
**EFFECT OF COMPUTER SIMULATION ON STUDENTS' INTEREST AND ACHIEVEMENT
IN SEXUAL REPRODUCTION IN PLANTS IN NIGER STATE, NIGERIA**

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Abstract

This study investigated effect of computer simulation on students' interest and achievement in sexual reproduction in Niger State, Nigeria. It adopted a pretest, post-test Quasi Experimental, control group design. A sample size of 178 students was selected from a population of 11,275 SS 11 Biology students in 240 public secondary schools in 2018/2019 academic session using Multi-stage random sampling techniques. Two research questions guided the study and two null hypotheses were formulated and tested at 0.05 level of significance. Plant Reproduction Interest Inventory (PRII) and Plant Reproduction Achievement Test (PRAT) were the instruments employed for data collection. The Instruments were Adapted, duly validated and the reliability index of PRAT and PRIS were 0.88 and 0.80 using Kuder- Richardson Formula 20 and Cronbach Alpha reliability methods respectively. ANCOVA was used to test the hypotheses while research questions

were answered using mean and standard deviation. The findings revealed that student taught using Computer Simulation Strategy performed better than those taught using the conventional teaching methods. Also the result of ANCOVA test indicate that there was significant difference in the interest ratings with F - ratio of 470.030 and P- value =0.000, achievement scores with F-ratio of 125.037 and P- value of 0.00 in favour of the group taught using computer simulation strategy. Based on this result, it was recommended that computer simulation strategy should be adopted for teaching of Biology in secondary schools and Science Teachers Association of Nigeria (STAN) should organize seminars, conferences and workshops to enlighten teachers on the effectiveness of CSS among others.

Keywords: Computer, Simulation, Conventional teaching method, Sexual Reproduction in Plants.

Introduction

The Biology curriculum in Niger is designed to be activity -oriented and student-centered and

the contents and contexts of Biology syllabus for secondary schools was intended to provide modern Biology course as well as meet the

needs of the society through relevance and functionality in its contents, methods, processes and application (Ezeh, 2007). The national policy statement (2013) notes that Biology teaching should emphasize adequate laboratory and field skills, meaningful and relevant knowledge to everyday life in matters of personal and community health and Agriculture, while ensuring reasonable and functional scientific attitude. Therefore, emphasis is laid more on teaching and learning of Biology as a process rather than as a body of knowledge. For this reason, field studies, guided discovery and laboratory techniques and skills were recommended. To ensure the full realization of these interesting objectives, the contents and contexts of the syllabus place great emphasis on field studies, guided discovery, laboratory techniques and skills coupled with conceptual thinking. Unfortunately, available evidence has revealed that students' performance in Biology has been quite discouraging (WAEC, 2018).

This poor performance of students in Biology at senior schools Certificate Examinations leaves one in doubt about the effectiveness of instructional materials and instructional delivery approaches popularly used by the Biology teachers for the teaching and learning of Biology in Nigerian secondary schools, particularly Niger State. Statistics from the West African Examinations Council WAEC (2019) reveal that students' achievement in Biology in the May/June examinations has been on the decline. This poor achievement could be attributed to lack of utilization of appropriate instructional

strategy, abstract nature of teaching Biological concepts, lack of qualified teachers, overcrowding of classroom, among others (Veselinovska,2011)). corroborating, WAEC Chief Examiner Report (2015-2019) asserted that conventional teaching approach which is commonly employed in Biology class rooms is deficient in meeting the needs of majority of learners.

This consistent poor performance of Biology students in external examinations has stimulated several speculations and arguments at the Science Teachers Association of Nigeria (STAN) workshops, meetings and seminars that has therefore, prompted the introduction of the new science modules. The concern has been on how to get science teachers depart from the conventional teaching approaches of science teaching to a new approach. Although the prescription did not specify simulated classroom in science teaching, recent findings about the advantages of virtual learning by the researchers particularly in this era of global pandemic (corona virus) opened an avenue for making relevant trials on computer simulation models (Coulter, 2009). Computer simulation strategy is one of the virtual teaching strategies which enable students to make use of all their senses in the learning process

In Biology classrooms, simulation can play an important role in creating virtual experiments which can be so helpful in teaching abstract topics like sexual reproduction in plants among others. Sexual reproduction in plants is an

important theme for all learners but it is an area where there are major difficulties in understanding (WAEC 2018). Many students and teachers consider sexual reproduction in plants concept as one of the most difficult topics in Biology. A major challenge to Biology educators is to teach these processes so that students can comprehend and understand their complexity. Because of this challenge, many teachers are looking for new approaches that may enhance students' interest in learning of the processes which may lead to better understanding, of the concepts and the use of visualization as in computer simulation is significant among these approaches.

There is poor achievement in science and technology courses, the implication of this is that very few students will be qualified to study science and technology courses in higher institution, which will lead to the dwindling of man power in this area. This poor achievement can be traced to a lot of factors among which is ineffective teaching strategies. Improved teaching strategies which comprises of virtual teaching strategies might stimulate students' interest in learning thereby helping them understand the concepts of Sexual Reproduction in Plants which might result to higher achievements in the external examinations. Therefore, it is important to investigate virtual learning strategies to ascertain their effects on students' achievement in Biology. This research therefore investigated one of the virtual learning strategies, (Computer Simulation Strategy) to ascertain its effect on students' interest and

achievement in Sexual Reproduction in plants in senior secondary schools in Niger state, Nigeria.

Research Questions

The following questions guided the study:

1. What are the mean Interest ratings of students taught Sexual Reproduction in Plant with Computer Simulation Strategy (CSS) and those taught with Conventional Teaching Method (CTM)?
2. What are the mean achievement scores of students taught Sexual Reproduction in Plants with Computer Simulation Strategy and those taught with Conventional Teaching Method?

Statement of Hypotheses

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

H₀₁: There is no significant difference in the mean interest ratings between students who were taught sexual reproduction in plants using Computer Simulation Strategy and those with the Conventional Teaching Method (CTM)

H₀₂: There is no significant difference in the mean achievement scores of students who were taught Sexual Reproduction in Plants using Computer Simulation Strategy (CSS) and those taught with the Conventional Teaching Method (CTM)

Methodology

The research design adopted in this study was quasi-experimental with non-equivalent Control group in which pretest and post-test was used. The population of the study consisted of all the

240 public co-educational senior secondary school class two (SSII) Biology students in Niger State in 2018/2019 academic Session. There were 11275 Biology students, 5903 males and 5372 females. The sample for the study was made up of 178 students in four coeducational public senior secondary schools in Minna educational zone of Niger State. Multi-stage sampling technique was employed to draw the sample. The two instruments used for data collection in this study were Plant Reproduction

Achievement Test (PRAT) and Plant Reproduction Interest Inventory (PRII). The instruments were adapted and duly validated by experts in the field and the reliability indices of the instruments were determined to be 0.88 and 0.80 respectively.

The hypotheses were tested using Analysis of Covariance (ANCOVA) using Statistical Package for Social Sciences (SPSS). The significance of the various statistical analyses was ascertained at 0.05 alpha levels..

Results

Research Question 1

What are the mean interest ratings of students taught sexual reproduction in plants using Computer Simulation Strategy and Conventional Teaching Method?

Data in respect of analysis are presented in Tables 1

Table 1: Means and standard deviations of interest ratings in PRII of students taught sexual reproduction in plants using CSS and those taught using CTM

Group	N	Pre- Interest		Post -Interest	
		Mean	SD	Mean	SD
CSS	81	26.67	12.069	66.73	11.088
CTM	97	34.25	15.309	35.02	15.253

Table 1 shows mean interest ratings of students exposed to Computer Simulation and Conventional Method. The computer simulation strategy has the higher interest ratings of 66.73 when compared to conventional teaching method with interest ratings of 35.02.

Hypothesis One

There is no significant difference in the mean interest ratings between students taught using CSS and those taught with the conventional teaching method (CTM). The result obtained is as presented in table 2

Table 2: Results of ANCOVA on Students' Interest ratings in PRII

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	56480.285 ^a	2	28240.143	246.242	.000	.738
Intercept	32662.499	1	32662.499	284.803	.000	.619
Pre-Interest	12102.224	1	12102.224	105.526	.000	.376
Group	53905.055	1	53905.055	470.030	.000	.729
Error	20069.760	175	114.684			

a. R Squared = .738 (Adjusted R Squared = .735)

Table 2 reveals a significant difference in the interest ratings of students exposed to Computer Simulation Strategy and Conventional Teaching Method. F - ratio = 470.030 and P- value =0.000. Since P-value of (0.000) is less than 0.05 set as level of significance, the null

hypothesis was rejected. The result implies that the computer simulation strategies produced a significant effect on the post-test interest scores of students when covariate effect (pretest) was controlled.

Research question 2

What are the mean achievement scores of students taught Sexual Reproduction in Plant with Computer Simulation Strategy and those taught with Conventional Teaching Method?

Table 3: Means and standard deviation of achievement scores in PRAT of students taught sexual reproduction in plants using CSS and those taught using CTM

Group	N	Pre- test		Post- test	
		Mean	SD	Mean	SD
CSS	81	22.57	10.07	78.82	11.355
CT M	97	30.54	32.302	59..52	12.71

Table 3 shows mean gain achievement score of students exposed to Computer Simulation

Strategy (CSS) and Conventional Teaching Method. The CSS has higher mean gain

achievement score of 59.52 and CT M has a lower mean gain achievement score of 3.54

Hypothesis Two

There is no significant difference between the mean achievement scores of students taught using Computer Simulation Strategy (CSS) and

those taught using the Conventional Teaching Method (CTM). The result obtained is as presented in table 4

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17755.308 ^a	2	8877.654	63.363	.000	.420
Intercept	360267.804	1	360267.804	2571.367	.000	.936
Pretest	1312.803	1	1312.803	9.370	.003	.051
Group	17518.661	1	17518.661	125.037	.000	.417
Error	24518.810	175	140.107			

a. R Squared = .420 (Adjusted R Squared = .413)

Table 4: Result of ANCOVA on students' Achievement score in PRAT

Table 4 shows the result of ANCOVA of posttest scores as the dependent variable with the pretest as the covariate used in the analysis. The groups revealed that there is significant difference between the mean achievement scores of students taught sexual reproduction in plants

in the experimental and control group. This is from the fact that F-ratio= 125.037 and P- value = 0.00. Since the P-value of 0.00 is less than 0.05, the dependent variable indicates a significant difference suggesting that we reject the null hypothesis

Discussion of Findings

The findings of this study reveal the effect of Computer Simulation Strategy and Conventional Teaching Method in enhancing teaching and learning of sexual reproduction in plants. The

result of interest reveals significant difference between the interest ratings of students in Computer Simulation Strategy, and Conventional Teaching Method in favour of Computer Simulation Strategy. The findings also revealed no significant difference between

the mean interest ratings of male and female students who were exposed to Computer Simulation Strategy. The mean interest ratings of student taught using Computer Simulation Strategy is higher than that of their counterparts who have been exposed to Conventional teaching method. Computer Simulation Strategy has been found to be facilitating in enhancing students interest in the learning of sexual reproduction in plants. This might be due to the fact that Computer Simulation Strategy seems to have students' activities and step by step assessment which help the students to master the concepts without much difficulty. This finding is in agreement with the findings of Abanikannda (2018) and Audu (2018) who opined that Computer Simulation instruction is more effective than the conventional teaching method.

The results of achievement reveal significant difference between the achievement of students in Computer Simulation Strategy and Conventional Teaching Method in favour of Computer Simulation Strategy. The findings on students' achievement in the Computer Simulation Strategy group compared to those in Conventional Teaching Method group are in agreement with the earlier findings of Efe and Oladikan and Oladele (2016), Asogwa, Muh'd, Asogwa and Ufoegbu (2016), Falode and Bashir (2015), Ezeudu and Ezinwanne (2013), Aoudu (2015), Flangovan (2014) and Fabiku (2016) Liao and Chan (2013), Thong (2014), Asogwa and Ufoegbu (2016) who found that students taught sciences using Computer Simulation achieved better than those taught using the

Conventional teaching methods. This also agrees with the findings of Bayrak (2014) Sarabandoa, Cravinob, Armando and Soaresb (2014) Mihindo, Wachanga, and .Anditi (2016) Asogwa, Muh'd, Asogwa and Ufoegbu (2016), who reported that students taught with computer simulation Strategy achieved better than those taught using the conventional methods. The trend of improved achievement by the experimental groups could be as a result of the enabling learning environment provided, where students use the Computer Simulation Instructional Package on sexual reproduction in plants. It could also be as a result of excitement over the new learning approach, handling of personal computers, and the elimination of bias and strained relationship between teachers and students

Conclusion

The findings of this study have shown that computer strategy is more effective than conventional teaching method in this study. These results imply that the learning approaches employed by Biology teachers in teaching might have been partly responsible for the persistent lack of interest and under-achievement of students in Biology since conventional methods were mostly used. The implications of this study lies on the development of more virtual learning strategies for teaching Biology.

Recommendations

From the on the findings of the study, the following recommendations were made:

- i. Science Teachers Association (STAN) should sensitize Biology teachers by way of organizing seminars, conferences and workshops on Computer Simulation Strategy, and encouraging teachers to develop and adopt Computer Simulation Strategy in teaching and learning of Biology, to improve on students' interest and achievement.
- ii. The Federal Government through the ministry of Education should ensure that teachers are trained on the use of computer Simulation Strategy to enable them use the CSS in teaching and learning of Biology so as to improve on the students' interest and achievement in Sexual reproduction in plants and Biology at large.
- iii. Pre-service teachers should be trained on how to develop and employ the use of Computer Simulation Strategy.
- iv. Nigerian schools should be provided with well-equipped computer laboratories to eradicate the fear of using computer for teaching and learning by teachers and students

References

- Abanikannda M. O. (2018) Effect of technology tools on students' interest in Biology: A survey of Osun state high schools in Nigeria. *African Research Journal of Education and Social Sciences*, 5(3),
- Aoude M. F. N. (2015) The impact of integrating computer simulations on the achievement of Grade 11 Emirati students in uniform circular motion department of curriculum and methods of Instruction M.ed. Unpublished theses. College of Education. United Arab Emirates University
- Asogwa, U. D, Muh'd A, Asogwa E. N & Ufoegbu A. (2016) Effect of interactive computer simulation on secondary school students' achievement and retention in genetics concepts. *Asian Journal of Information Technology* 15(14), 2313-2321
- Audu C. T. (2018) Influence of teaching styles on students' achievement and interest among biology students in secondary schools in Taraba state Nigeria. *Advances in Social Sciences Research Journal* (5)5
- Bayrak C. (2014) Effects of Computer Simulations programs on university students' achievements in Physics. *Turkish Online Journal of Distance Education-* (9) 4-7.
- Coulter, B. (2009). Science through modeling and simulation. *Connect. March/April 2009* (16-17).
- Efe H. A & Efe R. (2011) Evaluating the effect of computer simulations on secondary Biology instruction: An application of Blooms' taxonomy *Scientific Research and Essays* 6(10), 2137-2146,
- Elangovan T. & Ismail Z. (2014) studied: The effects of 3D computer simulation on Biology students' achievement and memory retention Perak, Malaysia. *Journal of Asia-Pacific Forum on Science Learning and Teaching* (15), 2-10
- Ezeudu F.O. & Ezinwanne O.P. (2013): Effect of simulation on students' achievement in senior secondary school chemistry in Enugu East Local Government Area of Enugu State, Nigeria. *Journal of Education and Practice* (4), 19.
- Ezeh C.C. (2007). Use of core curriculum in teaching biology. *Annual Conference Proceeding of Science Teachers Association of Nigeria*, 49- 74.
- Fabiku, M. S. (2016). Effects of computer simulation package on secondary school students' learning outcomes in economics in Ife East Local Government area of Osun, Unpublished Med thesis, Obafemi Awolowo University, Ile Ife, Nigeria.
- Mihindo W. J Wachanga, S.W. Anditi Z. O. (2016) Effects of computer-based

- simulation, teaching approach on students' achievement in the learning of chemistry among secondary school students in Nakuru Sub- County, Kenya. *Journal of Education and Practice* (8), 2-5 .
- Sangodoyin A.&Aremu, A. (2010) Computer animation and the academic achievement of Nigerian senior secondary school students in biology. *The Journal for the Research Center for Education Technology (RCET)* 12(1), 59 – 64.
- Sarabandoa C, José P. Cravinob,, Armando A. Soaresb (2014) Contribution of a computer simulation to students' learning of the Physics concepts of weight and mass. Research Centre "DidactiCSS and Technology in Education of Trainers" (CIDTFF), Aveiro, Portugal *Procedia Technology* 13, 112 – 121
- Thiong, J. K, Ndirangu, M. & Okere M. (2014) Effects of computer-based simulation module on secondary school students' achievement in understanding of magnetic effect of electric current. *Global Educational Research Journal: 2(8):* 096-102,
- Veselinovska S S (2011) The effect of teaching methods on cognitive achievement, retention, and attitude among biology students. *Cypriot Journal of Educational Sciences. 4 (2011)* 175-185
- West African Examinations Council (WAEC), (2018) Analysis of Result, Lagos; WAEC
- West African Examinations Council (WAEC), (2019). Chief examiners' report.