hypotheses

In line with the research question, this hypothesis was raised and tested.

1. There is no significant difference between the retention ability mean achievement score of secondary school biology students exposed to 7Es learning cycle and those exposed to conventional teaching method in Bauchi state.

Theoretical framework

The study will be based on Constructivist learning theory developed by Piaget (1969; 1976). The theory suggests that a classroom is no longer a place where students wait for the teacher to transmit the knowledge. The students learn by constructing their own knowledge through active participation in the learning process while the teacher acts as a facilitator who guides and helps the students in the group to develop their own understanding. The focus, therefore, shifts from teachers to the learners (Boghossian, 2006; Klenowski, Askew & Carnell, 2006). The theory emphasizes on student-centered teaching approach where students learn by doing, experiencing, and observing. The advocates of the theory maintained that the learning cycle promotes problem-based activities where students have to be active and curious to solve problem by themselves through interaction with their peers (Nikitina, 2010). The 7E's learning model is presented in figure 1.

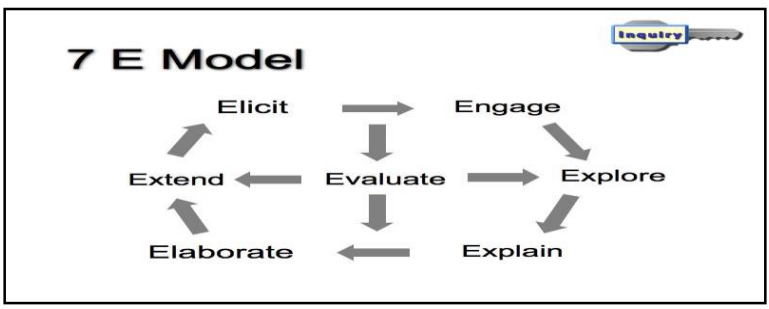

Figure 1: 7E Learning Cycle Model
Bentley, Ebert, and Ebert (2007)

The learning cycle emphasized that learning should start with (1) Elicit the prior knowledge of the learners; (2) Engage the learners by using a discrepant event to arouse their interest; (3) Explore the skills and knowledge of the students; (4) Explain the new concepts by allowing students to verbalize and clarify the concept; (5) Elaborate newly learned concepts of the students through questioning; (6) Evaluate the learning outcome of students through using of formative assessment; and (7), Extend the knowledge by helping students to connect the concept to different contexts, transfer new learning. The advocate of this theory such as Kahveci and Ay (2008) argued that, following these steps will help to promote academic achievement of students. The author further added that, learning takes place when students construct their own knowledge rather than having somebody to construct the knowledge for them. Thus, in the constructivist learning environment, the students learn by trying to understand the learning material on their own under the guidance of the teacher. The constructivist model encourages learners to acquire knowledge by discovery learning approach which results in better academic achievement and more knowledge retention by the students as well as application of their learning efficiently. It promotes effective learning through discovery and inquiry where students are given opportunities to produce and test their knowledge about a topic (Klenowski, Askew &

Carnell, 2006). The theory maintained that successful learning occurs when learners are exposed to student-centered approach. In particular, students are given the chance to create their own knowledge through active participation in the learning process and engage themselves in discussion and problem-solving activities with their peers under the guidance of a teacher which results in better academic achievement, motivation and more knowledge retention.

The implication of this theory to the current study is that, it was based on the students' interaction which allows depth and breadth understanding of concept among students which also form the cardinal principles of this study. In addition, the theory emphasised on promoting learning through sequential learning and teamwork skills which is also the focus of the current study, hence, the theory is consider suitable as it guide the researcher to determine the effect of 7E's Learning Cycle Instruction on the motivation, performance and retention ability of biology students.

Research Design

Sequential explanatory mixed research design was adopted for this study. The design involves collection of quantitative and qualitative data. The quantitative data was collected using quasi experimental design while the qualitative data was collected with the use of Focus Group Interview (FGI). The choice of the design was considered appropriately because it enabled the researchers collect data from the respondents and sought for more explanation via interview. Creswell (2014) opined that sequential explanatory mixed-method enables researcher to collect quantitative and qualitative data.

Population and Sample of the Study

The population of the study was 3328 SSII biology students in 2020/2021 academic section in public secondary schools in Bauchi town, Bauchi state, Nigeria. An intact two classes of 137 students were randomly selected and used for the study. A class of 66 students was assign the control group while a class of 71 students was used as experimental group. Nine students selected from experimental group were used for Focus Group Interview.

Instrument for Data Collection

Two instruments were used for the data collection. The first instrument was Biology Academic Achievement Test (BAAT) The BAAT is 30 multiple choice questions adopted from SSCE examinations question papers. The instrument was used collect data on the students' academic achievement of students. The BAAT instrument is categorized into pre-test, post-test and delayed post-test. The pre-test was used to collect data on student's entry level prior to the treatment. The post-test was used to determine students' academic performance after the treatment while the delayed post-test was used to determine the retention ability of the students. The post-test and delayed post-test equivalent but reshuffled after the post-test. The second instrument is Focus Group Interview (FGI) which was used to generate the views of the students on the effectiveness of 7Es learning strategy.

Validation and Reliability of the Instrument

The achievement test was validated by 3 experts in science education who determined the appropriateness of the instrument. The suggestions of the experts were incorporated into the instrument before administering. The finding of FGI and the raw data were also given to the colleagues for peer review to check agreement of the emerging findings with the raw data (Merriam, 2009). The outcome of the peer review confirmed the congruency of the emerging findings with the raw data.

The instrument was subjected to pilot study. A Split half reliability coefficient of 0.814 was obtained. The result indicated that instruments are reliable as suggested by George and Mallery (2003) who opined that a minimum reliability coefficient of .65 is acceptable for experimental study. The average difficulty index of the instrument was 98.8% and discriminating index of 0.7. The difficulty and discriminating are satisfactory as suggested by Anowar and Rohani (2013) who opined that, Ideal Difficulty of Four-response multiple-choice should be at least 74. Ebel and Frisbie (1986) also opined that that a discriminating index score of >0.39 should be considered satisfactory and retained for 4 multiple choice questions. Based on these, all the items were retained.

Method of Data Collection

The data was collected by researcher assisted by 2 research assistants. To prevent the influence of intervening variables, the researchers for the study were the regular biology teachers in each of the selected schools. The research assistant in the experimental group undergone three days competencies training for duration of 2 hours per day. The competencies training involved detailed explanations on the instructional strategy and how to use the strategy in the class. During the training section, the 7Es instructional package and a comprehensive lesson plans were given to the research assistants. To ascertained the competencies of the research assistant at the end of the training section, microteaching session was organised.

To determine the equivalence of the two groups of the students, pre-test was administered prior to the treatment. After the pre-test, students in the experimental group were taught genetics using the 7Es instructional strategy guided by drawn lesson plans while the students int eh control group were taught the same topic using lectures method guided by drawn lesson plans method. At the end of three weeks lessons, post-test was administered to the two groups of the students. The delayed post-test which was used to determine the retention ability of the students was administered to both control and experimental groups three weeks after the post-test. The scrips of the pre-test, post-test and delayed post-test were marked by the researchers guided by drawn marking schemes. The exercise last for 5 weeks.

The qualitative data was collected from the participants through Focus Group Discussion Interview (FGDI). The research assistants/teachers informed the participants about the date, time and venue for the focus group. Prior to commencement of the FGDI the teachers ensured the environment is quite and conducive for the interview. Attendance will also be taken to ensure all selected students are present. The interview lasted for 1 hour 45 minutes.

Procedure for Data Analysis

The data collected from the study were analyzed in three stages. In the first stage, the data were coded into Statistical Packages of Social Sciences (SPSS) version 25. The package was used to run mean score, standard deviation and mean difference to answer the research questions. ANCOVA was employed to test the research hypotheses at 0.05 level of significance. The hypotheses were tested at 0.05 level of significance.

The qualitative aspect of the data collected through focus group discussion (FGD) was thematically analyzed using Microsoft Excel Package (MEP). The choice of MEP was based suggestions of Meyer and Leanne (2009) who opined that Excel can be used for qualitative analysis using conditional formatting and other functions. Based on this, the researchers considered the package appropriate for the analysis.

Results of the Study

The results of the study are as presented in Table 1 to 3 and figure 2.

Research Question one

What is the difference between the mean retention achievement score of secondary school students taught biology using 7Es learning cycle and those taught using the conventional method in Bauchi state?

The result of retention ability of the two groups of students involved in the study is as presented in Table 1. From the Table, the retention mean score of 61 students in the control group was 27.99 with the standard deviation of 6.66. The students that were used for experimental had the mean score of 49.79 with standard deviation of 11.88. The mean difference between the two group of students stood at ±21.80. The observed mean difference fall under the index score of very large. The obtained mean difference suggested that there was very large difference between the mean retention of the two groups of students. The result favoured of students in the experimental group.

Table 1: Retention mean difference between students taught biology using 7Es LC and those taught using conventional method

Group	N	Mean	Std. Dev.	Mean Difference	Remark
Control	66	27.99	6.66	±21.80	Very large Difference (VLD)
Experimental	71	49.79	11.88		

Source: Fieldwork, 2021

Research Hypothesis

There is no significant difference between the retention ability mean achievement score of secondary school biology students exposed to 7Es learning cycle and those exposed to conventional teaching method in Bauchi state.

The result used for testing the null hypothesis presented in Table 1 indicated the [F (2, 134) =67.866 and $p=.000<0.05$. The result indicated that 7Es leaning cycle has significant effect on retention ability of biology science students in Bauchi state. This can

also be seen in the Partial Eta Squared of .336 obtained which suggested that the 7Es learning cycle has 33.6% effects on the retention ability of students in biology. The hypothesis was therefore rejected.

Table 2: Mean retention difference between students taught biology using 7Es LC and those taught using conventional method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	27033.669[a]	2	13516.834	902.114	.000	.931
Intercept	116.500	1	116.500	7.775	.006	.055
Performance	10749.979	1	10749.979	717.454	.000	.843
7Es L.C.	1016.870	1	1016.870	67.866	.000	.336
Error	2007.791	134	14.984			
Total	240393.000	137				
Corrected Total	29041.460	136				

Source: Fieldwork, 2021

Analysis of Qualitative Findings

Students views on the effects of 7Es learning cycle instruction on their retention ability in biology in Bauchi state

Table 3 and Figure 2 is the analysis of participants views on effects of7Es learning cycle on their retention ability of biology. The outcome of the interview led to development of three (understanding, clarity and Easy) sub-themes. From Table 3, participants 1, 3, 5, 7, and 9 opined the teaching approach has made them to understand difficult concepts in biology. Categorically, participants 1 and 9 maintained that, they can easily recall all that was taught using 7Es approach because it makes learning very easy. Participant 3 maintained that although the teaching method is time consuming but it makes learning more permanent. The 5th participant added that, there is no much difference in his mean performance between the second and last test conducted by the teacher. Quoting from the view of Participant 7, he said that "sir, ask me any question from what was taught, I am confident in answering it". All the participants were cheerful on the teaching approach.

From the result in Table 3, participants 1, 2, 5, 6 and 9 reported that the approach make biology very clear for their understanding. Participant 1 maintained that the through the teaching method he come to understand that biology is a simple subject. Similarly, the views of participants 2 and 6 indicated through the teaching method, their understanding of the subject, recalling ability and their love of biology has increased. When they students were asked what make the difference, participant 6 responded that the method is friendly and encouraging. The 9th participant added that, beside the two reasons, the approach enabled the students to participants in the classroom and ask questions in area of difficulties.

The views of respondents 1,3,5 and 8 participants indicated that the approach has made biology easy and simple to understanding. Participant 1 maintained that teaching

method had made him to love biology more. He added that the subject has become very easy for him. Participants 3 and 5 opined that their worry in science subjects will be come to an end if the teaching approach is upheld. Participant 5 stated he is proud in his 2nd and 3rd test because the performance is encouraging. Participant 8 further argued that, his problem in biology has educed drastically because of his performance in the 2nd and 3rd test. Participant 9 stated that his biology phobia has reduced and he has more confidence in the subject. Generally, all the participants agreed that the method has improve their recalling ability because it is either friendly, lovely or make the learning easy.

Table 3: Views of Biology Students on Role of 7Es LC on their Learning and Retention

S/No	Views	Focus Group Participant								
		1	2	3	4	5	6	7	8	9
1	Understanding	√		√		√		√		√
2	Clarity	√	√			√	√			√
3	Retention	√	√	√	√	√	√	√	√	√
4	Easy	√		√		√			√	

Source: Fieldwork, 2021

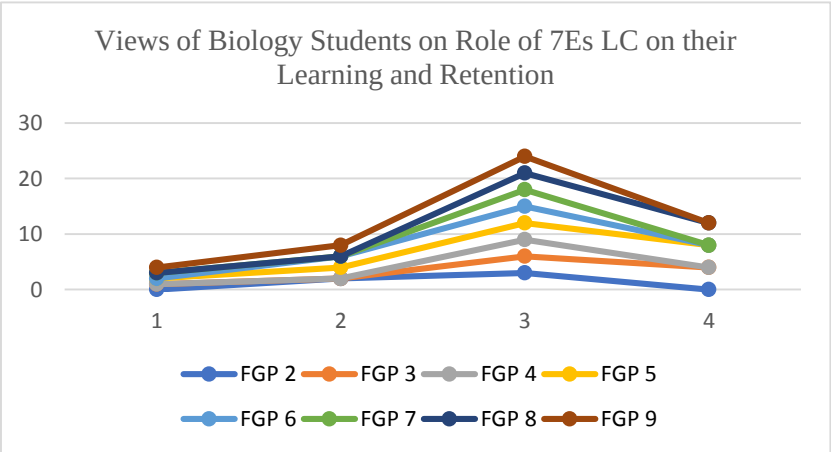

Figure 2: Model forStudents' retention in Biology; *Source: Fieldwork, 2021*

Discussion of the Findings

The result of research question one and the finding of null hypothesis one disclosed that there was significant difference in mean retention achievement test of the two groups of students for the study. The finding agrees with the earlier findings of Oludipe and Oludipe (2010) which revealed that there was statistically significant difference between the retention mean academic achievement of students taught science concepts using 7Es learning cycle and those taught using the conventional lecture method. The outcome of the result favoured students in the experimental group. Adamu and Jibrin (2018) in their studies, state that mastery learning approach enhances students' academic achievement and retention in integrated science and mathematics than the conventional teaching method. The study conducted by Bunkure (2012) also reported that students in the experimental group (5E teaching cycle) of varied ability levels had higher retention ability than the control group (Lecture) of varying ability levels. Similarly,Semerci and Batdi (2015) reported that the learning cycle enhances students" achievement and retention. Similarly, the study conducted by Kajuru, and Kauru. 2014), who carried out studies to investigate the effect of 7E's's constructivist approach on Polytechnic student's achievement and retention in trigonometry in Polytechnics in Kaduna State. The study revealed that students taught trigonometry using 7E's's constructivist model did better than those taught using the conventional method in both achievement and retention.

The Views of students in the FGI suggested 7Es LC enhancing students understanding of topic taught in class, make difficult concepts very clear, promotes retention ability of the students and make learning easy. The finding is in line with the finding of Hussain and Suleman (2016) which also indicated that students exposed to constructive teaching and learning easy, and promotes performance and retention ability of the students. Filgona ,Filgona and Sababa (2017) investigated the effects of Mastery Learning Strategy on students achievement in Physical Geography. The result of the study indicated that the learning cycle has the potentials to improve students' learning outcomes, achievement and retention in all spheres of cognitive domain in Physical Geography than the Conventional teaching Method. The study of Muhammad, Efe and Salisu (2021) who carried a study on the influence of the 5E teaching cycle on the Retention ability of Students of varied abilities in Mole Concepts of Chemistry among Senior Secondary School in the Zaria Educational Zone reported that, the retention ability of students in the mole concept, shows that a significant difference exists in the mean retention abilities of SS II chemistry students of varied abilities levels taught mole concept with 5E teaching cycle and those taught with lecture method.

Conclusion

The outcome of the study indicated that 7Es learning cycle has positive effects of academic achievement, retention and motivation of biology students. This therefore suggested the instructional approach has the potential of enhancing the retention ability of secondary school students in Biology in Bauchi state. The study recommended that Bauchi state government through ministry of education should organize workshops, seminars, conferences, symposiums, in-service and retraining programme for teachers on the 7Es learning cycle teaching strategy where teachers are provided chances to be aware of the effectiveness of the teaching approach and improve their personal skills for teaching of biology science in the state.

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