



## Effect of Computer Simulation Strategy on Junior Secondary Students' Retention in Basic Science and Technology in Jos, Plateau State, Nigeria

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### ABSTRACT

*This study was conducted to examine the effects of computer simulation strategy on junior secondary school students' retention in basic science and technology in Jos North Plateau State, Nigeria. Two research questions and hypothesis were raised and formulated. The study employed a Pretest-Posttest Non-equivalent Control Group Design for non-randomized samples. Intact classes were used in the study. The population of the study was 1,494 from the 22 public secondary schools in the study area. The sample size of the study was 75 comprising male and female from both the experimental and control groups. The instrument for data collection was Basic Science and Technology Achievement Test BSTAT. The instrument was validated by experts three from the Department of Science and Technology Education, Test and Measurement and Evaluation and Educational Psychology of the University of Jos. The reliability of the instrument was 0.79. The two groups were pretested to determine their equivalence, the treatment lasted for six weeks after which the posttest was administered and after two weeks the retention test was re-administered and data were analysed using mean and standard deviation to answer the research questions. The use of ANCOVA was effective in answering the research hypothesis because of non-randomization of sample. Findings of the study revealed that computer simulation was significant in teaching BST at  $p < 0.05$ , and there is no gender difference on retention of male and female in the experimental group  $P > 0.05$ . Based on the findings, it was recommended that teachers should adopt the use of Computer Simulation Strategy since it has proven effective on students' retention in Basic Science and Technology. It was also recommended that the Computer Simulation Strategy should be adopted in teaching other subjects.*

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### INTRODUCTION

Basic Science and Technology is a subject that prepares students to learn the basics of scientific knowledge as a foundation that they can aspire to study biology, chemistry, geography, mathematics, physics and other related subjects, it prepares the younger generations from the junior secondary school to the senior secondary school. It gives a foundation to the learner, Basic Science and Technology inculcate the use of technology it also introduces the learner to the use

of scientific discoveries and use of technology in problem solving.

Basic Science and technology interplay with the society to bring about sustainable development. According to the National Policy in Education (Federal Republic of Nigeria, 2013), education is an "instrument per excellence" for achievement of national development. To buttress the emphasis on science and technology education in the national policy on Education, Basic Science and Technology has been made

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mandatory as a subject for all Nigerian children at the basic education level. The Basic Science and Technology concepts are organized into themes and avoid duplication of contents and unnecessary repetition of topics in the different science disciplines, it therefore arouses curiosity and develops scientific attitudes and skills in students (Umar, Sidi & Michael, 2024). Basic Science is aimed at enabling the child who is exposed to it to acquire the specific science process skills such as observing, organizing information acquired, generalizing on the basis of acquired information, predicting as a result of generalization and designing experiment to check predictions (FRN, 2013).

Basic Science is also a subject which is trusted to grant the students general education and emphasizes the importance of observation for increased understanding of the environment. Basic science education in Nigeria encompasses subjects such as physics, chemistry, and biology, which are foundational for understanding technological applications. Despite the critical role of these subjects, students often struggle with scientific concepts due to out-dated teaching methods and a lack of practical experiences (Ogunleye, 2018).

The use of a lecture method by science teachers has been criticized by many researchers (Dania, & Eluowa, 2023). This instructional method, according to them, is extremely didactic in approach, teacher-cantered, and does not lead to meaningful learning. It only encourages the development of passivity, docile learning and overdependence on the teacher and on textbooks. Basic Science and Technology is a subject designed based on the process teaching strategy. Therefore, using the lecture method solely to teach the subject is inappropriate. The author observed that the kind of strategies for teaching and learning of Basic Science and technology and technology which are capable of achieving the objectives of the school and society are those which emphasize the teaching of process skills of science and child-cantered inquiry-based instruction. The search for improved strategies for teaching and learning of Basic Science and Technology is therefore a continuous process.

Computer Simulation strategy involve the use of computer programs to behave or imitate real-world experience providing students with engaging and interacting learning experience in a focused environment, the strategy allows students to visualize abstract concept and students are likely to remember and retain information. Computer-based simulations protect students and teachers from hazards, given that there is no direct contact with toxic or radioactive substances. They also provide flexibility in performing experiments. Exposure to hazards may discourage female students from partaking in traditional hands-on practical activities (Nwosu & Ndanwu, 2020).

In order to address these loopholes, educators should continue to explore and implement innovative teaching methods that cater for the diverse needs of students. Incorporating technology, project-based learning, and collaborative activities can help to engage students and enhance their learning experiences. Retention refers to the ability to remember what was taught after some time. According to Eze, Ezenwafor and Obidile (2016) retention has to do with the ability to remember and recall what has been taught after a given period of time as a mark of students' progress. Retention in Basic Science and Technology, as in most other courses, is very important as it shows the extent to which students can recall and apply the knowledge gained after a period of time. Retention is a measurement constructs that every teacher should be concerned with. Teachers should be encouraged to teach students by participation in the learning process as this may improve their retention without gender disparities.

The word "gender" has attracted the attention of many scientists (biologists, psychologists, and researchers) as a result of which a lot of literature exists on different aspects of the concept, (Inas, & Susan, 2023). However, students' gender may also be a factor to consider as the teacher considers applying blending learning approach to the teaching of Basic Science and Technology. Research discovered that students' retention varies in accordance with students' gender (Inas, & Susan, 2023). Also, the



psychological construct of the learner that moderate students' retention and achievement at the terminal or national examination. It is against the backdrop that, this study will examine the effects of computer simulation strategy on Junior Secondary students two retention to see whether there is going to be an improvement in Jos-North L.G.A Plateau State.

### STATEMENT OF THE PROBLEM

The Importance of basic science and technology cannot be overemphasized. In cognizance with the importance of science and technology despite all efforts of the government, parents and community at large students keep failing the scenario of failure if allow to continue in the future the objectives of Basic Science and Technology to national development will not be achieve. This is evidence in the analysis of Basic Science Certificate Examination in Plateau State by Plateau State Education Resources Centre (ERC) results analysis of (2019-2023) indicate over the years student's achievement in Basic Science and Technology is not impressive. Despite efforts of teachers to make classroom instruction interactive and engaging, students' retention in this skill course have been low. Emerald (2023) stated that, good retention strategies are strongly linked with instructional strategy that encourages active and independent learning.

### Aim and Objectives of the Study

In view of the above problem, the aim of this study is to investigate the Effect of computer simulation on junior secondary school student's retention in Basic Science and Technology in Jos-North Plateau State with the following specific objectives to guide the study:

1. Determine the retention achievement scores of the experimental and control groups.
2. Find out the retention achievement of male and female in the experimental group.

### Research Questions

1. What is the retention mean scores of the experimental and control groups?
2. What is the retention mean scores of male and female in the experimental group?

### Research Hypothesis

1. There is no significant mean score difference between the retention mean scores of the experiment and control groups.
2. There is no significant difference in the retention mean scores of male and female in the experimental group.

### METHODOLOGY

The design of the study was quasi experimental Pre-test Post-test Non-equivalent Control Group Design. The population for this study comprised all the Junior Secondary two students from the 22 government owned schools in Jos-North Local Government Area. There are 1,494 JSS 2 students in Jos-North LGA. This details were obtained from the ministry of education the reason for choosing JSS II for this study is because, the students are already offering Basic Science and Technology right from JSS I. They are not confronted with any external examination ahead.

Sample of the study consists of 35 male and 42 female students making a total of 75. This sample is obtained from two public secondary schools and it is adequate to conduct an experimental study, to serve as experimental and control group. The experimental group consist of 35 students (16 male and 19 female) while the control group consist of 40 students (17 male and 23 female), making a total of 75 as the sample size. The sampling technique used in the study was the simple random sampling technique. This was done by coding the 22 schools on pieces of papers and putting them in a cup. After scrambling two schools were picked and assigned to experimental and control groups respectively. Intact classes were used since the two schools are coeducational in nature. Also, the school



authorities would not allow for randomisation of sample.

Data was collected using Basic Science and Technology Achievement Test (BSTAT) The instrument has 40 multiple choice items. The instrument BSTAT was subjected to face validity. The validation was carried out by three experts in the department of Science and Technology education, measurement and evaluation unit of foundation department of University of Jos, and one experience geography teacher in senior secondary school. The instrument, research objectives and research questions will be made available as at the time of the validation exercise.

Test-retest method was used in collecting data. The results obtained were subjected to reliability analysis using Kuder-Richardson ( $k-R_{21}$ ). This is because the items are dichotomous in nature. According to Ali (2017), any instrument with a reliability co-efficient between 0.55 to 0.99 is deemed reliable enough for a research purpose. The reliability of the instrument was 0.79 which make the instrument reliable for the study. The pre-test will be administering in other to collect information on the level of equivalence of the experimental and

control groups. This will be done in the first day of the researcher in the school.

The administration of the treatment will be done with the help of a research assistant where by the use of computer simulation strategy will be used in teaching the experimental group as treatment while the research assistant will apply conventional teaching method in teaching the control group this shows that the control group will not receive treatment. These will last for six (6) weeks as planned in the study the use of lesson plan for both the experimental and control groups will guide the two groups. The research questions were answered using descriptive statistics of mean and standard deviations while all the hypotheses were tested at 0.05 level of significance using Analysis of Co-variance (ANCOVA). When the ( $P < 0.05$ ) level of significance, the null hypotheses will be rejected and when rule ( $p < 0.05$ ) the null hypothesis will be accepted.

## RESULTS

**Research Question One** What is the post-posttest achievement scores of the experimental and control groups?

Table 1: Mean Retention Scores of Experimental and Control Groups

Group	N	Mean	SD	Mean Diff
Experimental	35	55.57	7.32	19.82
Control	40	35.75	7.06	

The findings in Table 1 revealed that students' retention mean scores was 55.57 with standard deviation 7.32 for the experimental group while the retention mean score of the control group was 35.75 with a standard deviation of 7.06. Similarly, retention mean score difference between the post-posttest between the experimental and control groups is 19.82 in favour

of the experimental group. The difference at the post-posttest is higher than the post-test suggesting that students in the experimental group retained better than those in control group.

### Research Question Two

What is the post-posttest achievement of male and female in the experimental group?

Table 2: Mean Retention Scores of Males and Females in the Experimental Group

Gender	N	Mean	SD	Mean Diff
Male	16	57.06	6.69	2.74
Female	19	54.32	7.77	

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**Research Hypothesis One**

There is no significant difference between the post-posttest achievement mean scores of the experimental and control groups.

Table 3 ANCOVA Results of Post-Posttest Difference Between the Experimental and Control Groups in Basic Science and Technology

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	88.111 <sup>a</sup>	1	88.111	1.676	0.204
Intercept	5656.849	1	5656.849	107.628	0.000
Posttest	88.111	1	88.111	1.676	0.204
Group	147.367	1	147.367	4.658	0.000
Error	1734.461	73	52.559		
Total	109909	74			
Corrected Total	1822.571	75			

a. R Squared = .048 (Adjusted R Squared = 0.873.)

Table 9 revealed that  $F(1, 71) = 4.235$ , ( $P$  value = 0.000). Since the  $P$  value is less than 0.05 level of significance, the null hypothesis is rejected. Therefore, there is a significant difference between the post posttest achievement mean score between the experimental and control group in Basic Science and Technology. Findings also revealed that the adjusted R square is 0.873

meaning that the 87.3 % of changes in the students' achievement was due to the treatment while the rest was due to error. This model is significant since  $P < 0.05$ .

**Research Hypothesis Two**

There is no significant difference between the post-posttest achievement mean scores of male and female students in the experiment group.

Table 4: ANCOVA Results of Post-Posttest Achievement Mean Scores of Male and Female Students in the Experiment Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	35.369 <sup>a</sup>	1	35.369	0.779	0.392
Intercept	509.482	1	509.482	11.223	0.005
Posttest	35.369	1	35.369	0.779	0.392
Gender	156.746	1	156.745	4.856	0.649
Error	635.569	14	45.398		
Total	52769	16			
Corrected Total	670.938	15			

a. R Squared = .053 (Adjusted R Squared = -0.015)

Table 10 revealed that  $F(1, 14) = 4.856$ , ( $P$  value = 0.0654). Since the  $P$  value is greater than 0.05 level of significance, the null hypothesis is accepted. Therefore, there is no significant difference between the post-posttest achievement mean score between male and female students in the experimental group in Basic Science and Technology. Findings also revealed that the

adjusted R square is -0.015 meaning that the  $< 1.0$  % of changes in the students' achievement was due to the treatment while the rest was due to error. This model is not significant since  $P > 0.05$ .

**DISCUSSION OF FINDINGS**

Findings of the study revealed that computer simulation strategy is effective in

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improving Junior Secondary School student's retention in Basic science and technology. Similarly, the study discovered that there is a significant difference between post-test and post-test achievement mean scores of the experimental and control group in Basic Science and Technology. This shows that the treatment strengthens students' retention even after the learning process. It is an indication that the treatment is effective and should be imbibed by teachers at large. This tally with the findings of Uwambajimana and Minani, (2023) and Mihindo and Kamonjo (2022). Therefore, the treatment is effective in improving students' post-test achievement at the same times.

Similarly, the study also finds out that there is no significant difference between the post-test achievement mean scores of male and female students in the experiment group. This is because the study revealed that gender is not a factor that affects students' achievement. Since there is no gender difference in achievement between male and female students in the experimental group that were exposed to treatment. So, male and female students have equal retention level but with little difference that was not significantly clear in the study.

This finding also corroborates the findings of Laurence and Wenceslas (2022), Mhamed, Mohamed, Abdesselam, Taoufik, and El-Mehdi (2021). Their findings revealed that there is no gender difference between male and female students as well as no difference of post-test between the two when exposed to the same treatment. Therefore, computer simulation strategy is effective strategy that improved student's retention irrespective of gender difference. It was concluded that computer simulation strategy is an effective teaching method that enhances students' retention in Basic Science and Technology irrespective of gender. It was recommended that Basic science and technology teachers should be encouraged to teach using computer stimulation.

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