

# Effects of Simulation Strategy Senior Secondary Two Biology Students' Interest and Academic Achievement in Plateau Northern Senatorial Zone, Nigeria

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**Abstract:** The study sought to examine the effects of simulation strategy on senior secondary school Biology academic achievement in Plateau Northern Senatorial Zone, Nigeria. Two specific objectives and two research questions were raised and two hypotheses formulated and tested at .05 level of significance. Quasi-experimental research design, specifically the pre-test-post-test non-equivalent control group design was used in the conduct of this study. The population of the study consisted of all the 5130 SS II Biology students, 2795 males and 2335 females). The sample size was 74 SS II Biology students, which consisted of the experimental group with 44 students (19 males and 25 females), and control group with 30 students (17 males and 13 females). The instruments used for the study was, Human Circulatory System Achievement Test (HCSAT) which was developed and validated by the researcher. The research questions raised were answered using mean and standard deviation while the hypotheses formulated were tested using ANCOVA and ANOVA. The study showed that the achievement mean scores of the experimental group was higher than the mean scores of the control group after treatment. This signifies that simulation strategy improves students' achievement more than the traditional method of teaching Biology. The study recommended the need for teachers to used simulation strategy in teaching so as to improve students' achievement in Biology.

**Keyword:** Simulation; Simulation Strategy; Academic Achievement; Biology.

## I. INTRODUCTION

Science is a branch of knowledge that deals with the study of facts systematically arranged and showing the operation of general laws. The objectives of teaching sciences as contained in the Nigerian National Policy on Education (2014) is to equip students to live effectively in the modern age of science and technology. The national policy on education (2014) further reiterates that science teaching and learning is an instrument for inculcating necessary scientific knowledge, skills and competencies to students so as to equip them with necessary skills needed for useful living. The science subjects that are taught to students at the senior secondary schools include mathematics, chemistry, physics, biology and geography among other. These subjects are the basis of any science subject required of science students at the secondary school level of education. Biology is the science of life that studies living matter, structure, functions and

behaviour of organism. It is concern with the study of living things and their vital organs, it deals with physiochemical aspects of live of both humans and other animals. It is concerned with evolution, distribution and taxonomy of life.

Biology is a prerequisite for pursuing a number of careers such as pharmacy, medicine, biochemistry, botany, zoology, nursing among others (Adebanjo & Shogunle, 2020). Biology helps students to understand themselves and how the systems in the body of every living thing works. It encourages the ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture. Biology helps us to understand the living world and the ways its many species including humans function, evolve and interact. Advances in medicine, agriculture, biotechnology have brought improvement in the quality of lives. Despite the importance of biology, available statistic from the Plateau State ministry of education shows that students performance in the subject in west African examination council WAEC and national examination council NECO, is below average, the statistics shows that on the average (within six years under review) out of an average enrolment of 33,641 students; only 20% (6,899 students) passed at credit level and above while 32% (10,835 students) had passes and 48% (15,907 students) failed. This has the potentials to affect students career especially students who may want to pursue courses such as medicine, nursing, biochemistry, pharmacy, botany, zoology among others.

Some reasons that have been held responsible for students' poor performance include, teachers attitude, students interest in the subject, teaching methods used, availability of instructional materials, teaching environment among others. This therefore calls for the need for teachers to employ students' centred methods of teaching so as to improve students' achievement in the subject hence the need to used simulation strategy. Effective teaching in secondary schools should emphasize the use of activity-oriented methods and instructional strategies that make students to achieve their learning objectives. Many teachers used the traditional approach in which the teacher is active in the teaching process and the students are rather passive, as a result reducing interest and academic achievement in Biology in most

secondary schools in Nigeria ( Femi & Adewale, 2012 ). This is a cause for concern to all stakeholders in the educational sector. One of the reasons that have been pointed out as responsible for the poor achievement of students in Biology is the defective teaching strategies employed by Biology teachers in Senior Secondary Schools hence the need for teachers to use student centred method such as simulation strategy.

Simulation strategy is an experientially strategy that challenge students' misconception and encourage higher order thinking which promotes critical thinking abilities and self-directed learning (Kreber, 2001). Simulation is a model of what exists and showing a representation of a manageable real event in which the learner is an active participant engaged in learning behaviour by applying previously acquired skills or knowledge. It is a general and flexible teaching approach that can be used in teaching science subjects that requires students to challenge for higher thinking order (Talan, 2021). It is frequently used in situation where students need to develop skills and experiences that will help them to improve their learning ability. Simulation strategy helps to improve student academic achievement when used in teaching and learning.

Some studies revealed that simulation strategies facilitate students learning, for instance, Talan, (2021) Konak, (2019) found that simulation technique which is student centred approach makes learning apprehensive and facilitate permanent learning by restructuring the student knowledge. Again Monday (2021) reported that simulation strategy helps to augment and contributes to achieving sensible learning in students. Similar studies have been conducted, though not exactly to the present study, for instance Talan (2021) conducted a study on the effect of simulation technique on achievement: a meta-analysis studies and the study found that students that were taught using simulation perform better than those that were taught using conventional method.

Again, Bello, Ibi and Bukar (2021) conducted a study on effect of simulation technique and lecture method on students' achievement on students' academic on sexual reproductive system and findings showed that students that were taught sexual reproductive system using simulation strategy performed better than students that were taught using lecture method. Similarly, Monday (2021) conducted a study on effects of computer simulation on students' achievement and retention in sexual reproductive system and findings showed that students that were taught reproductive system using computer simulation achieved higher than those that were taught using conventional method. From the review, most of the studies that were conducted used a different state other than plateau state and the studies used different subject.

The study that used biology used sexual reproductive system while the present study will use circulatory system. The foregoing shows that the two studies are not the same and hence the need to conduct the present studies so as to fill the gap not covered by the reviewed studies and hence the need

for the present study. This study: therefore seeks to determine the effect of simulation strategy on biology students' achievement in northern senatorial zone of plateau state, Nigeria. Students' gender and achievement is another variable to the present study. Gender difference in students' achievement have been in consistent as reported in literature. For instance Oderinde (2016) found that males performed better than females in economics while Rafael (2014) found no significant difference on students achievement based on gender in economics, hence the need to investigate whether students gender will affect achievement of students in circulatory aspect of biology after exposure to simulation strategy.

Individual interest therefore, is conceptualized as a relatively stable affective-evaluative orientation toward certain subject areas or objects. The amount of interest an individual has on a particular activity determines the level of success in that activity. Both the instructors and the learners can make the teaching-learning process a thing of joy or fun when the instructor is interested in and able to secure the attention of the learners to instruction. Interest in science is very important as it motivates students to learn. It is however worrisome that, recent studies show a decline in interest of students especially in science as both male and female children grows (Abanikannda, 2018). Gender refers to the socially constructed roles and relationships, personality traits, attitudes, behaviours, values, relative power and influence that society ascribes to sexes on a differential basis. It is noteworthy, that gender differences in science learners exist. Science classes in most Nigerian schools are crowded by male students. This variation that exists remains unclear. Could it be that most cultures in our society do not give females the opportunity to experience the environment which is the pre-requisite to learning of sciences?. Rather, females are kept indoors to do the house work, while the males are left to explore the environment that might have the tendency to raise the interest for science subjects. The broad question for this study therefore is; what is the effects of simulation strategy on students' achievement and interest in circulatory system aspect of biology based on students' gender?

## II. PURPOSE OF THE STUDY

The purpose of the study is to determine the effect of simulation strategy on senior secondary two biology students' achievement in northern senatorial zone of plateau state. The specific objectives are to:

- 1) Determine the achievement mean scores of the experimental and control group in circulatory system aspect of biology before and after exposure to treatment.
- 2) Examine the achievement mean score of male and female students in circulatory system aspect of biology after exposure to treatment.
- 3) find out the effect of simulation strategy on SSS II students' interest in Biology in Plateau Northern Senatorial Zone, Nigeria.

*Research Questions*

- 1) What are the achievement mean scores of the experimental and control group in circulatory system aspect of biology before and after exposure to treatment?
- 2) What are the achievement mean scores of male and female in circulatory system aspect of biology after exposure to treatment?
- 3) What is the effect of simulation strategy on SSS II students' interest in Biology in Plateau Northern Senatorial Zone, Nigeria?.

*Research Hypotheses*

- 1) There is no significant difference in the achievement mean scores between the experimental and control group in circulatory system aspect of biology after exposure to treatment
- 2) There is no significant difference in the achievement mean scores between male and female in circulatory system aspect of biology after exposure to treatment

**III. METHODOLOGY**

The research design used for this study was Quasi-experimental research design, specifically the pre-test-post-test non-equivalent control group design was used in the conduct of this study. The population for the study consisted of 5130 senior secondary two biology student made up of male and females. A sample of 74 students (both male and females) were used in this study. Multistage sampling and simple random sampling techniques were used in selecting the schools and students that were used for the study. This include selecting the zone, area office and the schools used. The instrument used for data collection was the circulatory system achievement test which was developed and validated by the researcher. Two experts in biology education and one from research, measurement and evaluation validated the instrument. The comments and suggestions of the experts were reflected in final version of the instrument. The reliability of the instrument was established using Cronbach alpha reliability test, after the instrument was administered to a sample of 50 SS II biology students from a school different from the school that was used for the study and it was found to be .85 which showed that the instrument as reliable. The experimental group was exposed to simulation strategy for five weeks while the control group was exposed to conventional method of instruction for five weeks. The two groups were pretested and post-tested to determine the effect of treatment on each group. The data were collected using circulatory system achievement test, which the students are subjected to after the five weeks of exposure to the simulation strategy during the process of teaching and learning process. The data were analysed. The data collected was processed and analysed in relation to the research questions that were raised and the hypotheses that were formulated for the study. Both descriptive and inferential statistics was used. The Statistical Product and Service Solutions (SPSS) version 26 was utilized for both the descriptive and inferential analysis. The research

questions were answered by using the mean scores and standard deviation of the students' responses. This is to produce a reliable measure of location. While the hypotheses were tested at 0.005 level of significant using Analysis of Covariance (ANCOVA) for hypotheses one and two Therefore, the decision rule for the ANCOVA is thus: The decision rule will be to reject the null hypothesis if the test statistic from the table is below the F critical value, otherwise do not reject the null hypotheses. Mean and standard deviation decision rule is based on the fact that the pre-post mean and standard deviation calculated are compared for the control and experimental group (Kloos, 2016). Also, the mean of BIS was calculated from each item, which was compared with the benchmark of 2.50 to ascertain the general interest in biology, specifically human circulatory system, to be either low or high.

**IV. RESULTS**

*Research question one*

What is the achievement mean scores between the experimental and control groups in circulatory system aspect of biology before and after exposure to treatment?

Table 1: Results of the Analysis on Students' Achievement between the Experimental and Control Group before and after Treatment

Group		N	Mean	SD	MD
Experimental	Pretest	44	43.8	6.19	28.7
	Posttest	44	72.5	5.8	
Control	Pretest	30	42.26	3.98	1.44
	<b>Posttest</b>	<b>30</b>	<b>43.7</b>	<b>3.99</b>	

The results of the analysis from Table 1 showed that the experimental group had mean of 43.8, SD 6.19 before treatment and a mean of 72.5, SD5.8 after treatment while the control group had mean of 42.26, SD 3.98 before treatment and a mean of 43.7, SD 3.99 after treatment the experimental group had mean difference of 28.7 while the control group had mean difference of 1.44. From the result, it implies that the experimental group achieved higher than the control group.

*Research question two*

What is the achievement mean scores of male and female biology students in circulatory system aspect of biology after exposure to simulation strategy?

Table 2: the results of the analysis on students' achievement mean scores based on gender

Group	N	Mean	SD	MD
Male	19	72.5	5.8	1.2
Female	25	73.7	3.9	

The results of the analysis from Table 2 show the achievement of male and female students after exposure to treatment. From the results, the males had mean of 72.5, SD 5.8 while the females had mean scores of 73.7, SD 3.9. The result further shows that the mean difference between the two groups is 1.2. From the results, it shows that females' students achieved higher than the male students. Hence simulation strategy

improves female students' achievement than the male students in the study area.

*Research Question Three:*

To what extent will simulation strategy affect SSS II students' interest in Biology after treatment in Plateau Northern Senatorial Zone, Nigeria?.

Table 3: Mean and Standard Deviation of the status of SSS II students' interest in Biology after treatment in Plateau Northern Senatorial Zone, Nigeria.

Group	N	BIS	SD
		Mean	
Experimental	44	0.49	4.00
Control	30	0.40	1.30

Table 3 revealed that students in the control group have a mean interest rating of 0.40 and standard deviation of 1.30 while those in the experimental group have a mean interest rating of 0.49 and standard deviation of 4.00. Therefore the mean in Biology interest Scale scores of students in experimental group was higher than that of those in the control group.

*Hypothesis one:*

There is no significant difference in the achievement mean scores between the experimental and control group after exposure to treatment.

Table 4: Summary of ANCOVA on Pre-test Achievement Mean Scores of the Experimental and Control group

Sources	Type III Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
Corrected Model	17006.517 <sup>a</sup>	2	8503.259	337.967	.000	.905
Intercept	2304.143	1	2304.143	91.580	.000	.563
PRETEST	158.005	1	158.005	6.280	.015	.081
GROUP	16043.301	1	16043.301	637.651	.000	.900
Error	1786.361	71	25.160			
Total	285553.000	74				
Corrected Total	18792878	73				

a. R Squared = .905 (Adjusted R Squared = .902)

To test for hypothesis one, an analysis of Co variance (ANCOVA) was computed. As can be seen from the results on Table 4, the computed p value was .000 which is less than .05. Therefore, there is sufficient data against the null hypothesis, hence it is rejected. It therefore means that there is significant difference between the pre-test achievement mean scores of the experimental and control group.  $F(1,73) = 637.651, p < .05$ . On the contrary ( $p = 637.651$ ) for the covariate (pre-test) between the experimental and control groups on post-test achievement is significantly higher than the .05 level of significance ( $\alpha = .05$ ).

*Hypothesis two:*

There is no significant difference in the achievement mean scores between the males and females after exposure to treatment.

Table 5: Results of ANOVA for Post-Test Achievement Mean Scores of Males and Females in the Experimental Group

Sources	Sum of Squares	df	Mean Squares	F	Sig.
Between Groups	248.204	1	248.204	.865	.0358
Within Groups	12050.228	73	286.910		
Total	12298.432	74			

To test for hypothesis two, an analysis of variance (ANOVA) was computed. As can be seen from the results on Table 5, the

computed p value was .0358 which is less than .05. Therefore, there is sufficient data against the null hypothesis, hence it is rejected. It therefore means that there is significant difference between the post-test achievement mean scores of males and females in the experimental group in Plateau North Geo-Political Zone, Nigeria.

V. DISCUSSION OF RESULTS

The results of the analysis showed that the experimental group that was exposed to simulation strategy achieved higher than the control group. This findings is in accordance with the study by Adebajo and Shogunle (2021) who reported that students' that were exposed to simulation strategy achieved higher in respiratory system aspects of biology than the students that were exposed to lecture method. The implication is that simulation strategy improved students' performance in circulatory system aspect of biology. The results of the analysis from research question two revealed that female student achieved higher than male in circulatory system aspect of biology, this is in disagreement with the findings by Monday (2021) who found that students gender does not affect students' achievement in science subject. The implication of this findings is that female achieved higher than male students in circulatory system aspect of biology. The result from Table 3 revealed that students in the control group have a mean interest rating of 0.40 and standard deviation of 1.30 while those in the experimental group have a mean interest rating of 0.49 and standard deviation of 4.00.

Therefore, the mean in Biology interest Scale scores of students in experimental group was higher than that of those in the control group. The result of this study is in agreement with the findings of Sarioğlan (2020) who found that simulation-based instruction was more effective in increasing students' interest compared to traditional teaching method. This also aligns with Zumyil (2019) who indicated that the use of simulation instructional strategy enhanced students' interest in Biology.

The results of the analysis from hypothesis one showed that there is a significant difference in the achievement mean scores between the experimental group and the control group. This is in accordance with the findings by Bello, Ibi and Bukar (2010) who reported that students that were taught using simulation strategy achieved higher than students that were taught using lecture method. The implication is that simulation strategy improve students' achievement in biology more than lecture method. The results of the analysis from hypothesis two reveals that there is no significant difference in the achievement mean scores between male and female students, this is in tandem with the findings by Monday (2021) who found that students gender does not affect students achievement in science. The implications of this finding is that students' gender does not affect student achievement.

## VI. CONCLUSION

The findings of this study showed that students achievement improved after exposure to simulation strategy, hence, simulation strategy improve students' achievement in biology. Also the study revealed that students' gender does not affect achievement of students in circulatory system aspect of biology. Lastly, simulation-based instruction is more effective in increasing students' interest.

## VII. RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made:

- 1 Biology teachers need to employ simulation strategy in teaching biology in secondary school so as to improve student's achievement in the subject.
- 2 Curriculum and policy makers should make policies on the use of simulation strategies, so that teachers especially Biology teachers can implement those policies to enhance the teaching and learning process.
- 3 Students should be giving the opportunity to use simulation models in their learning process. This can be done if ministry of education and proprietors of private schools will make available the models for students use.

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