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# Effects of Spaced and Blended Learning On Senior Secondary School Students' Interest in Biology in Ekiti State

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**Abstract:**

The effects of Spaced and Blended Learning teaching strategies on the interest of senior secondary school students in Biology in Ekiti State was investigated. The study investigated the difference in interest of students exposed to Spaced and Blended learning teaching strategies before and after treatment. Quasi – experimental pre-test and post-test three group (two experimental groups and one control group) research design was used for the study. Using multistage sampling procedure, a total number of 149 S.S.S. 2 students (intact class size) were drawn from six public secondary schools in three Senatorial Districts of Ekiti State. Biology Interest Scale (BIS) was used to collect relevant data for this study. The face and content validity of the instrument was ensured while the reliability of the instrument was determined using Cronbach's alpha which yielded reliability co-efficient value of 0.83. The data were analyzed using both descriptive and inferential statistics. The study revealed that the three groups; Spaced Learning, Blended Learning and Conventional were homogeneous at the commencement of the experiment. The use of Spaced Learning and Blended Learning enhanced the interest of students in Biology than the conventional strategy. It was recommended among others that, in secondary schools the use of Spaced Learning and Blended Learning strategies should be incorporated in Biology class so as to enhance the interest

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of students in Biology. Textbooks could be written in slides which so as to accommodate the use of Blended Learning.

**Keywords**: Spaced Learning, Blended Learning, Interest, Biology,

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## Introduction

Biology is one of the fields in the natural sciences that studies living things, biology can be defined as the science of life. Nasr, and Asghar (2011) state that Biology in addition to studying life, studies also the structures, functions, growth, origin, evolutions, distributions, inter-relationships, problems such as diseases and adaptations of living things and proposes solutions where possible. It is a science subject offered in all the senior secondary schools in Nigeria, which is compulsory for both the science, and Arts oriented students. The word 'Biology' is coined from two Greek words; Bios meaning life, and logy (logia) which means study (Ezemoka, 2011). Thus the concept biology is concerned with the study of life, Biology is the branch of science that studies life using inquiry methods and discoveries, hence Ezemoka (2011) stated that since Biology involves inquiry and discovery, that inquiry should be the central theme in Biology teaching and learning for students to experience the world of life around them and to actually do Biology as opposed to learning Biology.

Biology as earlier observed by Odogwu (2008) provides a platform for teaching students the ability to apply learning of science concepts and principles in solving every day's problems. Elechi (2010) pointed out that, the teaching of biology is important because; it equips the students to comprehend the world around them and equips them with necessary skills to build a progressive society. The principles of Science taught in biology that could make students comprehend or understand their environment includes; observation, critical thinking, inferring among others.

Biology is one of the science subjects that senior secondary students offer in senior secondary certificate examinations in Nigeria (FRN, 2015). Interestingly, it is a popular subject among students and its popular nature among other science subjects has made it distinct choice for all students (Lawal, 2011). Biology is a very important science subject and a requirement for further studies of other science related professional courses such as medicine, agriculture, pharmacy, biotechnology, genetic engineering, among others. Biology is the key to economic, intellectual, sociological, human resource development and well-being of any society. It is of importance in many ways for both individual and societal development as seen in biotechnology and genetic engineering (Nwagbo & Chukelu, 2014). Based on these assertions on the importance of biology, there is need for it to be properly taught in the secondary schools to improve students' interest in the subject.

The Biology curriculum over the years has been delivered mechanically or by rote learning, which makes instruction teacher-centred. Hardly can vital abstract contents in Biology be effectively communicated to the learners theoretically. They need to be taught using relevant materials. The teacher and his/her method of teaching may have been a major source of student's low interest in Biology as most teachers still prefer using the 'chalk and talk' method in instructing learners.

These conventional methods of teaching are observed to dwell more on the transmission of knowledge in a manner that emphasizes memorization and has been characterized by some educators (Safia & Jawaid, (2013), Gillies, Nichols, Burgh and Haynes, 2014) as a poor method of teaching Biology and other science subjects as it involves

unidirectional flow of information/knowledge from teacher to the students and do not encourage process skill acquisition needed for proper understanding of biological principles, concepts and facts as the students pay attention while the teacher does all the talking.

Spaced Learning and Blended Learning are innovative methods that could improve students' interest in Biology and this why the researcher is interested in examining the effects of these two innovative strategies on interest of students in Biology. Spaced Learning is a teaching strategy in which; highly condensed learning content is repeated over time, with some minutes breaks during which distractor activities such as physical activities are performed by the students. Scientists have tried to understand long-term memory (LTM) processes through a variety of approaches including using repeated, spaced stimuli (Cohen & Yean, 2013). It is a general belief/observation that, if one is trying to learn something well or acquire a new knowledge, whatever it maybe; a set of facts, concepts, skills, or procedures; a single exposure is usually inadequate for good long-term retention. There is a common axiom that, "practice makes perfect." What is less obvious in this axiom is the timing of the practice because when it occurs, matters a great deal. Having the initial study and subsequent review or practice spaced out over time generally leads to superior learning than having the repetition(s) occur in close temporal succession (with total study time kept equal in both cases). This phenomenon is called the spacing effect (sometimes also referred to as the benefit of distributed practice) and was first observed by researchers over a century ago (Cohen & Yean, 2013).

The enhanced accessibility and capabilities of the Internet have created limitless possibilities for designing, developing and implementing innovative teaching methods. It appears that online learning is at least as effective, and often times more effective, than traditional, face-to-face classes. This "blended learning" approach combines the best pedagogical practices of an online learning community with the interaction of traditional, face-to-face learning.

Blended learning is an approach in education that combines both online materials, opportunities, and the traditional method. Multimedia such as image and sounds are used to make the educational process more effective, valuable, replicable and transferable. The uniqueness of the blended learning is represented by its ability to use the refined techniques from both, e-learning and traditional method, thus, the output will be a version of the best from each method; combines face-to-face interactions with technology-based learning, with the face-to-face interactions taking higher portion of the teaching time. Many educators have implemented this model into their classrooms to enhance effective teaching. The classroom may also be set up in a variance of ways. While the idea is to have the technology portion less than 50% of the time, teachers want to use the technology-based pieces as a way to enhance their instruction. Blended learning is a pedagogical approach that explicitly integrates online and face-to-face learning, and where students have meaningful interactions with their teacher with and without the mediation of electronic technology.

## Purpose of the Study

The study examined the effects of spaced-learning and blended learning on secondary schools students' interest in Biology in Ekiti State, the study examined

i. the difference in interest of students exposed to spaced learning, blended learning and conventional teaching strategies;
ii. the difference in interest of students exposed to spaced learning and blended learning before and after treatment;

**Research Questions**

1. What is the effect of spaced learning in eliciting students' interest in Biology?
2. What is the effect of blended learning in eliciting students' interest in Biology?

**Research Hypotheses**

1. There is no significant difference in the interest of students exposed to Spaced learning, Blended learning and Conventional strategies.
2. There is no significant difference in the interest of students exposed to Spaced Learning before and after treatment.
3. There is no significant difference in the interest of students exposed to Blended Learning before and after treatment.

**Methodology**

The study adopted a quasi – experimental pre-test and post-test three group design (two experimental groups and one control group). The homogeneity was established by pre-test while post-test was used after the treatment to measure students' interest. The design's pattern is shown below.

$E_1$: Experimental group 1 (E1) $O_1\ X_1\ O_2$
$E_2$: Experimental group 2 (E2) $O_3\ X_2\ O_4$
C: Control group (C) $O_5 X_c O_6$

Where:

$O_1$, $O_3$, $O_5$– (Observations before treatment)
$O_2$, $O_4$, $O_6$ – (Observations after treatment)
$X_1$ – Treatment (Spaced learning Strategy)
$X_2$ – Treatment (Blended learning Strategy)
$X_c$ – Treatment (Conventional Strategy)

The population of the study comprised all the public secondary schools in Ekiti State, Nigeria. Senior Secondary School (S.S.S.) II students offering Biology in all the public secondary schools were used. S.S.S. II students were used for the study because they had been taught some basic Biological concepts and could independently work with little or no supervision. The sample consisted of 149 students offering Biology (intact class size) which was drawn from 6 public secondary schools in Ekiti State, Nigeria. Multistage sampling procedure was used to select the samples used for the study.

Stage one; one Local Government Area (LGA) was selected from the three Senatorial Districts in Ekiti State using simple random sampling technique. The next stage involved the use of purposive sampling technique for selecting schools having electrical supply, computers and computer accessories. The third stage involved the use of random sampling technique to

group schools into different experimental and control groups. An intact class of Senior Secondary Class two (SSS II) students offering Biology from each of the six schools selected for this study were used.

One responsive and two stimuli instruments were used for collecting the data used for the study. The responsive instrument is Biology Interest Scale (BIS) and two stimuli instruments are;

1. Teachers' Instructional Guide on Spaced Learning Strategy (TIGSLS)
2. Teachers' Instructional Guide on Blended Learning Strategy (TIGBLS)

BIS consisted of two sections, Sections A and B. Section A sought for bio-data of the respondents while section B consisted of 20 items which sought for students' interest towards Biology.

## Results

**Research Question 1:** What is the effect of spaced learning in eliciting students' interest in Biology?

**Table 1:** Mean and Standard Deviation of Effect of Spaced Learning in Eliciting Students' Interest in Biology

| Strategy | Test | N | Mean | S.D | Mean Diff. |
|---|---|---|---|---|---|
| Spaced Learning | Before Treatment | 55 | 43.25 | 2.92 | 15.93 |
| | After Treatment | 55 | 59.18 | 1.45 | |

Table 1 shows the mean pre-treatment and mean post-treatment scores of interest of students exposed to spaced learning strategy. The mean pre-treatment score of interest of students is 43.25 while mean post-treatment score of interest of students is 59.18. The table above shows that the mean difference in students' interest in Biology between pre-treatment and post-treatment scores for spaced learning strategy is 15.93. The graphical representation below further shows the effect of spaced learning in eliciting students' interest in Biology.

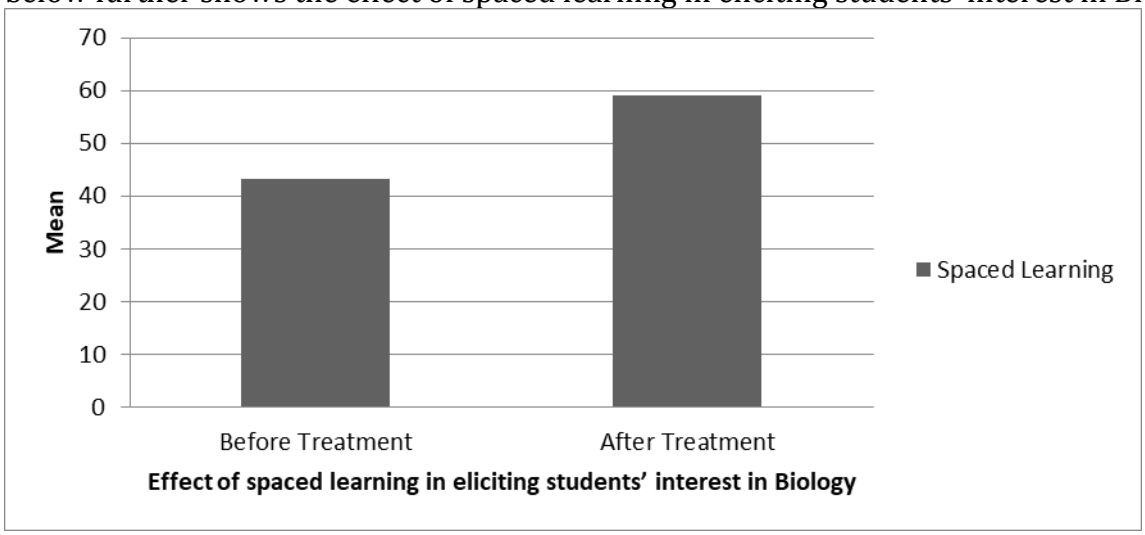

**Figure i:** Bar Chart Showing Effect of Spaced Learning in Eliciting Students' Interest in Biology.

**Research Question 2:** What is the effect of Blended Learning in eliciting students' interest in Biology?

**Table 2:** Mean and Standard Deviation of Effect of Blended Learning in Eliciting Students' Interest in Biology

| Strategy | Test | N | Mean | S.D | Mean Diff. |
|---|---|---|---|---|---|
| Blended Learning | Before Treatment | 40 | 42.73 | 2.40 | 26.30 |
| | After Treatment | 40 | 69.03 | 3.15 | |

Table 2 shows the mean pre-treatment and mean post-treatment scores of interest of students exposed to blended learning strategy. The mean pre-treatment score of interest of students is 42.73 while mean post-treatment score of interest of students is 69.03. The table above showed that the mean difference in students' interest in Biology between pre-treatment and post-treatment scores for blended learning strategy is 26.30. The graphical representation below further shows the effect of blended learning in eliciting students' interest in Biology.

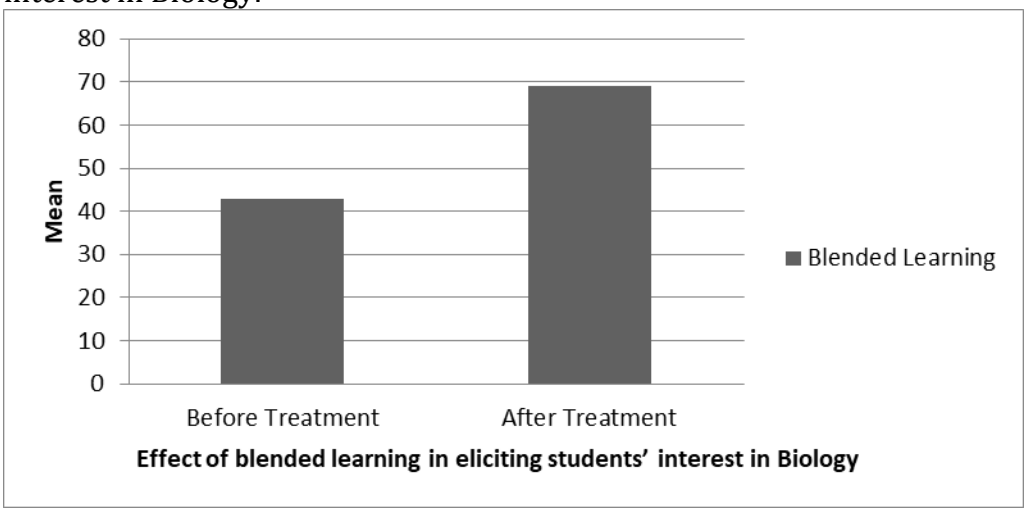


**Figure ii:** Bar Chart Showing Effect of Blended Learning in Eliciting Students' Interest in Biology

**Hypothesis 1:** There is no significant difference in the interest of students exposed to Spaced learning, Blended learning and Conventional strategies

**Table 3:** Analysis of Variance (ANOVA) for Difference in the Interest of Students Exposed to Spaced Learning, Blended Learning and Control Group

| Groups | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 2677.268 | 2 | 1338.634 | 315.996* | .000 |
| Within Groups | 618.490 | 146 | 4.236 | | |
| Total | 3295.758 | 148 | | | |

* P < 0.05

The result presented in table 3 showed that F-cal value of 315.996 is significant because the p value (0.000) < 0.05 at 0.05. Hence, the null hypothesis is rejected. This implies that there is significant difference in the interest of students exposed to spaced learning, blended learning and control group. In order to investigate the source of the differences observed, Post – hoc analysis (Scheffe) with mean difference was carried out.

**Table 4:** Scheffe Post – hoc test and Mean for Observed Difference in the Interest of Students in the Groups

| **Groups** | | **Spaced Learning** | **Blended Learning** | **Control Group** |
|---|---|---|---|---|
| | **Mean** | 59.18 | 69.03 | 59.78 |
| **Spaced Learning** | 59.18 | | | |
| **Blended Learning** | 69.03 | 9.8432* | | |
| **Control Group** | 59.78 | 0.5960 | 9.2472* | |

* P < 0.05

In table 4, a significant difference was found between the interest of students exposed to Spaced learning strategy and Blended learning strategy in favour of students exposed to Blended learning strategy. Also there was significant difference between the interest of students exposed to blended learning strategy and control group in favour of students exposed to blended learning strategy. However, there was no significant difference between the interest of students exposed to Spaced Learning strategy and Conventional strategy.

The result of post – hoc test also showed that, of all students exposed to Spaced learning, Blended learning and Conventional strategies, the interest of students exposed to Blended learning was the highest. Their interest in Biology was significantly better than those exposed to Spaced learning and Conventional strategies. Again, the interest of students in Biology exposed to Conventional strategy was better than those in Spaced Learning, implying that the interest of students in Biology exposed to Spaced Learning strategy was the least.

**Hypothesis 2:** There is no significant difference in the interest of students exposed to Spaced Learning before and after treatment.

**Table 5:** T-test Analysis for Difference in the Interest of Students Exposed to Spaced Learning Before and After Treatment

| **Variations** | **N** | **Mean** | **SD** | **df** | **$t_{cal}$** | **P** |
|---|---|---|---|---|---|---|
| Before Treatment | 55 | 43.25 | 2.92 | 108 | 36.210 | 0.000 |
| After Treatment | 55 | 59.18 | 1.45 | | | |

P>0.05

Table 5 shows that the t-cal value of 36.210 is significant because the P value (0.000) < 0.05. This implies that null hypothesis is rejected. Hence, there is significant difference in the interest of students exposed to Spaced Learning before and after treatment. The mean score showed a significant difference of 15.93.

**Hypothesis 3:** There is no significant difference in the interest of students exposed to Blended Learning before and after treatment

**Table 6:** T-test Analysis for Difference in the Interest of Students Exposed to Blended Learning Before and After Treatment

| Variations | N | Mean | SD | df | $t_{cal}$ | P |
|---|---|---|---|---|---|---|
| Before Treatment | 40 | 42.75 | 2.40 | 78 | 42.026 | 0.000 |
| After Treatment | 40 | 69.03 | 3.15 | | | |

P>0.05

Table 6 shows that the t-cal value of 42.026 is significant because the P value (0.000) < 0.05. This implies that null hypothesis is rejected. Hence, there is significant difference in the interest of students exposed to blended learning before and after treatment. The mean score showed a significant difference of 26.28.

**Discussion**

In a normal classroom interaction, there is need to use modern and learner centred approaches like Spaced and Blended learning teaching strategies so as ensure effective teaching and learning. It is worthy of note that, the quality of teaching and learning is a viable parameter that determines the interest of students in Biology and successful implementation of the Senior Secondary School Biology curriculum.

The findings of this study showed significant difference in students' interest in Biology between the experimental groups and control group. The findings of this study revealed significant difference in students' interest in Biology when exposed to Spaced Learning and Blended Learning because; it integrates the use of repetition, face to face and technology interaction which facilitates proper assimilation and comprehension. It is evident that, the use of resources that captivated the attention of students, motivated their interest and materials that appealed to both their senses of sighting, hearing, feeling and engagement elicited their curiosity, interest and performance in Biology. This study is in conformity with the findings of Audu (2018) that the use of appropriate teaching techniques by teacher during the teaching-learning process enhances students' interest and performance in Biology.

The findings of this study indicated that there was significant difference in the interest of students exposed to the three strategies; Spaced Learning, Blended Learning and Conventional strategies, students exposed to Blended Learning strategy performed better than those exposed to Spaced Learning and the conventional strategies and this might be as a result of Blended learning having the features of audio, visual and audio-visual materials which aided the students in comprehension, assimilation and retention of the concept taught. This study agrees with the findings of Sobel, Cepeda, and Kapler (2011) that the effective and efficient use of Spaced Learning enhances students' interest in Biology, Spaced learning having the feature of spacing out the learning content over it being massed could have aided students' understanding in that, Spaced Learning allows students mind to be actively ready to learn and be void of impediments, the ability of engaging the students in some physical activities or educational stimulant, creates in them the curiosity and readiness to learn and these stimulants when well-structured could aid transfer of knowledge or experience in other

fields or area. The findings of this study also agrees with that of Aladejana (2009), Yapici and Akbayin (2012), and Chandra and Watters (2012) that Blended learning strategy application in some schools yielded better results than the conventional strategy because, it gives flexibility for students' learning in terms of learning style and study time, it improves students' experience and enhances their engagement.

**Conclusion**

Based on the findings of this study, it could be concluded that, the three groups Spaced Learning, Blended learning and Conventional were homogeneous at the commencement of the experiment. The use of Spaced Learning, Blended Learning and Conventional strategy enhanced the interest of students in Biology, while Blended Learning is the most effective.

**Recommendations**

Based on the findings of this study, the following recommendations were made.

1. In other to enhance the interest of students in Biology, the use of Spaced Learning and Blended Learning strategies should be encouraged in Biology class in secondary schools.
2. Seminar and workshops should be organised for teachers so as to; update their knowledge in the use of Spaced Learning Blended Learning strategies in teaching and slides should be included in Biology textbooks which is needed to accommodate the use of Blended Learning.
3. Teachers should manage the time allocated well to accommodate the use of Spaced Learning during teaching-learning process so as to foster proper comprehension.
4. Electricity, electrical facilities, Computers, Computer accessories and Internet facilities should be provided to schools.

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