

Effects of Spaced Learning and Blended Learning On Senior Secondary School Students' Performance in Biology in Nigeria

AUTHOR(S): ADELEYE, Ademola Moffy Ph.D.
AND
AKINNODI, Oladamola Dickson

Abstract

The study investigated the effects of Spaced and Blended Learning teaching strategies on the performance of senior secondary school students in Biology in Nigeria. Specifically, the study was designed to ascertain the difference in the pre-test and post-test mean scores of students in experimental and control groups. The study investigated the difference in the performance of students based on their gender and school location. The study adopted quasi – experimental pre-test and post-test three group research design. The sample consisted of 149 S.S.S. 2 students drawn from Government owned secondary schools in Nigeria. The sample was selected using multistage sampling procedure. One research instrument namely Biology Performance Test (BPT) was used to collect relevant data used for the study. The face and content validity of the instrument was ensured while the reliability of the instrument was determined using Kuder-Richardson (K20) which yielded reliability co-efficient value of 0.87. The data were analyzed using descriptive statistics and inferential statistics. The findings of the study showed that the three groups were homogeneous at the commencement of the experiment. The use of Spaced Learning and Blended Learning enhanced better performance of students in Biology than the conventional strategy, Spaced Learning and Blended Learning strategies are not gender and location biased. Based on the findings of the study, it was recommended among

CJAR

Accepted 1 June 2020
Published 6 June 2020
DOI: 10.5281/zenodo.3883119



others that the use of Spaced Learning and Blended Learning strategies should be encouraged in Biology class in secondary schools so as to enhance better academic performance of students in Biology.

Keywords: Spaced Learning, Blended Learning, Performance, Biology,

About Author

Author(s): ADELEYE, Ademola Moffy Ph.D.

DEPARTMENT OF SCIENCE EDUCATION,
FACULTY OF EDUCATION, EKITI STATE UNIVERSITY, ADO – EKITI, NIGERIA.

AND

AKINNODI, Oladamola Dickson

DEPARTMENT OF SCIENCE EDUCATION,
FACULTY OF EDUCATION, EKITI STATE UNIVERSITY, ADO – EKITI, NIGERIA.

Introduction

Biology occupies a unique position in the secondary school education curriculum because of its importance as science of life. In Nigeria, the secondary school Biology curriculum is designed to allow students' investigation into natural phenomena, to deepen students' understanding of Biological sciences, and also to encourage students' ability to apply scientific knowledge to everyday life in matters of personal, community, health and agriculture among others (Federal Ministry of Education, 2009).

The objectives of the Biology curriculum have been adjudged as laudable according to Soyibo (2008) and Yabugbe (2009) and there is evidence to show that even though many students find biology interesting, thereby registering for it in the senior secondary schools, many of them obtain poor results in the subject year in, year out. (Okebukola & Akinbola, 2008; Adewale, Nzewuihe & Ogunshola 2016). Regardless of the high number of students' enrolment in Biology in the senior school examinations conducted by West African Examination Council (WAEC) and National Examinations Council (NECO), reports from scholars and educators (Biology Chief Examiner's Report, Ige, 2009; Opara, 2011; Ogunbanwo, 2014) indicated that students' performance in Biology in the external examinations is poor.

One wonders whether it is because of lack of infrastructural facilities or the teaching methods in use. The poor performance of students in Biology in external examination according to Isiugo-Abanihe, Ifeoma and Tandi (2010) is linked to the use of conventional strategy in teaching secondary school Biology. The conventional teaching strategy often used by teachers in teaching Biology includes the lecture/expository method, demonstration and direct instruction among others. The quest to curtail the shortcomings of the conventional methods used in teaching and learning of Biology culminated in the discovery and suggestions by some researchers (Opara, 2011; Omotayo, Adedayo & Ayeni, 2014), for the use of innovative teaching methods such as inquiry method, blended learning, concept mappings, simulations and games, spaced-learning, constructivism, problem based learning among others. The innovative methods are considered as effective teaching methods that can improve on students' performance in Biology and this why the researcher is interested in examining the effects of two innovative strategies which are Spaced Learning and Blended Learning on academic performance of students in Biology.

Spaced Learning is a teaching strategy in which highly condensed learning content is repeated over time, with two 5–10 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). Spaced Learning is a teaching strategy which has used results from neuroscience research as the basis for its design. More specifically, a neural pathway needs repeated stimulation with a separation of at least ten minutes between stimulatory inputs in order for optimal memory retention to be attained. The ten minute gaps between stimulation represent the time needed to allow molecular processes within the neurons to take place, in order to strengthen the synaptic connections involved in creating a long-term memory (Cohen & Yean, 2013).

Blended learning is a teaching strategy that converts the curriculum into computerized topics and multimedia such as image and sounds to make the educational process more effective and valuable. According to Kuo, Belland, Schroder, and Walker (2014), blended learning is an approach that combines face-to-face interactions with technology-based learning. Blended learning can also be referred to as hybrid learning and it is based upon



face-to-face interactions 67% of the time and technology interactions 33% of the time. Activities carried out during the usual teaching hour are not sufficiently effective because of time constraints hence, with the blended learning model, students are able to carry out multimedia applications – which cannot be sufficiently taught during lessons - via the Internet (Moskal, Dziuban, & Hartman, 2013).

Purpose of the Study

The study examined the effects of spaced-learning and blended learning on secondary schools students' academic performance and Biology in Nigeria. The study specifically examined:

- i. the difference in the performance of students exposed to spaced learning, blended learning and conventional teaching strategies before and after treatment;
- ii. the influence of gender on the academic performance of students exposed to spaced learning and blended learning; and
- iii. the influence of location on the academic performance of students exposed to spaced learning and blended learning.

Research Question

The following null question was generated for this study:

1. What are the effects of spaced learning, blended learning and conventional strategies on the academic performance of students in Biology?

Research Hypotheses

The following null hypotheses were generated for this study:

1. There is no significant difference in the pre-test mean score of students exposed to Spaced Learning, Blended Learning and Conventional strategies.
2. There is no significant difference between the pre-test and post-test mean score of students exposed to Spaced Learning, Blended Learning and Conventional strategies.
3. There is no significant gender difference in the academic performance of students exposed to Spaced Learning.
4. There is no significant gender difference in the academic performance of students exposed to Blended Learning.
5. There is no significant location difference in the academic performance of students exposed to Spaced Learning.
6. There is no significant location difference in the academic performance of students exposed to Blended Learning.

Methodology

This study adopted a quasi – experimental pre-test and post-test three group design (two experimental groups and one control group). The base line of the knowledge of students that was used for the study and homogeneity was established by pre-test while post-test was used after the treatment to measure students' academic performance. The pattern of the design is as 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:

O₁, O₃, O₅ – (Observations before treatment)

O₂, O₄, O₆ – (Observations after treatment)

X₁ – Treatment (Spaced learning Strategy)

X₂ – Treatment (Blended learning Strategy)

X_c – Treatment (Conventional Strategy)

The population of the study comprised all Senior Secondary School S.S.S. II students offering Biology in all the public secondary schools in Ekiti State, Nigeria. The choice of S.S.S. II students was considered more appropriate because they had been exposed to some basic Biological concepts and majority of the students were able to independently work with little supervision. The sample consisted of 149 students offering Biology (intact class size) drawn from 6 public secondary schools in Ekiti State, Nigeria. The sample was selected using multistage sampling procedure.

In 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 stratified random sampling technique to select two public secondary schools from each of the three LGAs earlier selected bearing in mind location (a school each from rural and urban areas). The third stage involved the use of purposive sampling technique for selecting schools having electrical supply, computers and computer accessories. The fourth 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 students offering Biology from each of the six schools selected for this study were used.

Three instruments (one responsive and two stimuli instruments) were used for collecting the data used for the study. The responsive instrument is Biology Performance Test (BPT). The two stimuli instruments are;

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

BPT was used to measure performance of students in Biology. It consisted of two sections, Sections A and B. Section A sought for the bio-data of the respondents which include the name of the school, identification number, school location and sex. Section B consisted of 60 objectives items with four options (made of 15 questions on Knowledge, 15 questions on Comprehension, nine questions on Application, nine questions on Analysis, six questions on Synthesis and six questions on Evaluation). The items covered all the topics to be taught during the course of the study. The BPT was used for both pre-test and post-test data collection. The pre-test was designed to test the homogeneity of the three groups. The options of the questions of BPT used for pre-test was reshuffled for the post-test in order to prevent carry-over effect.

Experimental Procedure

The study was carried out in three phases and lasted for eight weeks (six weeks for treatment and a week each for pre and post test)

Phase I: Pre-treatment Stage (One week)

To carry out the research in the schools, the researcher obtained permission from the authorities of the six schools. A day workshop on the use and application of spaced and blended learning strategies was organized for the research assistants from the selected schools and they were trained on how to use TIGSLS and TIGBLS during teaching-learning process. The researcher administered the pre-test BPT on both experimental and control groups in order to ascertain the homogeneity of the three groups.

Phase II: Treatment Stage (Six weeks)

Spaced Learning: Students were exposed to forty minutes of teaching and learning thrice per week based on school timetables. Students were involved in eighteen sessions consecutively, covering all the topics using the spaced learning strategies. There is one to one step of both teachers and students, when the teacher introduces or gives the definition of the concept, the students would take some jottings from the board, the teacher with a concrete diagram

explains the male and female reproductive systems, the students would make drawings in their notes, the teacher engages the students in some distractor activities; the playing of puzzle game for some minutes, which is related to the topic which will serve as stimulation to the students towards the topic, students would also interact with each other in the process, the teacher revises the previous teachers' activities, the students asks questions from the teacher and the teacher answers the students' question and gives more explanations, the teacher explains the functions and attributes of the concept, he asks the students question on their awareness and understanding of the concept, students answers questions asked by teacher, the teacher shows the diagram and describe concept, the students are engaged in some distractor activities (Puzzle Game) for some minutes. The teacher evaluates and summarises the whole lesson.

Blended Learning: The training package consisted of a lesson plan on blended learning strategy for teachers. The teacher gives the topic and concepts to be taught to students before the real class session. Students surf the internet, consult their textbooks for various view of the concepts, make their jottings, the teacher listens to the variant views of the students, the teacher asks questions from the students and gives his own view, students interacts with each other, they discuss with each other, exchange their various views with each other, the teacher teaches the students and later expose them to multimedia instruction power point projection of what has been taught and discussed, the students pays attention and keen interest to what is been displayed, make jottings, asks questions from the teacher, the teacher takes his time to answer the students' question and also give further explanation as might be due. The students would be actively involved in the whole classroom section while the teacher would also be active but, not dominating, after having the various view of the students and the multimedia exposure, the teacher would asks question from the students, give his view and together with the students have a consensus agreement, summarises the whole lesson and gives the students notes.

Phase III: Post-treatment Stage (One week)

At the end of the treatment stage, BPT was re-administered on the students to determine the effects of the treatment on them. The options of the same BPT used during the pre-test were re-arranged to avoid test-wiseness and administered to the experimental and control groups.

Results

Research Question 1: What are the effects of spaced learning, blended learning and conventional strategies on the academic performance of students in Biology?

Table 1: Mean and Standard Deviation of Pre-Test and Post-Test Scores of Students Exposed to Spaced Learning, Blended Learning and Conventional Strategies

Strategies	Test	N	Mean	S.D	Mean Diff.
Spaced Learning	Pre Test	55	13.71	1.45	18.47
	Post Test	55	32.18	2.21	
Blended Learning	Pre Test	40	13.93	1.35	31.72
	Post Test	40	45.65	2.65	
Conventional	Pre Test	54	14.19	1.07	7.81
	Post Test	54	22.00	8.46	

From Table 1, it is shown that the mean difference in students' performance in Biology between pre-test and post-test scores for spaced learning strategy is 18.47, blended learning is 31.72 and conventional strategy is 7.81. It appears that the use of Spaced learning, Blended learning and Conventional strategies influences students' performance in Biology with

blended learning strategy being the most effective strategy in the teaching of Biology. The graphical representation below further shows the most effective strategy in the teaching of Biology.

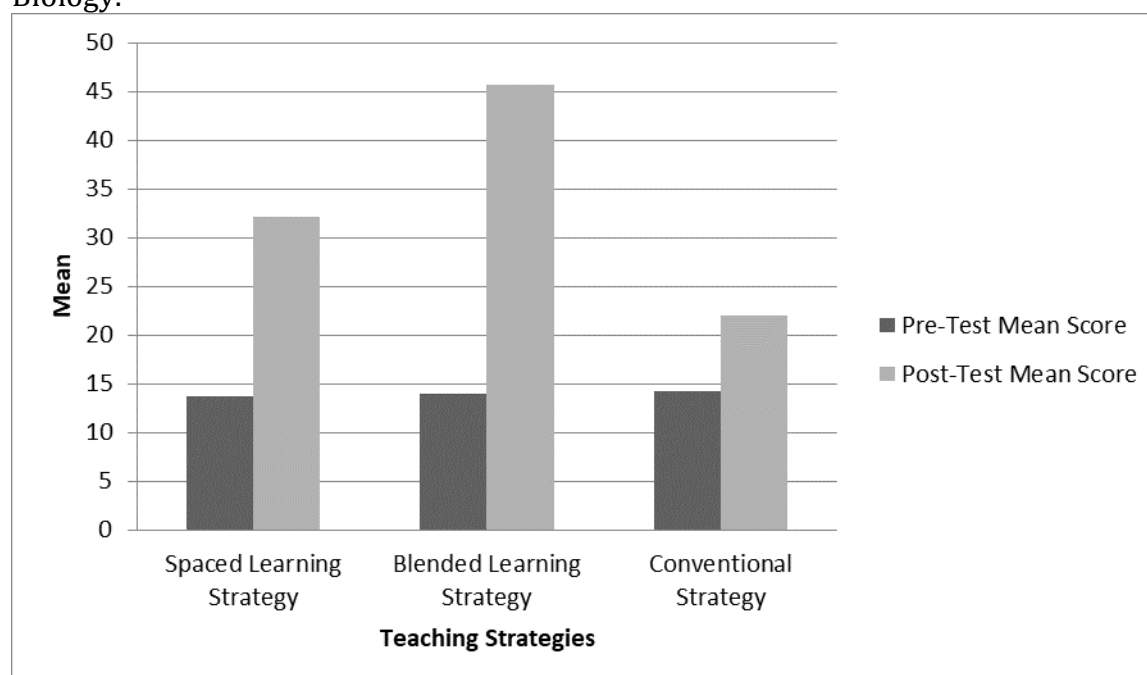


Figure i: Bar Chart Showing Pre-Test and Post-Test Mean Scores of Students Exposed to Spaced Learning, Blended Learning and Conventional Strategies

Test of Hypotheses

Hypothesis 1: There is no significant difference in the pre-test mean scores of students exposed to Spaced Learning, Blended Learning and Conventional strategies.

Table 2: Analysis of Variance (ANOVA) for Difference in Pre-Test Mean Score of Students in Experimental and Control Groups

Groups	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.188	2	3.094	1.849	.161
Within Groups	244.269	146	1.673		
Total	250.456	148			

$P > 0.05$

The result presented in table 2 showed that F-cal value of 1.849 is not significant because the p value (0.161) > 0.05 at 0.05 level of significance. Hence, the null hypothesis is not rejected. This implies that there is no significant difference in the pre-test mean score of students exposed to spaced-learning, blended learning and control groups. The students in the groups are homogeneous at the commencement of the study.

Hypothesis 2: There is no significant difference between the pre-test and post-test mean scores of students exposed to Spaced Learning, Blended Learning and Conventional strategies.

Table 3: Analysis of Covariance (ANCOVA) for Pre – test and Post – test Mean Scores of Students under the Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	13041.990 ^a	3	4347.330	151.054*	.000

Intercept	550.458	1	550.458	19.126*	.000
Pre-test	88.990	2	44.495	1.546	.111
Groups	13021.312	2	6510.656	226.222*	.000
Error	4144.291	144	28.780		
Total	170688.000	149			
Corrected Total	17086.282	148			

a. R Squared = .759 (Adjusted R Squared = .754) * P < 0.05

The result presented in table 3 shows that there is a significant difference in the pre – test and post – test mean scores of students in the groups (spaced learning, blended learning and control groups) as $P = 0.000 < 0.05$. There is a strong evidence to reject the null hypothesis which states that there is no significant difference between the pre-test and post-test mean score of students exposed to spaced learning, blended learning and control groups. This result led to the rejection of the null hypothesis. By implication, there is significant difference between the pre-test and post-test mean score of students exposed to spaced-learning, blended learning and control groups. In order to find out the most probable effective strategy, Multiple Classification Analysis (MCA) was carried out. The result is shown in Table 4.

Table 4: Multiple Classification Analysis (MCA) of Students' Performance in Biology by Treatment

Grand Mean = 33.28					
Variable + Category	N	Unadjusted Dev'n	Eta ²	Adjusted Independent + Covariate	for Beta
Experimental (Spaced Learning)	55	-1.1	.84	0.99	.09
Experimental (Blended Learning)	40	12.37		12.29	
Control	54	-11.28		-11.19	
Multiple R					.871
Multiple R ²					.759

The result in Table 4 shows the Multiple Classification Analysis (MCA) of students' performance in Biology by treatment. It reveals that, with a grand mean of 33.28, students exposed to blended learning had highest adjusted mean score of 45.65 ($33.28 + 12.37$) than their counterparts in spaced learning and the control group with spaced learning having 32.18 ($33.28 + (-1.1)$) and control group 22.00 ($33.28 + (-11.28)$). This means that blended learning strategy was the most effective strategy of teaching Biology in Ekiti State, Nigeria. Followed by spaced learning strategy and the least was conventional strategy. The treatment explained about 84% ($Eta^2 = 0.84$) of the observed variance in students' performance in Biology. The three treatment strategies accounted for 75.9% ($R^2 = 0.759$) contribution to academic performance of the students in Biology.

Hypothesis 3: There is no significant gender difference in the academic performance of students exposed to Spaced Learning

Table 5: T-test Analysis for Gender Difference in the Academic Performance of Students Exposed to Spaced Learning

Variations	N	Mean	SD	df	t _{cal}	P
Male	27	32.22	2.14	53	0.132	0.896

Female	28	32.14	2.32			
--------	----	-------	------	--	--	--

P>0.05

Table 5 shows that the t-cal value of 0.132 is not significant because the P value (0.896) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to Spaced Learning.

Hypothesis 4: There is no significant gender difference in the academic performance of students exposed to Blended Learning

Table 6: T-test Analysis for Gender Difference in the Academic Performance of Students Exposed to Blended Learning

Variations	N	Mean	SD	df	t _{cal}	P
Male	21	45.81	2.69	38	0.396	0.694
Female	19	45.37	2.65			

P>0.05

Table 6 shows that the t-cal value of 0.396 is not significant because the P value (0.694) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant gender difference in the academic performance of students exposed to Blended Learning.

Hypothesis 5: There is no significant location difference in the academic performance of students exposed to Spaced Learning

Table 7: T-test Analysis for Location Difference in the Academic Performance of Students Exposed to Spaced Learning

Variations	N	Mean	SD	df	t _{cal}	P
Urban	32	32.00	2.42	53	0.716	0.477
Rural	23	32.43	1.90			

P>0.05

Table 7 shows that the t-cal value of 0.716 is not significant because the P value (0.477) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant location difference in the academic performance of students exposed to Spaced Learning.

Hypothesis 6: There is no significant location difference in the academic performance of students exposed to Blended Learning

Table 8: T-test Analysis for Gender Difference in the Academic Performance of Students Exposed to Blended Learning

Variations	N	Mean	SD	df	t _{cal}	P
Urban	19	45.68	2.96	38	0.077	0.939
Rural	21	45.62	2.40			

P>0.05

Table 8 shows that the t-cal value of 0.077 is not significant because the P value (0.939) > 0.05. This implies that null hypothesis is not rejected. Hence, there is no significant location difference in the academic performance of students exposed to Blended Learning.

Discussion

This finding established the homogeneity of the three groups involved in the study prior to the experiment. In other words, it could be said that the knowledge baseline for the three groups involved in the study are equal. Consequently, any significant difference recorded afterwards would not be ascribed to chance, but to the specific treatment applied.

The findings of this study indicated that there was significant difference in the post-test mean scores of students exposed to the three strategies; Spaced Learning, Blended Learning and conventional strategies. There was a better improvement in the performance of students resulting from their exposure to Spaced Learning and Blended Learning strategies.

This implies that the introduction of Spaced Learning and Blended Learning to the experimental group made them to perform better than the control group that was not exposed to treatment. The performance of students were observed to increase after being exposed to the Spaced Learning and Blended Learning 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' academic performance 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 Piaget's Cognitive theory is in support of the steps involved in Spaced Learning, the theory stresses the readiness of learners, invention and discovery after which, there would be retention and transfer of knowledge. The findings from the hypothesis on gender difference between the experimental groups showed no significant difference. This means that, gender has nothing to do with students' response to the use of any of the instructional strategies i.e. Spaced Learning and Blended Learning. The findings agreed with Gambari and Adegbenro (2008), Osemmwinyen (2009), Ogunojemite, Omotayo and Jegede, 2009; Oludipe, 2012 and Nwagbo & Chukelu, 2014 who observed that gender has no effect on students' academic performance in Biology. But, the findings contradicted the report of Benson (2011), Olatunbosun (2011) Omotayo, Adedayo and Ayeni (2014) who in their study found that significant differences exist in the academic performance of male and female students in Biology.

The finding further disclosed that there was no significant difference between the academic performance of students in urban and rural areas exposed to Spaced and Blended Learning strategies. By implication, Spaced and Blended Learning strategies are not location biased because location of the student has no influence on their academic performance when taught Biology using Spaced and Blended Learning strategies. This result supports the findings of Ajayi (2016), and Kolawole and Olofin (2018) who concluded in their study that there is no significant difference in the performance of students in rural and urban settings. But the result contradicted the findings of Opara (2011), Umar and Samuel (2018) who concluded that students in urban settings performs better their counterparts in rural settings because, those in urban settings are readily funded by government and has access to other educational facilities.

Conclusion

Based on the findings of this study, it is concluded that, the three groups Spaced Learning, blended learning and Conventional were homogeneous at the commencement of the study. The use of Spaced Learning, Blended Learning and Conventional strategy enhanced performance of students in Biology, while Blended Learning is the most effective. Spaced and Blended learning strategies are not gender biased and potent in all locations.

Recommendations

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

1. The use of Spaced Learning and Blended Learning strategies should be encouraged in Biology class in secondary schools so as to enhance better academic performance of students in Biology.
2. Biology teachers should be given adequate orientation through workshops and seminars to update their knowledge in the use of Spaced Learning Blended Learning strategies in teaching.
3. Slides should be included in Biology textbooks which is necessary so as to accommodate the use of Blended Learning.

References

- Adewale A.M, Nzewuihe. G. & Ogunshola .F. (2016). Academic Performance in Biology at Senior Secondary School Certificate Examination (SSCE) and the Influencing Factors among Students in Owerri Municipal of Imo State, Nigeria. *International Journal of Education and Evaluation*. 2 (1), 155-159
- Ajayi, L.F. (2016). Effects of collaborative learning on sex, location and attitude towards chemistry among secondary school students in Nigeria. *Journal of Research in Science Education*, 1(1), 67 - 75
- Benson A.A. (2011). Effects of multimedia instruction on senior secondary school Students' Performance and interest in Physics. *European Journal of Educational Studies*, 3(3), 537 – 548
- Cohen, M.S & Yean, V.X. (2013). Do students think that difficulty or valuables materials should be restudied sooner rather than later? *American Psychological Association*.
- Federal Ministry of Education (2009). *Senior Secondary School Curriculum Biology*.
- Gambari, A. I. and Adeghenro, D. V. (2008). Effects of computer assisted instruction on mathematics performance and interest amongst students in Minna Metropolis. *Ilorin Journal of Education*, 27, 63-70.
- Ige, A. (2009). Strategies for Improving Biology Teachers for Optimum Performance. [on line] available, @ <http://en.oboulo.com/>
- Isiugo-Abanihe, M.; Ifeoma, L; andTandi, I. (2010).Evaluation of the Methodology Aspect of Science Teacher Education Curriculum in Nigeria. *Pakistan Journal of Social Sciences* 17 (2) 170-176.
- Kolawole, E.B & Olofin S.O. (2018): Effects of Goal Setting Skills and Peer Modelling Strategies on Academic Performance of Ekiti State Students in Mathematics. In Book of Reading of Prof. Onwuamanam, Ado-Ekiti University Press. 293-303
- Kuo, Y., Belland, B. R., Schroder, K. E., & Walker, A. E. (2014).K-12 teachers' perceptions of and their satisfaction with interaction type in blended learning environments. *Distance Education*, 35(3), 360-381.



- Moskal, P., Dziuban, C., & Hartman, J. (2013). Blended learning: A dangerous idea? *Internet and Higher Education*, 18, 15-23.
- Nwagbo, .C. & Chukelu, U. C. (2014). Effects of Biology Practical Activities on Students' Process skill Acquisition. *Journal of Science Teachers Association of Nigeria*, 46. (1), 58-70
- Ogunbanwo, R.A. (2014), Analysis of Students' Performance in West Africa Senior Certificate Examination s in Boarding and Day Secondary Schools in Kano Metropolis, Nigeria. *A Thesis* submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria.
- Ogunojemite G.B, Omotayo K.A & Jegede S.A (2009) Educational Technology: The influence of Gender on performance and interest in Nigeria Universities . *International Journal of Research in Education*, 2(2), 56 - 62
- Okebukola, P. &Akinbola, U. (2008).Resources for teaching. *Science Education Review* 3, (1), 10-14.
- Olatunbosun, S.M. (2011). The level of acquisition of Chemistry. Practical skills among senior secondary school students in Ekiti State, Nigeria. *Research in Curriculum studies*. 6(1), 87-92
- Oludipe, O. I. (2012). Gender Difference in Nigerian Junior Secondary Students' Academic Performance and interest in Basic Science. *Journal of Education and Social research*, 2 (1), 93-99.
- Omotayo K.A, Adedayo J.O and Ayeni M.F (2014). Science Education Reform Effort: Effect of Utilising Laboratory Method of Instruction on Students' Performance in Science. *Asian Journal of Education and e-learning*, 2(3), 110 - 119
- Opara, J. A. (2011). Inquiry Method and Students' Academic Performance and interest in Biology: Lessons and Policy Implications: *American-Eurasian Journal of Scientific Research*, 6 (1), 28-31.
- Osemwinyen, A. C. (2009). *Effects of e-learning on retention and performance and interest in secondary school mathematics in Abuja, Nigeria* (Unpublished doctoral dissertation). University of Nigeria, Nsukka
- Sobel, H. S., Cepeda, N. J., & Kapler, I. V. (2011). Spacing effects in real-world classroom vocabulary learning. *Applied Cognitive Psychology*, 25, 763-767.
- Soyibo (2008).Attitude and performance and interest in Biology.*Journal of Teachers' Association*. 20 (2), 26 – 36.
- Umar, U.S. & Samuel, R.I. (2018). School location as correlate of students' achievement in Basic Science. *International journal of innovative research*. 6(3), 14-17.
- Yabugbe. (2009). Recent advances in science teaching in Nigeria. *Journal of Teaching and Learning* 3 (1), 6-10.



Cite this article:

Author(s), ADELEYE, Ademola Moffy Ph.D., AKINNODI, Oladamola Dickson, **(2020)**. "Effects of Spaced Learning and Blended Learning On Senior Secondary School Students' Performance in Biology in Nigeria". **Name of the Journal:** Commonwealth Journal of Academic Research, (CJAR.EU), P, 53- 65. **DOI:** <http://doi.org/10.5281/zenodo.3883119> , Issue: 3, Vol.: 1, Article: 6, Month: June, Year: 2020. Retrieved from <https://www.cjar.eu/all-issues/>

Published by



AND

ThoughtWares Consulting & Multi Services International (TWCMSI)

