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Effect of Blended Teaching Method on Junior Secondary School Students' Retention in Basic Technology Subject in Biu Educational Zone, Borno State Nigeria

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Abstract

The main purpose of this study is to determine the effect of blended teaching method on junior secondary school students' retention in Basic Technology subject in Biu Educational Zone of Borno State, Nigeria. Two research questions and two null hypotheses were formulated to guide the study. The study adopted quasi-experimental design of pretest, posttest nonrandomized nonequivalent control group design. The population of the study was 22,968 Junior Secondary School students offering Basic Technology in Biu Educational Zone of Borno State. Purposive sampling technique was used to select two Junior Secondary School in Biu Educational Zone of Borno State for the study. The total sample size was 182 students in their JSS II. The instrument for data collection was developed by the researcher titled: "Basic Technology Retention Test (BTRT)". The instrument was validated by three experts. A reliability coefficient of 0.88 was obtained using Cronchbach Alpha after the draft instrument was trial tested on 30 JSS II students of Government Day Juniour Secondary School, Damaturu, Yobe State, Nigeria. Mean and standard deviation was used to answer the research questions while z-test and ANOVA was used to test the null hypotheses at 0.05 level of significance. The finding of the study revealed that the There is significant difference in the mean retention scores of

students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State; Male students' retention mean scores were higher than their female counterpart in both blended and lecture teaching methods. This indicates that blended teaching method is effective in teaching both male and female students. Based on the findings, the following recommendations were made: Government should liaise with the appropriate school authorities in order to encourage and support the use of blended learning platform in secondary schools as this could enhance students' retention in various subjects.

Keywords

Blended Learning, Teaching Method, Junior Secondary School, Retention, Basic Technology

1. Introduction

Information and communication technology (ICT) such as computers, internet, multimedia, virtual classrooms, smart classrooms and so on have been used widely in different fields. This technology been introduced to the field of education in recent years have influence the pedagogical aspect of teaching/learning. The use of technology in education has change the mode of teaching/learning, however, the teaching/learning processes in practice is majorly overtaken by lecture and memorization. By using this lecture method of instruction, the students have less experience in getting information in the-learning activities. Internet technology supports the-learning process through online-learning (e-learning). E-learning is distant learning environments in which internet, network technologies are used for presenting, and receiving the content used (Horton, 2002). E-learning ensures the flexibility and efficiency, which cannot be found in classroom environment. It allows the student to learn everywhere and every time. Moreover, e-learning is not only based on technology but also it is a process of interaction between teachers, students and learning resources (Bersin, 2004). Although e-learning has several advantages, there is also several limitation of online-learning environment. It cannot replace-learning in the classroom. Face to face, learning provides the social interaction needed for learning. In other words, face-to-face processes are important and should not be left behind in learning and as such the need for blended learning becomes vital (Yapici & Akbayin, 2012; Bonk & Graham, 2004).

According to Zaytoon (2005), blended teaching method is usually a student centered teaching method. Blended learning extends teaching and learning beyond the classroom walls, developing critical thinking, problem solving, communication collaboration and global awareness. Blended learning enhances students learning especially by creating opportunities for them to improve their understanding through their own exploration and research on certain issues and topics (Sharpe, Benfield, Roberts, & Francis, 2006). It encourages student – led learning and allows students to learn at their own pace. It gives greater flexibility of learning for students, which in turn, improves students learning experiences and achievement. In blended learning, the student can learn from an online course that matches his/her different learning styles, and at the same time, students can learn from teachers in class (Osguthrope &

Graham, 2003).

In blended learning, a student can also learn from social interaction, whether face-to-face or online and get immediate feedback. Through blended learning, the students' achievement is higher because, retention of the learning material is increased with media and Virtual Learning environment tools (Thompson, 2003) and has access to different online resource (Saidu, 2021).

Retention is the ability to remember things or storage of information over some period, this time is called retention interval (Obeka, Bichi, & Aminu, 2012). If for some reasons, the subject is unable to produce the response at the end of the retention interval forgetting has occurred. Among the attributes of retention that are closely related to success, are the power to recall (i.e., memory) and to recognize (Ogbonna, 2007). Memory is the capacity to retain an impression of the experiences. Memory, according to Ogbonna, is classified based on duration, nature and retrieval of perceived items. Iji (2003), asserted that man is endowed with limited capacity for memorization and to correctly and effectively use or apply whatever one has learnt, retention must come to play an important role. The more active the learner is in the leaning process the better he or she retains what is taught (Singh, 2021).

According to Johnson and Johnson (2017), blended learning enhances elaborative thinking and better understanding, which lead to learning that is more meaningful. This has the potential of increasing depth of understanding, the quality of reasoning and the accuracy of long-term retention. In this study, the effect of blended teaching method on retention ability of the students was investigated. Permanent and meaningful learning is the target of educational endeavor. Understanding and retention are the products of meaningful leaning when teaching is effective and meaningful to the students (Obeka, Bichi, & Aminu, 2012). Several factors influence retention. According Singh (2021), anything that aid learning should improve retention while things that lead to confusion, or interference among learning materials decrease the speed and efficiency of learning and accelerates forgetting. However, technology-enhanced classes such as Basic Technology in Junior Secondary Schools aid students' retention.

Basic Technology is a subject that introduces students to the basic rudiments of technology. It deals with the fundamentals of engineering and technology. This subject was introduced into the curriculum in Nigeria in order to reduce ignorance about technology and to help lay a solid foundation for true national development. Basic Technology is a subject offered in the Junior Secondary Schools as one of key subjects on the same level as Mathematics and Science. The three main objectives of teaching Basic Technology in Nigeria are: (1) to provide pre-vocational orientation for further training in technology (2) to provide basic technology literacy for everyday living and (3) to stimulate creativity (FRN, 2004).

Echavez (2003) reported that the students in technology-enhanced classes had better understanding of course content, immediate feedback self-learning and control of their learning. Blended learning environments provide students the option to select the type of learning environment that best meets their individual learning and scheduling needs. It allows students to experience and take advantage of

the best educational elements that both face-to-face classroom environment and the online learning environment have to offer.

A study by Sisco, Woodcock and Eady (2015) revealed that students taught using online e-teaching synchronous platform have high rate of retention than those in face-to-face presentations, and in terms of quality teaching learned materials, the online presentations was considered as good as face-to-face presentations. In the same vain, Hiralaal (2012) reported that the students got immediate feedback from online assessments, and there was greater teacher-student interaction as well as student-student interaction through meaningful dialogue with peers. Finally, there was more convenience, flexibility and access to learning in the blended learning environment that help students retained learning tasks as well as quick recall of the needed skills. Contrarily, Chang, Shu, Liang, Tseng and Hsu (2014) examined the effects of blended e-learning on electrical machinery performance and found no significant difference in retention test scores between blended e-learning and traditional method of teaching. Supporting Chang, Shu, Liang, Tseng and Hsu (2014) report, Elmer, Carter, Armga and Carter (2016) found no significant difference in the retention ability between those taught using blended and traditional teaching methods.

Many different studies (Ahmed, 2011; Ferriman, 2013) found positive results in retention for blended learning. Kazu and Demirkol (2014) performed a six-week long study with 54 twelfth grade biology students in Turkey. The students in the blended learning group, which had access to a class blog that allowed them to answer questions, interact, and take notes collaboratively, scored statistically significantly higher on the posttest than students in the control group, which was a traditional, face-to-face classroom. On the other hand, Kazu and Demirkol (2014) looked at whether or not gender played a role in this outcome, but Kazu and Demirkol found that while females did score higher in both groups, there was no significant evidence that one method worked better for one gender over the other.

1.1 Statement of the Problem

The researchers observed that technology teachers in Borno state over the years had been relying greatly on lecture methods in teaching or presenting technological ideas and concepts to students. This is may be one of the causes of low students' performance in Basic Technology in Borno state. Despite the strength of the rapid spread of technology around the world in recent times, there is a decline in the academic performance of students in basic technology in the state. This poor performance has been recorded for some years by the examining bodies such National Examinations Council (NECO, 2014-2019), school promotion examinations and the qualifying examinations conducted by the State Ministry of Education (Borno State Ministry of Education, 2019). This poor performance has been ascribed to the use of ineffective teaching strategies and teachers' lack of the necessary digital competence. Basic technology was structured to assist learners to develop interest in technology. The problem of this study is the continued or persistent decline in students' performance in Basic Technology, in upper basic schools in Biu education zone, Borno state. If this trend is not checked, the objectives of basic technology curriculum in particular and the upper basic school programme will not

be achieved. Therefore, there is the need to identify effective ways and means of improving students' performance in Basic technology in the state upper basic schools.

1.2 Purpose of the Study

The main purpose of this study is to determine the effect of blended teaching method on Junior Secondary School students' retention in Basic Technology subject in Borno State. Specifically, the study sought to:

1. Determine the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State
2. Determine the mean retention scores of male and female students taught Basic Technology using blended and lecture teaching method in Biu Educational Zone of Borno State

1.3 Research Question

1. What is the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State?
2. What are the mean retention scores of male and female students taught Basic Technology using blended and lecture teaching method in Biu Educational Zone of Borno State?

1.4 Hypotheses

H_{O1}: There is no significant difference in the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State

H_{O2}: There is no significant difference in the interaction effect of male and female student taught Basic Technology using blended and lecture teaching method in Biu Educational Zone of Borno State

2. Methodology

2.1 Research Design

The study adopted quasi-experimental design of pretest, posttest nonrandomized nonequivalent control group design. According to Cohen, Manion and Morrisom (2007), quasi-experimental design is employed only when randomization was not possible and it is typically easier to set up than real experimental design. Similarly, to use a natural classroom setting for experimental research without random assignment, a nonequivalent group design of Quasi-experimental is considered more appropriate (Sambo, 2005). The model sketch of the design of the study is presented below:

GP I: O_1 x O_3

GP II: O_2 O_4

Where:

GP I=Experimental group taught with Blended Learning Strategies (BLS) and

GP II=Control group taught with Conventional Lecture Method (CLM).

O_1, O_2, are pre-test scores of the two groups,

O_3, O_4 arepost-test scores of the two groups,

x is the treatment for the experimental groups, while

O is the observations (Campbell in Duhu, 2006).

Blended teaching method was used for experimental group while lecture method was used for control group.

2.2 Area of the Study

The study was conducted in Borno State of Nigeria. Borno State is located in North East part of Nigeria and lie on latitude 9^{0} 15' N and longitude 12^{0} 25' E.

2.3 Population of the Study

The population of this study comprised of all 22,968 Junior Secondary School students offering Basic Technology in Biu Educational Zone of Borno State, Nigeria as at the 2019/ 2020 session.

2.4 Sample and Sampling Technique

Purposive sampling technique was used to select two Junior Secondary School in Borno State for the study. The total sample size was 182 students in their JSS II.

2.5 Instrument for Data Collection

The instrument for data collection was developed by the researcher titled; "Basic Technology Retention Test (BTRT)". The achievement test consisted of 50 multiple-choice items with four (4) options lettered A-D, which were given, scores. To ascertain the validity of the instrument, BTRT was subjected to both content and face validation by three validates from the department of Electrical Technology Education, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria. The validates took into consideration the clarity and ambiguity of questions, number of items and construct, ability to elicit accurate information and suitability of the BTRT items for the purpose of the study. In establishing the reliability of the instruments (BTRT) used for the study, a trial test was conducted on 30 JSS II students of Government Day Juniour Secondary School, Damaturu, Yobe State, Nigeria, which was not part of the study area and a reliability index of 0.88 was obtained using Cronchbach Alpha.

2.6 Method of Data Collection/Analysis

Data for the study was collected through the administration of posttest and retention test on the two groups. Mean statistics was used to answer the research questions, while z-test and Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 level of significance. To answer the two research questions of the study, both posttest mean scores of experimental and control groups were compared for mean difference. Higher mean score showed better retention. The decision for testing the two null hypotheses of the study was that; when the calculated z- and f- values were lower than the p-and α- values respectively, the null hypotheses were accepted, conversely, the null hypotheses were rejected.

3. Results

3.1 Research Question One

What is the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State?

Table 1. Mean of Posttest and Retention Test Scores of Students in Basic Technology Taught Using Blended and Lecture Teaching Method

Teaching Method	N	Posttest		Retention		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Blended Teaching Method	93	63.61	15.62	58.27	16.35	-5.34
Lecture Teaching Method	89	54.65	19.14	42.32	19.87	-12.33
Retention Mean Diff.				**15.95**		

Table 1 shows the analysis of the level of retention of students taught Basic Technology using blended teaching method and lecture teaching method. The results showed that students taught using the blended teaching method had higher retention score ($\bar{X}$ =58.27) with a mean gain of -5.98 than those taught using the lecture teaching method having a lower retention score ($\bar{X}$=42.32) with a mean gain of -12.33 after the post delayed test were administered. The retention mean difference stood at 15.95 in favour of the blended learning group. The mean gain of -5.98 indicated the amount out of 63.61 that was not put into memory for the blended teaching method while 12.95 out of 42.32 was not put into memory for lecture teaching method. It was therefore, concluded that students retain more content taught using blended teaching method than lecture method.

3.2 Research Question Two

What are the mean retention scores of male and female students taught Basic Technology using blended and lecture teaching methods in Biu Educational Zone of Borno State?

Table 2. Mean and Standard Deviation of Mean Retention Scores of Male and Female Students Taught Basic Technology Using Blended and Lecture Teaching Methods

Teaching Method	Gender	N	Posttest		Retention		
			$\bar{X}$	SD	$\bar{X}$	SD	Mean Gain
Blended Teaching Method	Male	62	68.12	12.98	60.43	13.23	- 7.69
(Experimental Group)	Female	31	54.29	11.73	48.89	15.32	- 5.40
Lecture Teaching Method	Male	65	50.58	11.45	41.48	12.56	- 9.10
(Control Group)	Female	24	48.08	11.30	35.66	14.51	- 12.42

The result of the analysis in Table 2 shows the posttest mean achievement score and the retention mean scores of both male and female students in Basic technology taught using both blended and lecture teaching methods. The posttest and retention mean score of the male students in the experimental group was 68.12 and 60.43 having a standard deviation of 12.98 and 13.23 respectively. While the female in the experimental group scored 54.29 in the posttest and 48.89 in the retention test. This result indicated that male students' retention level was higher than that of the female counterpart. Male and female

students performed better with a mean score of 50.58 and 48.08 respectively in the posttest, realized for the use of lecture teaching method while the retention mean score stand at 41.48 and 35.66 male and female respectively. Their standard deviation ranges from 11.30 -12.56. This result indicates that blended teaching method is effective in increasing students' knowledge retention.

3.3 Hypothesis One

There is no significant difference in the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State.

Table 3. z-test Analysis of the Mean Retention Scores of Students Taught Using Blended Teaching Method

Teaching Method	N	$\bar{X}$	SD	z-Cal.	z-Crit.	Remark
Blended Teaching Method	93	58.27	16.35	2.65	1.96	Reject H_O
lecture teaching method	90	42.32	19.87			

Table 3 shows the z-test analysis of the mean retention score of students. Table 3 showed that at 0.05 level of significance, the z-cal. value was 2.65, which is greater than the table value of 1.96. Therefore, the null hypothesis that stated that there is no significant difference in the mean retention scores of students in Basic Technology taught using blended and lecture teaching method was rejected. Based on this, it was concluded that there was significant difference between the retention test scores of students in basic technology when taught using blended and lecture teaching method.

3.4 Hypothesis Two

There is no significant difference in the interaction effect of male and female student taught Basic Technology using blended and lecture teaching method in Biu Educational Zone of Borno State.

Table 4. Summary of ANCOVA of Significance of Interaction Effect of Teaching Methods and Gender on Students' Retention in Basic Technology

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5514.610[a]	4	1378.653	22.660	.000
Intercept	27042.056	1	27042.056	444.475	.000
PRETEST	13.025	1	13.025	.214	.644
TEACHING METHOD	4309.991	1	4309.991	70.841	.000
GENDER	148.285	1	148.285	2.437	.120
TEACHING METHOD * RETENTION	.150	1	.150	.002	.960
Error	10768.752	177	60.840		
Total	655028.000	182			
Corrected Total	16283.363	181			

a. R Squared = .339 (Adjusted R Squared = .324)

The results of the analysis in Table 4 showed that, there is no significant interaction between treatments (experimental and lecture methods) and gender (male and female) on students' retention F = 0.002 (df = 4, 181), P = 0.96. Since the computed p-value (0.96) is greater than 0.05 level of significant, therefore, the null hypothesis of no significant interaction is upheld and concluded that, there is no significant interaction between treatment (experimental and lecture methods) and gender (male and female) on students' retention.

4. Findings of the Study

Based on the results presented, the following findings were made:

1. Students taught using blended teaching method had higher retention mean scores than those taught using lecture method. This means that blended teaching method improves students' retention
2. Male students' retention mean scores were higher than their female counterpart in both blended and lecture teaching methods. This indicates that blended teaching method is effective in teaching both male and female students
3. There is significant difference in the mean retention scores of students in Basic Technology taught using blended and lecture teaching method in Biu Educational Zone of Borno State
4. There is significant difference in the interaction effect of male and female student taught Basic Technology using blended and lecture teaching method in Biu Educational Zone of Borno State

5. Discussion of Findings

The finding of this study revealed that students taught using the blended teaching strategy had higher retention score than those taught using the lecture method after the retention test was administered. Students in the experimental group obtained higher mean retention scores than those in the control group. This shows that the experimental group retained more of the basic technology content taught than the control group. This was further confirmed by the z-test analysis, which shows that the experimental group significantly retained higher than the control group in the basic technology concepts taught. The findings of this in relation to students retention is in accordance with those of Paul and Richard (2017) who revealed that there is significant difference between the levels of students' retention used in their study when taught with station-rotation model of blended teaching. The results of this study have shown that, the use of blended teaching method in teaching basic technology will help students to retain the things they have learnt and in turn improve their academic achievement. No wonder, Bielawaski and Metcalf (2013) report that blended learning focuses on optimizing achievement of learning objectives by applying the right learning technologies to match the right learning styles to transfer the right skills to the right person at the right time as a result student tend to retained much information in this type of teaching-learning strategies.

The result that males performed better than females in the blended learning class is not surprising because females had lower confidence and less experience in the use of computers in teaching and

learning. They tended to learn how to use technology from others, whereas males were more likely to learn from their own experience. Another reason for this result is that male students are more articulated in the use of technologies than their female counterparts are. Females are however better in language than science and social sciences and could also be due to the fact that male students can withstand harder task than female students Schumacher and Morahan-Martin (2011) found that in general, men tend to have more favorable attitudes toward computers. Ong and Lai (2016) reported that men's rating of computer self-efficacy, perceived usefulness, perceived ease of use, and behavioral intention to use e-learning are all higher than that of women. Scholars who believe in gender differences have tried to provide explanations for their existence. Cockburn and Ormond (2013) claimed that technology has traditionally played a gendered role in the western society. In the area of information technology, males are main designers and developers. This may cause a mismatch between technology and women's learning, working and living styles. Furthermore, Wilson and Smilanich (2005) found that the language used in technology fields is male-oriented. This may alienate females and prevent them from participating in these fields. Campbell and Varnhagen (2012) argued that some computer applications in education such as self-paced tutorials may not work for the benefit of women who are more relational learners than males. Gender stereotype does not favor women either in the use of technology. Some studies suggest that the higher computer anxiety of girls is related to the sex bias of teachers, who were found to make more eye contact with boys when discussing technology and computers (Okebukola, 2013).

6. Conclusion

Based on the findings of the study, it was concluded that blended teaching method enhances students retention of passed knowledge as the process of knowledge acquisition involved the students engaging themselves in the activities and by so doing acquire knowledge as well as skills to perform such a task. The students in the experimental group showed high retention ability than those in the lecture method and the blended learning method support all categories of students irrespective of their gender.

7. Recommendations

The study made the following recommendations:

(i) Government should liaise with the appropriate school authorities in order tpo encourage and support the use of blended learning platform in secondary schools as this could enhance students retention in various subjects

(ii) Students should be encouraged to take maximum advantages of the opportunities offered by blended learning since blended learning could be utilized to complement other method of teaching and learning as well as for individual learning.

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