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Effect of Learning Activity Package on Retention in Biology Concepts among Senior Secondary School Students in Otukpo, Benue State, Nigeria

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Abstract

The study was designed and conducted to determine the effectiveness of the Learning Activity Package (LAP) in influencing students' retention in Senior Secondary School Biology. Two research questions and two null hypotheses were formulated. A Quasi-Experimental Pre-test, Post-test, Non-equivalent Control Group Design was adopted for the study. A sample of 317 SS II biology students, drawn by both purposive and simple random sampling techniques from four co-educational schools in Otukpo Educational Zone was used for the study. The four schools were assigned to experimental and control groups respectively. Two intact classes in each school – (one as experimental and the other one as control group) were randomly selected. The experimental and control groups were taught the biology topic (Unit of Life) by the regular biology teachers. Three instruments – Pre-BPT and Post-BPT were developed, duly validated and reliability of equivalence, internal consistency and stability duly established (0.79 and 0.83 respectively) before using them for data collection. The research questions were answered using mean and standard deviation while the hypotheses were tested at ($P < 0.05$) using analysis of covariance (ANCOVA). The result of data analysis showed that: There is a significant difference between the experimental and control group, with the mean retention scores of the LAP group being significant more than the control group, but the male students' retention test was significantly greater than those of their female counterpart. A major educational implication of the findings is that the use of LAP does not show any significant difference in the retention of male and female students. Thus the use of LAP will not only help arrest the problem of male being regarded as high achievers in science-related courses but will also encourage the female students to enroll in such courses among others.

Keywords: Learning Activity Package, Biology, Retention and Gender

Introduction

The inculcation of scientific skills and attitudes in students can only be achieved through the proper teaching of the various science subjects. These include Biology, Chemistry, Physics, Mathematics, Health Science, Agriculture, etc. Biology is a natural science with a broad scope but has several unifying themes that tie it together as a single, coherent field. For instance, all organisms are made up of cells that process hereditary information encoded in genes, which can be transmitted to future generations. Proper teaching of biology will help the students to solve personal and societal problems. The knowledge of Biology helps to question superstitions, know the function of the various parts of the body, enables one to understand oneself, maintain good health practices such as the use of clean water, good sanitation, balanced diet, the need to vaccinate, among others (Maduabum, 1998). The importance of Biology as a secondary school subject can be further illustrated by the fact that a candidate must obtain a credit pass in it, for admission into any Nigerian University to study such important science – based courses as Medicine, Pharmacy, Biochemistry, Microbiology, Food Technology, etc. Students vary in their academic abilities and this tends to be reflected in the extent to which they are affected by a particular teaching methods. For instance, Diamond and Onwuegbuzie (2001) expressed concern over the influence of different teaching methods on learning benefits of students of different ability groups, stating that differences in intellectual functioning among learners necessitate variations in instructional strategies. Research conducted by Okeke (1986), Ezeh (1992) and Udeji (2017) indicated that teaching methods have differential effects on students of different academic ability levels (low, average, high levels) with one group benefiting more from a particular teaching method than the other. For instance both Eze (1992) and Udeji (2017) found out that with the various methods used, performance is significant with the high ability groups, while the findings of Okeke (1986) indicated that in as much as some students are highly gifted they do not achieve well in science this may be due to the teaching method employed which may not suit all the groups. In view of the foregoing, it might be necessary to find out the students' academic ability group (low, average / high) for which a particular teaching method will be more effective. Retention, according to Chauhan (1998), is a direct correlate of positive transfer of learning. This means that high retention may lead to high performance which is a factor of many variables such as interval between learning and retrieval, intervening experiences, specific subject involved, teaching strategies/methods used, and environmental situations, among others. Evidence from researches showed that there is no consistency on the

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variables that may lead to the students retaining more of what they have learnt. Separate studies carried out by Ndukwe (2015), Nnadi (2017) and Eze (2020) showed that there was no significant differences between the pupils mean post performance and retention scores. However, other studies carried out by Udousoro (2012) and Udeji (2017) showed that the methods employed in teaching science led to students' high retention and performance. These findings suggest that there is need to carry out more studies to clarify issues related to performance and retention as it concerns methods of teaching used in teaching. Since there is no consensus on the effect of methods on students' retention and performance, there is need to investigate a learner centered activity oriented method and its effect on retention. Learner centered activity oriented method may include the use of a Learning Activity Package (LAP).

A Learning Activity Package (LAP) is a student – centered, activity-oriented teaching strategy where the teacher acts as a facilitator of learning, guiding the students through a series of activities and problems, which may help learners to achieve highly. In LAP, learning materials are broken into small steps that are arranged sequentially from known to unknown and in an increasing order of difficulty. This suggests that LAP calls for individualized student attention. In solving the students' problems of poor retention in Biology, there is the need to shift from the conventional methods of teaching sciences to a more innovative method - a method that should seek for a way of making teaching more precise, while at the same time adjusting both the objective and methods of learning to the needs and characteristics of the individual learners. This innovative method must enable each student to work at his own pace thus accommodating both the fast and slow learners. In this method, the goals of the subject matter must be spelt out very well that students can arrive at the same goals independently along some avenue other than the one provided by the teacher. This calls for an individualized type of instruction. Individualized instruction, according to Chauhan (2008), is that in which the teachers attend to learning needs and problems of each learner separately. In other words, it means the tailoring of instruction to the particular needs and ability of each learner. The individualized instruction method can be approached and achieved through different methods such as Programmed Instruction (PI), Computer Assisted Instruction (CAI), Independent study (IS), Audio-Tutorial Training Models (ATTM), Learner-Controlled Instruction (LCI), Personalized System of Instruction (PSI), Protocol Packages (PP), and Learning Activity Package (LAP) among others. Learning Activity Packages (LAP) which is one of the teaching methods employed to achieve individualized instruction is the focus of the present study. Computer Assisted Instruction (CAI) had so much been advocated and had been established by research finding to be good for individualized instruction. The use in Nigerian Schools had been hampered by non-availability of computer systems in most public schools and even some private schools (Eze, 2018). Based on the non-available of these computer systems in our Nigerian schools the researcher advocates for the trial of another individualized method of instruction which can be readily available and can be affordable. This calls for the trial of the use of Learning Activity Package (LAP). From the researches available to the researcher the efficacy of LAP as a teaching technique in Biology was carried out by Abu (2011) in Zaria, Abu used LAP as an instructional material on students' performance in Biology. In the study, the LAP was developed on the topic micro-organisms and the subjects used were 25 randomly selected senior secondary two (SSII) students. The researcher used pre and post assessment to obtain data on the mastery of the objectives of the topic with the use of LAP by the subjects. The data was analyzed using simple percentage with 70%, as the criterion for mastery of the objectives of the LAP. The post assessment score obtained indicated that the objectives of the LAP were achieved in terms of students' mastery of those objectives. The above study is indirectly measuring retention in Biology and there was no evidence of validation of the instrument used. There was also no indication of the test of reliability of the instrument used to ensure that the generalization of the study will not be limited. The researcher was after the learners' mastery of the objectives of LAP and no other variable was employed in the study. Moreover, the method of data analysis was the percentage and there was no control group. Hence, in this study, more control of the characteristics of LAP was adopted by remedying the above deficiencies including using experimental / treatment and control groups for assessing the efficacy of the package. Variables like retention and interest levels were considered in the present study. However, the present study focused on the application of LAP as a method of instruction and not as an instructional material, and will be carried out in Otukpo, Benue State using four different schools which served as experimental and control groups. The developed LAP on the unit of life was used to ascertain the efficacy of the method with respect to students' performance and retention with varying ability levels. The reliability of the LAP was tested to ensure that the results of the study were not limited. The LAP used in this study was packaged by the researcher based on the publication made by Cardarelli (1992), details of the steps followed by



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the researcher in developing the LAP is contained in the Research Method. One related factor that is confronting the use of learner centered method to teaching is its ability to have the same impact on both male and female students equally. This raises the issue of gender in relation to interest, performance and retention. Influence of gender on students' performance and interest in science subjects has over the years attracted the attention and interest of scholars. However, it is worthy of note that opinions and findings about the issue have been diversified. Specifically, while some scholars (Onekutu and Onekutu, 2012; Eriba and Sesugh, 2016) found out that males achieve higher and retain more than females, others found out otherwise (Alkhateeb, 2012; Bleuer and Wattz, 2012; Omoniyi, 2006). Yet another group of scholars are of the view that retention in science subjects are not influenced by gender (Iloputaife, 2011 and Eze, 2018). Therefore this study will investigate the relevance and possible influence of gender on students' retention in Biology when LAP method is employed in teaching them.

Statement of Problem

The persistent poor performance of students in Biology as revealed by both research results and WAEC Chief Examiners' Reports calls for concern especially for teachers of Biology that enroll larger number of students. The problem has to a large extent been attributed to ineffective teaching method employed by the teachers – especially lecture teaching method which is teacher-centered. Consequently, there is felt need to improve on the teaching and learning of Biology by exploring the use of some innovative learner centered teaching–learning methods, since it is believed that meaningful learning may be as a result of active participation by students. Although, many studies had been carried out on some innovative methods, like Programmed Instruction and Computer Assisted Instruction methods. Findings have shown that they are student centered and can also enhance retention, but the problem of large class and non-availability of computer systems in most Nigerian classes has made their practicability nearly impossible. Therefore, there is still the need to investigate other innovative child-centered method that is affordable, readily available as well as flexible, combining both package learning and practical activities (i.e. minds – on and hands – on). Such a method should enable the teacher to easily diagnose the problems of the individual learner and allows the learners to evaluate themselves, receiving immediate knowledge of result. These calls for the trial of another individualize method such as Learning Activity Package (LAP). Hence, the study was set to find answer to the question: What is the effect of LAP on students' retention in Biology?

Research Questions

Two research questions were formulated to guide the study:

1. What is the effect of the LAP on mean retention level of students who were taught and those who were not?
2. What is the difference of the effect of LAP on mean retention level between male and female students who were taught in biology?

Hypotheses

Two null hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant differences in the mean retention level of students who were taught and those who were not in biology
2. There is no significant difference in mean retention score between male and female students who were taught in biology

Research Methodology

The design of the study was Quasi-Experimental Design of the Pretest Posttest Non-equivalent Group Design (Campbell and Stanley, 1967). The design is often used in classroom experiments when experimental and control groups are assembled as intact classes and no possibility of randomization. Hence, intact classes were used and there was no random assignment of research subjects. The population of the study comprised of all public co-educational senior secondary school class two (SSII) students who were offering biology in the three Local Government Areas in Otukpo Education Zone of Benue State, year 2023. Altogether, there were 2022 students. The choice of SSII students was due to the fact that "unit of life" is meant for SSII as contained in the Biology core curriculum of the Federal Ministry of Education (FME, 1985) for Senior Secondary Two (SSII). The choice of co-educational secondary schools was that gender is a variable in the study. The sample used for the study consisted of a total of 317 SSII Biology students (157 males and 160 females) drawn out from 18 co-educational secondary schools in Enugu education zone. This is because gender is a factor in the study. The 18 co-educational schools were purposively selected from 29 secondary schools in the zone. From the 18 co-educational schools, four schools that had up to two or more SSII classes were purposively selected. Two intact SSII classes in each school, one

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intact class was assigned to Learning Activity Package of instruction (LAP) while the other intact class was assigned to lecture method of instruction. The selection of the classes for either of the instructional methods was done through simple random sampling (balloting).

Presentation of Results

The analysis and results are presented in tables according to the research question and hypotheses as shown below.

Research Question 1: What is the effect of the LAP on mean retention level of students who were taught and those who were not?

Table 1: Mean retention and standard deviation scores of students taught the Unit of Life with LAP and lecture method.

		N = 317		
GROUP		MEAN	SD	N
LAP	Post test	22.21	5.91	160
	Retention test	22.95	5.49	
	Gain Score	.74		
Lecture Method	Post test	16.36	5.23	157
	Retention test	14.96	4.85	
	Gain Score	-1.43		

Table 1 above indicates that the LAP group obtained mean scores of 22.21 and 22.95 in the post test and retention test respectively, with standard deviation of 5.91 and 5.49. On the other hand the lecture method group obtained mean scores of 16.36 and 14.96 in the post test and retention test respectively with standard deviation of 5.23 and 4.85. Therefore, students taught with Learning Activity Package (LAP) had a gain score of .74 while the lecture method group had a gain score -1.43. The gain score of the LAP group being higher than the lecture method groups shows that the LAP group retained higher than the lecture method group. However, the standard deviation for the student in the LAP and lecture method groups in the retention test are 5.49 and 4.85, indicating that there are more extreme score in the LAP group while the scores of the students in the lecture group appear to be more clustered around the mean.

Research Question 2: What is the difference of the effect of LAP on mean retention level between male and female students who were taught in biology?

Table 2: Mean retention and standard deviation scores of male and female students

N = 317			
SEX	MEAN	SD	n.(cases)
Male	20.01	5.92	157
Female	17.99	6.99	160

Table 2 shows the differences in the mean scores of male and female students in the retention test on the Unit of Life. Male students' retention score was 20.01 while that of the female counterpart was 17.99. This shows that the male students generally retained more than their female counterpart. Similarly, the standard deviations for the male and female students were 5.92 and 6.99 respectively indicating that the individual scores of the male students were more closely related to their mean retention scores than those of their female counterparts.

Hypothesis 1

There is no significant differences in the mean retention level of students who were taught and those who were not in biology

Table 3 Analysis of covariance of students mean retention scores in BAT (instructional method X Gender and Instructional method X ability group).

Source of Variation	Type III Sum of Squares	df	Mean Square	F-cal	Sig	Decision
Corrected Model	7930.21	11	720.93	39.25	.00	S
Intercept	1719.70	1	1719.70	93.62	.00	S
Pre test Ability	372.89	1	372.89	20.30	.00	S
	27.72	2	13.86	.75	.47	NS



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Method	378.86	1	378.86	20.62	.00	S
Gender	113.30	1	113.30	6.17	.01	S
Ability X	156.89	2	78.45	4.27	0.02	S
Method						
Method X	15.39	1	15.39	.84	.36	NS
Gender						
Error	5602.76	305	18.37			
Total	127856.00	317				

S = Significant; NS = Not significant; N = 317; P = <0.05

Table 3 above shows that the calculated F-value for the effect of treatment on the students retention scores in the Biology retention test is 20.62 at 0.00 level of significance, which is less than 0.05 level set for the study. The null hypothesis is therefore rejected. This mean that a significant difference exist in the mean retention scores of Biology students taught the Unit of Life with LAP and those taught with lecture method.

Hypothesis 2

There is no significant difference in mean retention score between male and female students who were taught in biology. Table 3 shows that the calculated F-value for the effect of gender on students' retention in the unit of life taught is 6.17 and .01 level of significant. This is less than 0.05 level set for the study. The null hypothesis was therefore, rejected, hence there is a significant difference in the mean retention scores of male and female students in the Biology retention test.

Discussion of Findings

It has been observed in this study that the Learning Activity Package had significant effect on students' retention of Biology Concepts Learnt. (Table 2). The findings support these similar works on innovative methods that aid retention done by Egbugara (2008), Nworgu (2009) and Ezeudu (2015) but do not agree with the findings of Ndukwe (2015) and Eze (2018) who found that the difference in the mean post retention test scores was not significant. The fact that the Learning Activity Package helped students to retain more, may be because it is activity-packed and students were allowed to interact with the learning materials promoting meaningful learning and not rote-learning (Wandese, 1990). When the materials learnt are meaningful, they tend to be stored in the long term memory. Nevertheless, the finding of this study disagrees with the findings of Nnadi (2011), Erinsho (2015) and Ugwu (2017), who found significant difference in performance in their independent studies. This could be attributed to the fact that the activities in the Learning Activity Package are carried out by the students themselves, at their own pace during and after the school period, so this has given both the male and female students chances of performing equally. On the other hand, the mean performances score of male students being slightly better than their female counterparts can be associated with social attachment that males are more science incline than female. The finding of the study in respect of the effect of gender on students' mean scores in the retention test is such that male students' mean retention score was significantly greater than that of the female students. The result is in agreement with the findings of Nworgu (2009), Ezeudu (2015) and Ugwu (2017), who in their independent studies found that there is a significant difference in the retention of male and female students in various science subjects. But on the contrary, the finding of this study is in disparity with the findings of Eze (2018), Iloputaife (2011), Eze (2018) and Ndukwe (2020) who found no significant difference in the retention of the male and female students. Male superiority in the retention of the Biology concepts taught, may be traceable to the fact that the male achieved slightly better than their female counterparts in the performance test. Since one can only retain what one had known in the past, it follows therefore, that the male students who had acquired more knowledge would be expected to retain such knowledge more than their female counterparts, who recorded less performance in the same discipline in the same discipline in the posttest.

Conclusion

Learning Activity Package (LAP) was found to be more effective than the lecture method of students' retention in Biology. Also the male students' mean retention score was significantly greater than that of the female students. There is no significant interaction effect of treatment and gender on students' mean retention scores.

Recommendations

In view of the afore-mentioned educational implications of the result of this study, the following recommendations are made:



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1. As the use of Learning Activity Package has been found effective in promoting retention in Senior Secondary School Biology and since this teaching method is relatively new in Nigeria, it should be included in the Biology Curriculum of Teachers' Training tertiary institution, so as to popularize its use among the teachers and hence bring about more effective learning of Biology in our secondary schools.
2. In view of the established efficacy of the Learning Activity Package and the fact that most of the serving Biology teachers may not be familiar with its use, seminars and workshops should be organized by government and relevant professional bodies e.g Science Teachers Association of Nigeria (STAN) to educate and sensitize the teachers on the use of the Learning Activity Package of Biology teaching and learning.
3. As students of different ability levels have been shown to benefit differently from biology lesson with respect to performance and retention using Learning Activity Package, Biology students should be placed in classes according to their ability levels, to prevent the slow learner being "dragged" by the fast Learners.
4. Government agencies and professional associations whose responsibility it is to design and revise the curriculum for secondary schools should incorporate and emphasize the use of Learning Activity Package method in the teaching of senior secondary schools Biology.
5. Government, through the State and Federal ministries of education should encourage the Biology textbook writers to write and publish Biology textbooks based on the Learning Activity Package instructional method.

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