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

[1]Bashir, Rukayya Nakargo, [2]Grace A. Chollom, [3]Jibril, Hussaini Ibrahim
[1&2]*Department of Science and Technology Education, University of Jos*
[3]*Department of Information Technology, Federal University of Dutse*

ABSTRACT

This work was conducted to examine the effects of computer simulation strategy on junior secondary school students' achievement in basic science and technology in Jos North Plateau State, Nigeria. 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 determined their equivalence; the treatment lasted for six weeks after which the posttest was administered. Data were analyse using mean and standard deviation to answer the research questions. The use of ANCOVA was effective in answering the research hypothesis Findings of the study revealed that computer simulation is significant in teaching BST and there is no gender difference on achievement in the experimental group P>0.05. The study recommended that computer simulation teaching strategy enhanced students' achievement in basic science and technology, teachers should adopt the use of this strategy.

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INTRODUCTION

Science is the foundation upon which the bulk of present-day technological breakthrough is built. Nowadays, nations all over the world including Nigeria are striving hard to develop technologically and scientifically, since the world is turning scientific and all proper functioning of lives depend greatly on science. Henning (2018) defined science as an integral part of human society. Its impact is felt in every sphere of human life, so much that it is intrinsically linked with a Nation's development. Science as a field of study has done a lot for mankind. For instance, life has been made a lot easier for man as a result of advancements in science.

Through sciences, man has been able to better understand his environment and this has enabled him to manipulate the conditions of his environment to his own benefit. Science has also made it possible for man to acquire his desired needs easily. It has reduced human needs to the barest minimum. Therefore, science is a dynamic human activity concerned with understanding the workings of our world. This understanding helps man to know more about the universe. Without the applications of science, it would have been impossible for man to explore other planets of the universe. Conversely, the awareness of the existence, of other planets would not have been realized without science.

Corresponding author: Bashir Rukayya Nakargo
rukkybash96@gmail.com
Department of Science and Technology Education, University of Jos.

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Basic Science and Technology is a school subject designed to expose students to scientific and technological knowledge and skills that will enable them to make informed decisions, develop survival strategies and learn to contribute meaningfully in the contemporary world (Kinuthia, 2019). Basic Science Technology is a compulsory subject at the basic level and junior secondary school, the subject expose learners' scientific and technological knowledge which will be continue at senior secondary school and tertiary level of education in Nigeria. The 9- year Basic Science and Technology curriculum is the product of re-alignment and restructuring of the revised curricula for Primary Science and Junior Secondary School Integrated Science.

Basic Science and Technology evolved from Integrated Science and is a science presented to a child in such a way that the child gains the concept of the fundamental unity of science, the commonality of approach to problems of scientific nature and an understanding of the role and function of science in everyday life and the world in which they live (Federal Republic of Nigeria, 2013). Some relevant themes in Integrated Science are still maintained in the Basic Science and Technology curriculum. In selecting the contents, three major issues shaping the development of nations worldwide, and influencing the world of knowledge today were identified. These issues are globalization, Information and Communication Technology (ICT) and entrepreneurship education. The features of the nine-year Basic Science and Technology curriculum were stipulated and structured as follows: Lower Basic Education Curriculum (Primary One to Three Classes), Middle Basic Education Curriculum (Primary Four to Six Classes) Upper Basic Education Curriculum (Junior Secondary School Classes-JSS One to Three).

The Basic Science and Technology curriculum is designed to enable students become literate in sciences and to lay a sound foundation for their subsequent study of Biology, Chemistry, Physics, Geography among others at the senior secondary school level. In spite of the various innovations introduced into the educational system, the attainment of the desired goal remains an illusion. UNESCO (2017) reported that the low achievement in Basic Science and Technology has remained, despite all the efforts in terms of curriculum reforms on the part of Science Educators to see that a firm scientific base is developed. This under-achievement of students in Basic Science and Technology could be attributed to many factors such as the constant use of the lecture method of teaching, the retention level of students in Basic Science and Technology, difficulty in managing large classes, among others.

Computer simulation is a modern way that uses technological facilities in teaching students and it help the teacher to visualize the abstract concept they know how human breath but can't explain the process involve and how the gas go in absorbed by the body and move out through the nose, it ease the teachers work of description of the process while to students it makes it easy to learn the skills. Kosma (2018) stated that computer simulation as a form of computer program designed for specific objectives, which could be easily modified.

Achievement refers to the extent to which a student has achieved the short-term goals of a course, measured in the scores obtained after a test. As defined by the United States Department of Agriculture (2014), achievement is the accomplishments of students that results from study and learning in a schooling system. As it applies to education, achievement refers to the attainment of outcomes that are tied to educational experiences. Students are exposed to educational experiences within a given period and then assessed to see the outcomes of such exposure. The results of the assessments are computed and then used as the achievement of the students.

Similarly the achievement of students in Basic Science and Technology despite all efforts by the government in recruiting and payment of teacher's salaries, efforts of Parents and Teachers Association by providing enabling environment to complement that of the government and at the same time efforts of parents in providing the instructional materials and making other payments

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rukkybash96@gmail.com
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the achievement remain unsatisfactory because more than 60% of the students are achieving below credit level at the same time the fluctuation of yearly achievement of the students create a question to be answered this question may be due to teaching method and other factors that may affect achievement.

Gender is an attribute that classified the learner into male and female. This can be a factor that could influence the application of technology in the teaching and learning process, male and female students may differ in their Basic Science and Technology achievement. As pointed out in Eze, Ezenwafor and Obidile (2016), male and female students who were taught Basic Science and Technology did not differ significantly in their achievement scores in the course. On the other hand, Male and female students' achievement in Basic Science and Technology may differ when they are taught with innovative approaches like computer simulation strategy. It is against this backdrop that this study is geared to examine the effects of computer simulation strategy on junior secondary two students' achievement in Basic Science and Technology in Jos North Local Government area, plateau state.

STATEMENT OF THE PROBLEM

Proper knowledge of Basic Science and Technology the application of its principles will help students to develop their career in sciences and improve their achievement level in Basic Science Technology when appropriate teaching strategies are applied. However, Basic Science and Technology students appear performed poorly in the subject. Research conducted by Jamilu (2017) revealed that, poor teaching and learning of Basic Science and Technology emanates from lack of formative teaching, inability of teachers to improvise and use learning materials as well as their inability also to involve students in science activities both outside and inside the class. This is evidence in the analysis of Basic Science Certificate Examination in Plateau State by Plateau State Education Resources Centre (ERC) results analysis of (2019-223) indicate over the years student's achievement in Basic Science and Technology is not impressive 0.

Despite efforts of teachers to make classroom instruction interactive and engaging, students' achievement in this skill course have been low. Base on the data collected by the research with the aim of determining the achievement level of students in basic science and technology among public secondary schools in the study area, revealed that students' achievements in the subject is discouraging. This encourages the researcher to focus on public school in the study area. In addition to the low achievement of students' in BECE examination. The report revealed that students have been consistently failing Basic Science and Technology from 2019-2023. The results indicated that the rate of passing at credit level ranges between 36.4% to 64.3 %. Students' poor performance in Basic Science and Technology could result in their inability to perform in future when they choose a career in any of the science field. The problem of poor performance and its ripple effect on society calls for the need to try new approaches in the teaching of Basic Science and Technology.

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 achievement in Basic Science and Technology in Jos-North Plateau State with the following specific objectives to guide the study:

1. To find out the pre-test and post-test achievement scores of students in Basic Science and Technology in the experimental and control groups.
2. Determine the post-test achievement of students in Basic Science and Technology in the experimental group due to gender.

RESEARCH QUESTIONS

1. What is the achievement scores of students in Basic Science and Technology in the experimental and control groups?

Corresponding author: Bashir Rukayya Nakargo
rukkybash96@gmail.com
Department of Science and Technology Education, University of Jos.

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2. What is the post-test achievement mean score of students in Basic Science and Technology in the experimental group due to gender?

Research hypotheses

1. There is no significant difference between the pre-test and post-test achievement mean scores in Basic Science and Technology between experimental and control groups.
2. There is no significant difference in the post-test achievement 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. These 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 allowed 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.

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RESULTS

Research Question One

What is the pre-test and post-test achievement scores of students in Basic Science and Technology in the experimental and control groups?

Table 1 Achievement Mean Scores of students taught by Computer Simulation Strategy and Conventional Lecture Method

		Pre-test		Post-test		
Group	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean Diff**
Experimental	35	30.46	7.23	60.51	7.65	17.11
Control	40	27.85	5.69	43.40	9.24	

The findings in Table1 revealed respective achievement mean scores of 30.46 and 60.51 for students in the experimental group before and after exposure to treatment using computer simulation strategy; while those in the control group had respective mean scores of 27.85 and 43.40 before and after treatment. This finding revealed that not much difference was observed in the achievement mean scores of students in the two groups before the treatment. The result however, further indicates that students in the experimental group who were exposed to computer simulation learning strategy had a higher achievement mean score (60.51) after the treatment than those in the control group (43.40) who were taught using the conventional lecture method. This implies that students in the experimental group who were exposed to computer simulation learning strategy achieve higher than students in the control group who were exposed to conventional lecture method.

Research Question Two

What is the post-test achievement mean score of students in Basic Science and Technology in the experimental group due to gender?

Table 2 Achievement Mean Scores of Students in the Experimental Group Due to Gender

Gender	**N**	**Mean**	**SD**	**Mean Diff**
Male	16	62.94	7.74	4.46
Female	19	58.47	7.14	

The findings in Table 2 revealed the post-test achievement mean score of male students in the experimental group had 62.94 with a standard deviation of 7.74 while their female counterparts had an achievement mean score of 58.47 with a standard deviation of 7.14. The mean score difference is 4.46 in favour of the male students.

Research Hypothesis One

There is no significant difference between pre-test and post-test achievement mean scores in basic science and technology between experimental and control group.

Table 3 ANCOVA Result of Mean Score Difference between Pre-test and Post-test Achievement Mean Scores in Basic Science and Technology between Experimental and Control Group

Source	**Type III Sum of Squares**	**DF**	**Mean Square**	**F**	**Sig.**
Corrected Model	4841.658[a]	2	2420.829	29.313	0.000
Intercept	8963.979	1	8963.979	108.542	0.000
Pre-test	4.21	1	4.21	0.051	0.822

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rukkybash96@gmail.com
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Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Gender	4638	1	4638	56.16	0.000
Error	5946.129	72	82.585		
Total	208832	75			
Corrected Total	10787.79	74			

a. R Squared = .449 (Adjusted R Squared = .433)

Table 3 revealed that F (2, 72 = 29.313), (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 mean score difference between pre-test and post-test achievement mean scores in basic science and technology between experimental and control group in favour of the experimental group. Findings also revealed that the adjusted R square is 0.433, meaning that the 43.3% 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 in the post-test achievement mean scores of male and female in the experimental group.

Table 4: ANCOVA Results of Post-Test Achievement Mean Scores of Males and Females in the Experimental Group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	263.702[a]	2	131.851	2.536	0.015
Intercept	7604.679	1	7604.679	146.257	0.000
Pretested	38.192	1	38.192	0.735	0.398
Gender	222.14	1	222.14	4.272	0.047
Error	1611.857	31	51.995		
Total	125117	34			
Corrected Total	1875.559	33			

a. R Squared = .141 (Adjusted R Squared = .085)

Table 4 revealed that F (2, 31 = 2.536), (P value = 0.015). Since the P value is less than 0.05 level of significance, the null hypothesis is rejected. Therefore, there is a significant mean score difference between pre-test and post-test achievement mean scores in Basic Science and Technology between experimental and control group in favour of the experimental group. Findings also revealed that the adjusted R square is 0.085 meaning that the 85.0% 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.

DISCUSSION OF FINDINGS

This study was conducted to examined the effects of computer simulation strategy on JSS II students' achievement in basic science and technology in Jos North metropolis, plateau state Nigeria. Findings of the study revealed that computer simulation strategy is effective in improving Junior Secondary School student's achievement in Basic science and technology. This is evidently shown in the study. The first null hypothesis was rejected. The experimental group achieved higher than the control group significantly. This corroborates the findings of Aliya (2025) whom examined the Effects of

Corresponding author: Bashir Rukayya Nakargo
rukkybash96@gmail.com
Department of Science and Technology Education, University of Jos.

Computer Simulation on Students' Interest and performance in Upper Basic Science in Katsina State, Nigeria.

The experimental group achieved significantly higher than the control group that received no treatment. This is not different from the findings of Adam et al. (2021) and Umar, Sidi and Michael, (2024). They examined the study investigate the effect of Computer Simulation on students' academic achievement and interest in Education Technology in Colleges of Education in Niger State and investigated the effect of computer animation strategy on student's achievement in basic science among junior secondary schools in Gombe metropolis. Their finding proved that computer simulation strategy is effective in improving students' achievements.

Similarly, the study revealed that the pre-test and post-test achievement mean scores difference in basic science and technology in the experimental group was statistically significant in favour of the post-test. This has also proven that the treatment is effective in improving students' achievement after exposure to computer simulation strategy. This finding is not different from that of Terfa and Emmanuel (2017) and Uwambajimana and Minani, (2023). Both of them discovered that computer simulation strategy improved student's achievement significantly after comparing pre-test and post-test scores in the experimental and control groups. Furthermore, this study discovered that, there is no significant interaction effects of treatment and gender on achievement mean score between pre-test and post-test achievement mean scores in Basic Science and Technology in the experimental and control group.

This shows that gender is not a factor that influence the interaction of the treatment and achievement in the experimental group. This finding is similar to that of Dakur (2023) who conducted a study on effects of experiential learning on students' attitude and achievement in geography. Also, Mutheu, Peter, and Kisilu, (2023) examined the use of Computer Simulation Strategy as predictors of students' achievement in public Secondary Schools in Kangundo sub-county, Machakos county, Kenya discovered that there is no interaction effects of treatment and gender on student's achievement. At this juncture, gender is not a factor that influences student's achievement. This study concluded that computer simulation strategy is an effective teaching strategy that improves students' achievement in basic science and technology irrespective of gender. It was recommended that computer simulation teaching strategy enhanced students' achievement in basic science and technology, teachers should adopt the use of this strategy.

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Corresponding author: Bashir Rukayya Nakargo
rukkybash96@gmail.com
Department of Science and Technology Education, University of Jos.