# Comparative Effects of Blended and Non-Blended Learning Strategies on Students' Achievement in Basic Science

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#### ABSTRACT

The study investigated the comparative effects of blended and non-blended learning strategies on students' achievement in basic science in Onitsha Education Zone, Anambra State, Nigeria. The study specifically adopted the pretest posttest nonequivalent control group design. Two research questions and three null hypotheses guided the study. The population of the study comprised all the 2,479 JSS2 students from the 19 co-educational secondary schools in the zone. Simple random sampling technique was used to select two schools out of which 91 basic science students from two intact classes, one for the experimental and the other for the control, made up the sample size for the study. The validated instrument tagged "Basic Science Achievement Test" (BSAT) with reliability co-efficient of 0.87 was used to collect data for the study. Mean and standard deviation were used to answer the research questions while analysis of co-variance (ANCOVA) was used to test the null hypotheses. The results revealed that blended learning strategy (BLS) is more effective in enhancing students' achievement in basic science than the non-blended learning strategy (NBLS) irrespective of gender. Based on the findings of this study, it was recommended that basic science teachers should adopt the blended learning strategy for the purpose of improving students' achievement irrespective of gender.

Keywords: Blended learning strategy, Non-blended learning strategy, Achievement, Gender, Basic science.

#### Introduction

Science education plays a very important role in the development of a nation's knowledge base and economy. Every nation needs to equip her citizenry with adequate scientific knowledge and skills to be able to compete favorably globally. Science education is concerned with providing a nation with a scientifically literate people capable of making rational thoughts. To achieve this, a solid scientific foundation must be put in place in schools. The Federal Government of Nigeria discovered this in time and provided a foundational science subject in the primary and junior secondary schools. This subject was aptly named basic science.

Basic science was introduced in an attempt to teach science as a unified whole. It aims at providing a holistic view of science and technology content to the young learners. Its content basically integrates all the various components of sciences being presented to the learner in a holistic manner. It is the basis of science in actual fact. Basic science equips students with the necessary introductory scientific and technological knowledge and skills necessary to build a progressive society and this form the bedrock on which further scientific and technological studies rest. It is therefore imperative that junior secondary school students be well grounded in basic science to be able to study the core science subjects at the senior secondary school level.

Despite the overly important position occupied by this subject, it has been sadly noted that the performance of basic science students in both internal and external examinations is not encouraging. Performance reports by the Examination Development Center (EDC), Anambra state (2012-2017) have shown a persistent on-the-average achievement of students in this subject. This poor achievement is believed to have found its way into the senior secondary schools where the same students have been reported to perform even poorer in the core sciences. The report further stressed that students' poor achievement in basic science could be, among other factors, a result of poor teaching strategies employed by the teachers. This agrees with the research findings of Njoku (2002) and Oludipe (2012) who in their respective studies discovered some causes of this poor performance of basic science students, some of which are students' poor attitude towards the subject, teachers' inability to win and sustain students interest during basic science lessons, lack of modern science equipment for teaching basic science in schools and inability of the teachers incorporate learner- centered teaching methods. Gambari, Yaki, Gana and Ughovwa (2014) in their study recommended that innovative ICT based teaching strategies should be adopted more often in science classrooms. An example of such innovative teaching method is the blended learning strategy.

The blended learning strategy involves the effective combination of different modes of lesson delivery, models of teaching and styles of learning which are exercised in an interactively meaningful learning environment. Blended Learning courses combine multimedia and classroom learning activities and uses digital resources in an optimal way in order to improve student learning outcomes (Garrison, 2004). Blended learning combines the best features of classroom interaction and multimedia based teaching method. Blended learning strategies in this study refer to a teaching method involving both face-to-face/live instruction and multimedia/digital based instruction. It involves the effective combination of digital resources and traditional method of lesson delivery.

Many studies carried out in different subject areas on the comparative effectiveness of media based learning and the traditional method of instruction revealed that students taught with media based learning achieved higher than their counterparts taught with the traditional method of instruction (Gambari, Yaki, Gana & Ughovwa, 2014; Rotimi, Ajogbeje, Akeju, & Simpson, 2012; Vebrianto & Osman, 2011; Serin, 2011). This could be because of the interesting nature of the instructional technique. In this study, learning materials on the concept of energy was prepared using blended learning strategies for the experimental group to find out if there will be an improvement in the students' academic achievement.

Academic achievement is the extent to which a student has achieved his/her short or long term goals. Nwana (2007) defined achievement as the attained ability or degree of competence in school tasks usually measured by standardized tests and expressed in grades. According to Mutua (2015), academic achievement is the successful completion, through effort, of the acquisition of academic content and skills which is determined by the scores or grades that students get in an examination or test.

There has been a report of persistent on-the-average academic performance of basic science students in both internal and external examinations (EDC, 2017). Njoku (2002); Afuwape and Oludipe (2008);Oludipe (2012); Gambari, Yaki, Gana and Ughovwa, (2014) in their various studies attributed this persistent poor achievement of basic science students to lack of understanding of the questions, poor observation skills, and poor teaching methods and strategies employed by the teacher. These studies advocated the need for teachers to employ learner-centered teaching methods that will be innovative and fun. This type of learning strategy should be able to enhance the academic achievement of students irrespective of gender.

Gender is a socially ascribed attribute which differentiates males from females (Elitzen, 2006). According to Udosoro (2011), gender is a cultural construct that distinguishes the roles, behavior, mental and emotional characteristics between males and females developed by a society. Several studies have been done to find out if gender really has an effect on achievement in science in general and basic science in particular. Unfortunately, the findings are contradictory. For instance, Oludipe in his study on the influence of gender on junior secondary school students in basic science using cooperative learning teaching strategy discovered that there was no significant difference in the academic achievement of male and female students (Oludipe, 2012). Offiah and Egolum (2007) revealed from their study that male students are academically higher than their female counterparts. Aniodoh and Egbo (2013) revealed in their study that female students scored significantly higher than the male students in science subjects.

Other researchers like Arigbabu and Mji (2004) and Bilesanmi-Awoderu (2006) have provided reports that there are no distinguishing differences in the cognitive, affective and psychomotor skill achievements of students with respect to gender. Egolum, (2011) and Okeke, (2014) revealed that there is no significant difference in the performance of male and female students in science subjects. Another study carried out by Ajayi and Ogbeba (2017) examined the effect of gender on students' achievement. The study revealed that there is no significant difference in the mean achievement scores between male and female students and there is no interaction effect of teaching methods and gender on students' achievement. A similar study carried out by Odinko and Arikpo (2015) investigated the effect of computer assisted instruction (CAI) and gender on pupils' achievement in basic science. Their results showed that there is no significant difference in the achievement scores of male and female students and there is no significant difference in the achievement scores of male and female students and there is no significant difference in the achievement in basic science. Their results showed that there is no significant difference in the achievement scores of male and female students and there is no significant difference in the achievement scores of male and female students and there is no significant difference in the achievement scores of male and female students and there is no significant difference in the achievement scores of male and female students and there is no main interaction effect of teaching methods and gender on the achievement of students in basic science.

Consequent upon the above, it is obvious that this issue of gender difference in achievement in basic science is still far from being conclusive. Therefore, because of the inconclusiveness of the evidence in academic achievement due to gender, this study also investigated whether gender has any influence on achievement of students in basic science.

#### **Statement of the Problem**

One of the objectives of teaching and learning of basic science in secondary schools is to promote an understanding of basic science concepts being taught with a view to applying such knowledge as solutions to real life problems. These aims and objectives cannot be realized except through the effective effort of the classroom teacher.

The performance reports of basic science students in Basic Education Certificate Examination (BECE) have repeatedly showed a persistent on-the-average achievement of students in basic science in Onitsha Education Zone. According to the performance reports, this recurrent level of achievement in basic science could be as a result of students' lack of understanding of the questions, poor teaching methods and strategies, and the inability of the teachers to introduce innovative teaching methods that will enhance students' academic achievement.

To achieve the goals set by the Federal Republic of Nigeria concerning science teaching, it is necessary that a well-designed teaching strategy which will provide the sort of learning necessary for the students to perform above average should be employed. It is on this premise that this study sought to investigate the effects of blended and non-blended learning strategies on students' academic achievement in basic science. It also investigated the influence of gender on students' achievement in basic science.

# **Purpose of the study**

This is to determine the comparative effectiveness of blended and non-blended learning strategies on students' achievement in basic science. Specifically, the study determined

- 1. The mean achievement scores of basic science students taught using blended and Non-Blended Learning Strategies
- 2. The mean achievement scores of male and female basic science students taught using blended and Non-Blended Learning Strategies
- 3. The interaction effects of gender and teaching methods on students' achievement in basic science.

# **Research Questions**

The research questions posed for this study are

- 1. What is the difference in the mean achievement scores of students' taught basic science using blended learning strategy and those taught using Non-blended learning strategy?
- 2. What is the influence of gender in the mean achievement scores of the basic science students' taught using Blended learning strategy (BLS)?

# **Research Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of significance

- H<sub>01</sub>: There is no significant difference in the mean achievement scores of students' taught basic science using blended learning strategy and those taught using non-blended learning strategy.
- H<sub>02</sub>: There is no significant gender influence in the mean achievement scores of basic science students' taught using Blended learning strategy.
- H<sub>O3</sub>: There is no interaction of teaching methods and gender on students' achievement in basic science.

# Method

#### **Research design**

Quasi-experimental research design specifically pre-test post-test non-equivalent control group design was employed in this study. This design was chosen because the participants were not randomized hence intact classes were used.

The population of the study comprised all 2479 year II junior secondary school students (982 males' and1179 females) from the 19 co-educational secondary schools in Onitsha Education zone, Anambra state, Nigeria. Co-educational schools were chosen because gender is a variable in the study while JSSII students were chosen because the topics taught in the study are contained in the JSSII scheme of work. Simple random sampling technique was used to draw 2 co-educational schools and also select the intact classes used for the research. The sample size of the study is made up of 91 JSSII students from the two intact classes sampled from the 2 selected junior secondary schools. These intact classes served as the experimental and control groups for the study.

Basic Science Achievement Test (BSAT) with 40 items, 4 options was used for the study. The BSAT was developed by the researcher and was validated by 2 experts, one from Nnamdi Azikiwe University, Awka and another from University of Nigeria, Nsukka. The BSAT was trial tested with 30 basic science students outside the area of the study and scores obtained was used to establish the reliability. Kuder-Richardson's formula 20 (KR-20) was used to establish the

reliability of the instrument. The reliability coefficient of BSAT was found to be 0.86. KR-20 was used because the items were dichotomously scored.

# **Experimental Procedure**

The Basic Science Achievement Test (BSAT) was administered on the students in both the experimental and control groups (Pre-testing) before the commencement of treatment and no feedback was given to the students on their pretest achievement. The experimental group was taught some selected basic science concepts using blended learning strategy (BLS) which is a combination of the conventional lecture method and multimedia resources which included animations, pictures and video simulations with a do-it-yourself guide, while the control group was taught the same lesson concepts using only the conventional lecture method which is referred in this study as non-blended learning strategy (NBLS).

After five weeks of teaching and the revision period, the same instrument (BSAT) was reshuffled and re-administered to the same students in their classrooms on the sixth week (Post-testing).

#### Method of Data Analysis

The research questions were answered using mean and standard deviation while the hypothesis were tested using Analysis of covariance (ANCOVA) at 0.05 level of significance.

#### Results

1. What is the difference in the mean achievement scores of students' taught basic science using blended learning strategy and those taught using non-blended learning strategy?

# Table 1: Mean achievement scores of students' taught basic science using blended learning strategy and those taught using Non-blended learning strategy

Groups	No	Posttest Mean	Posttest SD	Mean Difference
BLS	43	67.47	12.21	31.34
NBLS	48	36.13	11.26	

Data in Table 1 reveals that the students taught basic science using Blended learning strategy (BLS) had posttest mean achievement score of 67.47 and posttest standard deviation score of 12.21 while those in the control group taught with non-blended learning strategy (NBLS) had post-test mean achievement score of 36.13 and posttest standard deviation score of 11.26. The two groups had a mean difference of 31.34. With posttest mean score of 67.47, BLS is effective in enhancing students' achievement in basic science. The standard deviation scores of both groups show that the experimental group (BLS) had a higher score variation than the control group (NBLS).

2. What is the difference in the mean achievement scores of male and female students' taught basic science using Blended learning strategy?

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	Gender	No	Posttest	Posttest	Mean	
			mean	SD	Difference	
_	Males	15	69.33	11.22	2.87	
	Females	28	66.46	12.77		

 Table 2: Posttest mean achievement scores of male and female students' taught basic science using Blended Learning Strategy (BLS)

Data in Table 2 reveals that the post-test mean achievement scores of male basic science students taught using BLS is 69.33 with standard deviation of 11.22 while the posttest mean achievement scores of the female basic science students taught using BLS had a posttest mean achievement score of 66.46 and standard deviation of 12.77. The table also shows a mean difference of 2.84 between male and female achievement scores. This shows that the male and female students have close achievement scores when taught using BLS. This result shows that BLS is not gender biased although the scores show that the males performed slightly better and the standard deviation scores show that the male students had achievement scores more clustered around the mean than the female students.

# **Hypothesis Testing**

HO<sub>1</sub>: There is no significant difference in the mean achievement scores of students' taught basic science using blended learning strategy and those taught using non-blended learning strategy.

Source	Type III Sum	Df	Mean Square	F	Sia
			Square		big.
Corrected	23831.247 <sup>a</sup>	4	5957.812	47.599	.000
Model		-			
Intercept	38727.454	1	38727.454	309.406	.000
Pretest	1386.365	1	1386.365	11.076	.001
Method	19739.435	1	19739.435	157.705	.000
Gender	145.833	1	145.833	1.165	.283
method *	1 ( ( 1	1	1.661	.013	.909
Gender	1.661	1			
Error	10764.358	86	125.167		
Total	270675.000	91			
Corrected Total	34595.604	90			

Table 3: Analysis of covariance of students' mean achievement scores in Basic science

a. R Squared = .689 (Adjusted R Squared = .674)

The findings on Table 5 show that there is a statistical significant main effect of teaching method on students achievement in Basic science F(157.705), p=0.000<0.05, therefore, the first null hypothesis is rejected. Thus, there is significant difference in the mean achievement scores of basic science students exposed to Blended learning strategy (BLS) and those exposed to Non-blended learning strategy (NBLS) in favour of those taught with BLS.

# HO<sub>2</sub>: There is no significant gender difference in the mean achievement scores of male and female students' taught basic science using Blended learning strategy and those taught using Non-blended learning strategy

The results of the study in table 3 show that there was no statistical significant main effect of gender on students achievement in Basic science F(1.165), p= .283>0.005, therefore the null hypothesis is not rejected. Thus there is no significant difference in the mean achievement scores of male and female students taught basic science concepts using BLS.

# HO<sub>3</sub>: There is no interaction effect of teaching methods and gender on students' achievement in Basic science

Data in Table 3 shows that at 0.05 level of significance F is (.013), p=.909>0.005 therefore, the null hypothesis three is not rejected. Thus, there is no significant interaction of teaching methods and gender on students' achievement in basic science.

#### **Discussion of Findings**

The findings of this study revealed that there is a statistical significant difference in the achievement scores of students taught basic science concepts using blended learning strategy and those taught the same concepts using non-blended learning strategy. The difference agrees with the findings of Gambari, Yaki, Gana and Ughovwa, 2014; Rotimi, Ajogbeje, Akeju and Simpson, 2012; Vebrianto and Osman, 2011 and Serin, 2011 who discovered in their respective studies that learning with a mix of digital resources and face-to-face classroom instruction enhanced the achievement of students better than those taught with just face-to-face classroom instruction. This agreement could be because blended learning strategy wins and sustains the interests of the students during lesson delivery, provides diverse views of a particular concept, appeals to the senses of the learners and promotes concretization of perceived abstract concepts.

The results of this study also revealed that there was no statistically significant influence of gender on the mean achievement scores of basic science students. This could be because blended learning strategy is gender friendly. This result is in tandem with the findings Arigbabu and Mji, (2004) and Bilesanmi-Awoderu (2006) that provided reports that there are no distinguishing differences in the cognitive, affective and psychomotor skill achievements of students with respect to gender. Egolum, (2011) and Okeke, (2014) revealed that there is no significant difference in the performance of male and female students in science subjects.

This result contradicts that of Offiah and Egolum, (2007); Oludipe, (2012); Aniodoh and Egbo (2013). Their research findings revealed that there is a statistically significant influence of gender on students in the sciences. This contradiction could be as a result of the teaching method they employed in their study.

This study also revealed that there is no significant interaction of teaching methods and gender on students' achievement in basic science. This finding is in line with that of Odinko and Arikpo (2015); Ajayi and Ogbeba (2017) who agreed from their study that there is no significant interaction between teaching method and gender on students' achievement in basic science.

#### Conclusion

This study has confirmed that basic science students taught with Blended learning strategy (BLS) attained a high significant mean achievement than their counterparts taught with Non-blended learning strategy (NBLS). Therefore the use of BLS enhanced students' achievement better than the use of NBLS.

The findings also revealed that gender did not significantly influence students' achievement in basic science. This implies that BLS is gender friendly. The findings also revealed that there was no interaction between teaching methods and gender on students' achievement in basic science.

# **Educational Implications of the Study**

The findings of this study have implications for education particularly in basic science teaching and learning in junior secondary schools in Nigeria. A more innovative and interesting instructional strategy must be developed and implemented in basic science classrooms if this subject will achieve its aims. Since this study showed that Blended learning strategy was effective in enhancing basic science students' achievement irrespective of gender, it is therefore imperative that this instructional strategy be employed effectively in basic science lesson content delivery in schools.

# Recommendations

Based on the findings of this study, the following recommendations have been made

- 1. In-service training programs for basic science teachers in form of seminars, workshops and conferences should focus more on how to use innovative teaching methods such as blended learning strategy in basic science lesson content delivery.
- 2. Teacher training institutions should include blended learning strategy in the integrated science special methods course.
- 3. Curriculum planners should plan the curriculum in such a way that enough time should be given for blended learning strategy.
- 4. Government should endeavor to provide adequate technological devices should be provided by the appropriate authorities for use in schools.

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