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Effect of Virtual Learning Strategy on Students' Retention of Difficult Concepts in Basic Science and Technology in Basic Education Schools in Benue State, Nigeria.

Uduaka, Anieze[1], Adejoh, Musa James[2] and Jirgba, Mbakohol Christy[3].

[1]Depatment of Integrated Science Education, College of Education, Joseph Sarwuan Tarka University, Makurdi, Nigeria. uanieze@gmail.com
[2]Depatment of Biology Education, College of Education, Joseph Sarwuan Tarka University, Makurdi, Nigeria. adejohmj71@Gmail.Com
[3]Depatment of Integrated Science Education, College of Education, Joseph Sarwuan Tarka University, Makurdi, Nigeria. mbayagh@gmail.com

ABSTRACT.

The study investigated the effect of virtual learning strategy on students' retention of difficult concepts in Basic Science and Technology in basic education schools in Benue State, Nigeria. The study was guided by two specific objectives. Two research questions and two hypotheses were formulated to guide the study. The researchers adopted a quasi-experimental research design. The population of the study was 23,994 students and the sample size was 239 students. The study used one instrument, Basic Science and Technology Retention Test (BSTRT) for data collection. The instrument was validated by five experts with reliability coefficient of 0.78. The data obtained from the study were analyzed using mean, standard deviation and ANCOVA. The findings revealed that students taught Basic Science and Technology using virtual learning strategy had higher knowledge retention than those taught with the conventional teaching method and there is no significance difference in the mean retention scores of male and female students. The researchers therefore concludes that virtual learning strategy is an effective strategy for teaching Basic Science and Technology difficult concepts as it helps to increase students' retention ability. The researchers recommends that virtual learning strategy is an effective strategy in teaching Basic Science and Technology and should be implemented for the teachers of Basic Science and Technology at all levels of Basic education.

Keywords: Virtual Learning Strategy, Students, Retention, Difficult Concepts, and Basic Science and Technology.

1. Introduction

The education sector is seen as one of the most important sectors in every economy in the world. It has been the backbone of all meaningful developments of every nation all over the world. The advancement in science and technology has recently changed the educational systems in the societies with the introduction and use of computer software packages for the classroom instructional purposes. [5] Bharathy (2015), stated that the use of computers in the learning process brings a major paradigm shift in education that promises advantages over lecture learning system where the potential benefits of computers cannot be overemphasized as it gives students a sense of empowerment and control the pace and repeat the lessons when they feel the need to do so.

Science and its applications are part of the daily activities that make life better and understandable. Science has been regarded as the bedrock upon which the modern-day technological breakthrough is built upon. Science has been a major tool for technological growth in all aspect of human life. The National Policy on Education [8] (FRN, 2014), identified the goal of science education to include, building of national unity, inculcation of national consciousness, training the mind to understand the world around us, acquisition of appropriate skills, development of mental, physical and social abilities of the citizens to contribute to national development. [11] Musa *et al.*, (2021) stated that, science is a subject that is difficult to understand. One of the causes of science (Basic Science and Technology in particular) subjects experiencing difficulty for students, is the lack of learning media that can provide illustrative images of real phenomena, so that students seem to have difficulty understanding the material without media availability ([4] Awal, 2015). Efforts to solves this problem therefore led to the introduction of Basic Science and Technology in the Basic Education Schools i.e Primary and Junior Secondary Schools.

Basic Science and Technology is a combination of the former Integrated Science and Introductory Technology which a child encounters at the Upper Basic level of education. It is a composite form of science at Upper Basic level of education involving concepts from Chemistry, Physics, Biology, Technology, Physical and Health Education, and Geography. It prepares students at the Upper Basic level for subsequent study of specialized core science courses ([7] Enemarie, Ogbeba, & Ajayi, 2019; [1] Achor & Agbidye, 2014). The goals of Basic Science and Technology according to Nigerian Educational Research and Development Council [12] (NERDC) (2012) are to develop learners' interest in science and technology; acquire basic knowledge and skills in the subject; apply basic scientific and technological knowledge and skills to meet contemporary societal needs, among others.

Also, the Federal Republic of Nigeria [8] (FRN, 2014), in release of her educational objectives for secondary schools, emphasizes the need to equip students to live effectively in the modern age of science and technology. Basic science and technology being a unique approach to science education has some concepts which are in themselves difficult for students to understand, ([1] Achor & Agbidye, 2014). Ncharam in [1] Achor and Agbidye, (2014) established that students' inability to comprehend and retain difficult concepts in Basic Science and Technology results in poor achievement of the students at the Junior Secondary School Certificate Examination (JSSCE) and general backwardness in scientific and technological advancement. Effective and meaningful learning occurs when learners are able to retain and recall concepts already learnt.

Retention and achievement in Basic Science and Technology, are of paramount importance in science learning. Bichi in [16] Tukura *et,al.*,(2020), described retention as the ability to store and remember things experienced or learned by an individual at a later time. Jiya in [18] Upu (2015) argued that when teaching is characterized by rote learning, meaningless memorization, or verbalism, students learn ineffectively. However, [6] Bichi (2012) believed, when there is interference among learned material; speed and efficiency of learning is often decreased. Whereas anything that aids learning should improve retention. Thus, learned facts cannot be retained for a long time, nor can they have a significant effect on the learning outcome. According to [18]Upu (2015), retention is the ability of students to retain knowledge of the contents taught as evident in the mean retention scores of their test, after weeks of post-test. From the foregoing therefore, retention is the amounts of contents and objectives taught, which a learner is able to retain and recall after a given period of time. It has been found that students forget most of the specific facts and concepts taught them, but remember what they do practically. This is an agreement with the old Chines saying "I hear I forget; I see I remember; I do I understood". According to [14] Oludipe, (2014), gender plays a significant role in retention ability of students in Basic Science and Technology.

Gender imbalance is conceived as the structural relationship of inequality between males and females as manifested in education. Gender inequality in education has remained a perennial problem of global scope [17] (UNESCO, 2021). Nworgu in [1] Achor and Agbidye (2014), revealed that there exist gender differences in science achievement in our schools. They discovered that male students performed significantly better than female students but this may not be the case all the times. [2] Adeniran (2013) noted that female students perceive science as a very demanding course which requires high intelligence and critical thinking. He suggested that gender stereotypes in classroom can be broken by adopting a teaching strategy that gives equal opportunities to both boys and girls. According to [6]Bichi (2012) students tends to develop high interest if the right teaching strategy is employed. This teaching strategy could be virtual Learning. It is therefore necessary for this study to check the effects of virtual learning on the students' interest in Basic Science and Technology.

Virtual learning has gained significant attention in recent years as technology continues to advance and shape the landscape of education. Traditionally, classroom instruction has been the primary mode of delivering Basic Science and Technology education. However, with the rapid expansion in internet access and availability of digital tools and platforms, virtual learning has emerged as a potential solution to address the challenges faced by students in understanding difficult concepts. Therefore, because of the different ways that students learn, diversity is needed in the teachers' teaching strategy. To keep students engaged, instructional programs and teaching techniques require creative methods [19](Zaidi et al., 2018). This includes the adoption of new forms of lesson delivery to make learning more engaging, increase interest and enhance the comprehension of the content taught as well as high achievement [9](Gulley & Jackson, 2016). It is on this note that the researchers sought to ascertain the Effect of Virtual Learning Strategy on Students' Retention of Difficult Concepts in Basic Science and Technology in Basic Education Schools in Benue State, Nigeria.

1.2 Objectives of the Study

The main objective of this study is to determine the effect of virtual learning strategy on students' retention of difficult concepts in Basic Science and Technology in basic education schools in Benue State, Nigeria.

Specifically, the study determined:

1. the mean retention scores of students taught difficult concepts in Basic Science and Technology using virtual learning strategy and those taught using conventional method;
2. the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy;

1.3 Research Questions:

The following research questions were asked and answered by the study;

1. What is the mean retention scores of students taught difficult concepts in Basic Science and Technology using virtual learning strategy and those taught using conventional method?
2. What is the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy?

1.4 Research Hypotheses.

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

1. There is no significance difference in the mean retention scores of students taught difficult concepts in Basic Science and Technology using virtual learning strategy and those taught using conventional classroom.
2. There is no significance difference in the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy.

2. Methodology

The study adopted a quasi-experimental research design. The study area is Benue State. The population of the study is 23,994 (12,233 males and 11,761 females) Basic 8 (Upper Basic II) students in UBE schools in Benue State. The sample size for the study was 239 Basic 8 (Upper Basic II). The experimental group has 116 students (53 Males and 63 Females) and the control group has 123 students (54 males and 69 Females). The sampling techniques was multistage sampling. Purposive sampling techniques was used in selecting of the schools for the study in the three educational zones in the State on the basis that the school must be a UBE school, and it must be co-educational (male and female) because gender is a moderating factor in the study. Random sampling was used to select the schools to assign to the experimental group and control group.

The instrument for data collection was Basic Science and Technology Retention Test (BSTRT). The instrument was administered four weeks after the treatment. Lesson was carried out in accordance with the lesson plan for both experimental and control groups respectively. The research questions were answered using descriptive statistic of mean and standard deviation. Inferential statistical tool Analysis of Covariance (ANCOVA) was used to test the research hypotheses at 0.05 alpha level of significance.

3. Results and Discussion

This section presents the results and discussion of findings of the study.

Research Question 1

What is the mean retention scores of students taught difficult concepts in Basic Science and Technology using virtual learning strategy and those taught using conventional method?

Table 1: Mean and Standard Deviation of the Retention Score of Students Taught difficult Concepts in Basic Science and Technology Using virtual Learning Strategy and those Taught Using the Conventional Classroom Method.

Groups	**Post-test**			**Retention**			
	N	**Mean**	**Standard Deviation**	**Mean**	**N**	**Standard Deviation**	**Mean Gain**
Experimental	**116**	28.12	3.79	28.78	**116**	3.12	**0.66**
Control	**123**	26.31	3.64	26.17	**123**	3.50	**0.14**
Mean Difference		**1.81**		**2.61**			**0.52**

The results presented in Table 1, shows that the mean retention scores of students taught Basic Science and Technology using virtual learning strategy was 28.12 for posttest and 28.78 for the retention, with corresponding standard deviation of 3.79 and 3.12 respectively. However, the mean retention scores of students taught Basic Science and Technology with the conventional classroom method was 26.31 for the post-test and 26.17 for the retention, with standard deviation of 3.64 and 3.50 respectively. The mean gain for the experimental group was 0.66 while the control group is o.14. The group mean difference was 1.81 for post-test and 2.61 for retention while the retention mean gain was 0.52 in favor of the experimental group.

Research Question 2

What is the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy?

Table 2: Mean and Standard Deviation of the Retention Score of Male and Female Students Taught Difficult Concepts in Basic Science and Technology Using Virtual Learning Strategy.

Groups	**Post-test**			**Retention**			
	N	**Mean**	**Standard Deviation**	**Mean**	**N**	**Standard Deviation**	**Mean Gain**
Male	**53**	29.19	3.58	29.57	**53**	2.82	**0.38**
Female	**63**	27.22	3.75	28.11	**63**	3.30	**0.89**
Mean Difference		**1.97**		**1.46**			**0.51**

The results presented in Table 2, shows that the mean retention scores of male students taught Basic Science and Technology using virtual learning strategy was 29.19 for post-test and 29.57 for the retention test with corresponding standard deviation of 3.58 and 2.82 respectively. However, the mean retention scores of female students taught Basic Science and Technology with using virtual learning strategy was 27.22 for the post-test and 28.11 for the retention test, with standard deviation of 3.75 and 3.30 respectively. The mean gain for the male students was 0.38 while the mean gain for the female students was 0.89. The group mean difference was 1.97 for post-test and 1.46 for retention test, while the retention mean gain was 0.51 in favor of the female students.

Research Hypothesis 1

There is no significance difference in the mean retention scores of students taught difficult concepts in Basic Science and Technology using virtual learning strategy and those taught using conventional classroom.

Table 3: Summary of ANCOVA Result of the Difference in Student' Retention Score of the Experimental and Control Groups in Basic Science and Technology.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2748.468[a]	2	1374.234	456.750	.000	.795
Intercept	.165	1	.165	.055	.815	.000
Retention	2552.511	1	2552.511	848.370	.000	.782
Group	**28.972**	**1**	**28.972**	**9.629**	**.002**	.039
Error	710.059	236	3.009			
Total	180128.000	239				
Corrected Total	3458.527	238				

a. R Squared = .795 (Adjusted R Squared = .793)

The result of the Analysis of Covariance presented in table 3 shows that $F_{1, 238} = 9.69$ and the P-value of 0.002 is less than .05 ($P<0.05$) level of significance. This shows that the test was significant. Therefore, the null hypothesis was rejected. The result implies that there is a statistically significant difference between the mean retention scores of students taught Basic Science and Technology with virtual learning strategy and those taught using conventional teaching method. This means that students who were exposed to virtual learning strategy retained more than those not exposed to virtual learning strategy.

Research Hypothesis 2.

There is no significance difference in the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy.

Table 4: Summary of ANCOVA Result of the Difference in Mean Retention Scores of Male and Female Students taught Difficult Concepts in Basic Science and Technology Using Virtual Learning Strategy.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	987.061[a]	2	493.531	84.339	.000	.599
Intercept	6.977	1	6.977	1.192	.277	.010
Retention	875.753	1	875.753	149.656	.000	.570
Group	**11.898**	**1**	**11.898**	**2.033**	**.157**	.018
Error	661.249	113	5.852			
Total	93378.000	116				
Corrected Total	1648.310	115				

a. R Squared = .599 (Adjusted R Squared = .592)

The result of the Analysis of Covariance presented in Table 4 shows that $F_{1, 115} = 2.033$ and the P-value of 0.157 is less than .05 (P>0.05) level of significance. This shows that the test was not significant. Therefore, the null hypothesis was not rejected. The result implies that there was no statistically significant difference in the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology with virtual learning strategy. This means that the male students did not retain more than their female counterpart after being exposed to virtual learning strategy in Basic Science and Technology.

3.1 Summary of Major Findings

Based on the analysis of data from the study, the following findings were made:

1. Students taught Basic Science and Technology using virtual learning strategy had higher knowledge retention than those taught with the conventional teaching method.
2. There is no significance difference in the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy.

4. Discussion of Findings

The finding of this study based on research question one and hypothesis one revealed that students taught difficult concepts in Basic Science and Technology using virtual learning strategy had higher knowledge retention scores than those taught with the conventional lecture method. It also revealed that there was a statistically significant difference in their knowledge retention. The findings of this study agrees with [16] Tukura *et,al.,* (2020) who found that the use of e-learning have positive effect on students' retention and performance among Basic Science students. The finding also agrees with the finding of [3] Akaa (2023), who found that the students taught Agricultural Science using Google Classroom have higher retention than those taught using the conventional method.

Findings from research question two and hypothesis two revealed that there was no significance difference in the mean retention scores of male and female students taught difficult concepts in Basic Science and Technology using virtual learning strategy. This findings is in agreement with the findings of [16] Tukura *et,al.,* (2020), who found that there was no significant difference in the level of retention between male and female students taught Basic Science concept using e-learning. The findings of the study contradict the finding of [3] Akaa (2023), who found that there is a statistically significant difference between the mean retention score of male and female SS1 students taught Agricultural Science using google classroom. Notably, the current findings contradict with others because the work was centered on difficult concepts in Basic Science and Technology and basic 8 students (Upper Basic 2).

4.1 Conclusion

Based on the findings, the researchers deduced that the method used in teaching Basic Science and Technology has significant effect on the students' retention ability. The researchers therefore concludes that virtual learning strategy is an effective strategy for teaching Basic Science and Technology difficult concepts as it helps to increase students' retention ability of both male and female student in Basic Science and Technology.

4.2 Recommendation

Based on the findings of the study, it was recommended that;

Virtual learning strategy is an effective strategy in teaching Basic Science and Technology as it helps to promotes students' ability to retain difficult concepts in Basic Science and Technology and therefore should be implemented for the teachers of Basic Science and Technology at all levels of Basic education.

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