
**SIMULATION TECHNIQUE AS A STRATEGY FOR ENHANCING
STUDENTS ACADEMIC ACHIEVEMENT IN PHYSICS, KOGI STATE,
NIGERIA**

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ABSTRACT

This study focuses on the effect of using simulation techniques to enhance students' academic achievement in Physics in Kogi State. Two research questions and two hypotheses guided the study. The study adopted a Quasi-experimental design. A sample of 294 senior secondary two students out of the total population of 7920, were selected randomly using the multistage sampling, technique. Physics Achievement Test-(PAT) was used for data collection. The data collected was analyzed using mean, standard deviation, and analysis of covariance (ANCOVA). The findings revealed that the simulation teaching techniques had a significant effect on students' academic achievement in physics. And female Also the finding revealed that there is a significant difference between the mean achievement scores of male and female students taught physics using simulation techniques. The researcher recommended that physics teachers should be retrained to adopt the use of simulation teaching techniques in order to enhance students' achievement in physics among others.

Keywords: Simulation, Technique, Academic Achievement, and physics.

1.0 INTRODUCTION

Acquiring science education especially physics is now a practical process that is characterized by constant changes of activity or progress. This is one of the reasons change continues to take place within its structure from time to time. The society in which science education is meant to serve is equally a dynamic one. Therefore to be relevant to the needs and the aspirations of society, science education must continue to keep pace with changes in society. This dynamism is reflected in contemporary Nigerian society, where educational policies have been very unstable, coupled with the unstable political climate of the country and insecurity. Science education is meant to solve the problem of society (Okoronka, 2018). Since new problems keep surfacing in society, from time to time, like the case of Covid19, science education too must respond accordingly to keep to its objectives. It is this issue of relevance in science education that leads to the emergence and development of new disciplines and curriculum in the area of science education from time to time. The

introduction of physics education in the school curriculum as a discipline is to enhance effective and functional living in modern society.

Physics is one of the cores and fundamental subjects studied in senior secondary schools in Nigeria. Madu (2017) points out that physics is a discipline that enhances effective and functional living in modern and dynamic society. According to Ezuibiro (2016), the teaching of physics must be centered on innovative methods that aim at seeking the truth which includes problem detecting, problem-solving, and learning by experimenting and discovery. The importance of physics in the Nigerian educational system cannot be over-emphasized as noted by Okeke (2015) that in spite of the immense benefits to be derived from the knowledge of physics, there seems to be poor handling of the subject in the secondary schools leading to students' poor academic achievement. The poor academic achievement of students could be a result of the teaching strategy adopted by physics teachers. This had made a number of physics educators in the country like Orji (2014), Achor (2015), Ezuibiru (2016), Musa (2017) Madu (2017), and Abuh (2021) study the problem empirically with the hope of finding causes and possible solutions.

Achievement can be defined as the act of accomplishing a task well (Ryder, 2016). Students' achievement is a major determinant of success or failure in an academic program. The academic achievement of secondary school students has continued to be a source of worry to those in the mainstream of science education in Nigeria and society in general. Science educators, examination bodies, and parents/guardians all over Nigeria today complain of students' poor performance in Physics and other science subjects at senior secondary certificate examination (SSCE). The chief examiner's report (2010-2018) in SSCE result shows students consistent low academic achievement in physics. This trend of poor achievement in physics and science subjects generally has aborted the ambition of many students since credit (A1-C6) in physics is a requirement for studying science disciplines such as medicine, pharmacy, space science, engineering, ICT, and physics education. Some of the causes identified by researchers are the poor background of students, poor strategies of teaching which do affect students' achievement in physics (Nwafor, 2015). While the method of presentation is supposed to be activity-based, most Nigerian secondary school teachers rely on the lecture method. This teaching method is theoretical and teacher-directed, instead of being constructive or activity-based. In the lecture method, the teacher according to Oguniyi (2016) simply becomes the expositor and drillmaster while the learner remains the listener and storehouse of facts that can be retrieved when a student hears his name called by the teacher. A study of teaching behavior and students' achievement in physics by Achor (2015) shows that student activities are better than teachers activities in promoting active learning in the physics classroom.

In this regard, for physics instruction to be effective, teachers should employ innovative and creative teaching techniques. The researcher, therefore, sought the use of simulation teaching techniques that will enable students to achieve good results in science subjects generally and physics in particular.

Simulation is the act of representation of the behavior or characteristics of a system through the use of another outlet especially computer programs designed for the purpose (Krulik, 2016). Krulik further buttresses that Simulation is the analysis of the problem which clearly illustrates real-life or hypothetical situations. Simulation permits the learner (male or female)

to manipulate variables or parameters and then to observe the consequences of their choices. It is a physical or social interaction or a representation of a manageable real event in which the learner is an active participant, engaged in learning behavior by applying previously acquired skills or knowledge. In interaction, students either male or female are required to share their ideas with others. In the process, social skills are developed as students are required to obey the rule of the game and work as a team in order to achieve the group goal irrespective of gender.

The researcher investigated another variable of interest to this study which is gender and its influence on students' achievement in physics concepts. Gender is used as a moderator variable because from literature, Agomouh (2010) and Madu (2017) have shown that students' conceptual understanding are gender-dependent using the innovative instructional approach, and Baser (2009) that found otherwise, this present study is to further validate these studies or otherwise using simulation teaching technique. One issue of concern in science education is gender achievements. Gender refers to social construct, characteristics, behavior, and roles which society ascribes to males and females. In recent times, educators have expressed diverse views about gender performance in Physics as one of the science subjects. Some scholars are of the view that males do better than females while others disagree with this view (Okeke, 2015). Rather, they argue that performance is a factor dependent on several factors such as socio-economic background, teaching strategies, attitude, and attention.

In a report by the West African Examination Council Senior Secondary Certificate Examination (2014), statistics of results in Nigeria by subject, grade, and gender revealed low enrollment and achievement of females in Physics. Therefore, one sees that the issue of gender in science achievement of students has not yet been resolved particularly in relation to academic achievement in Physics. This necessitated the need for further study of the influence of gender on students' academic achievement. The poor academic achievement in physics in the Kogi East Education zone of Kogi State is unsatisfactory, hence the need to find a way of solving this problem through research. The study is therefore to determine the effect of simulation teaching techniques, on students' academic achievement in physics in the Kogi East Education Zone of Kogi State.

2.0 STATEMENT OF THE PROBLEM

The rate of failure recorded by students particularly in Kogi East Education Zone of Kogi State has been a major concern to researchers. The low achievement in physics in external examination such as senior secondary certificate examination (SSCE) conducted by the West African Examination Council had been traced to the use of inappropriate teaching strategies like lecture method that does not put into consideration the student's activity and experience in teaching and learning process. This has led to the failure of producing the desired results in terms of academic achievement on the part of the students. Poor method of teaching invariably translates to students' poor achievement in physics. Hence a need to make sure that physics at all levels are taught using innovative technologies such as simulation teaching technique. Therefore this study investigates the effect of simulation teaching techniques on students' academic achievement in physics in the Kogi East Education Zone of Kogi State.

The specific purpose of this study is to

1. Determine the effect of simulation teaching technique on students' academic achievement in physics
2. Determine if there is any difference in the effect of simulation teaching techniques on male and female students' achievement in physics.

In line with the objectives of the study, the following research questions guided the study;

1. What is the difference in the mean achievement scores of students taught physics using simulation teaching technique and those taught using the conventional technique?
2. What is the mean academic achievement scores of male and female students taught physics using simulation technique?

Based on the objectives, the following null hypothesis guided the study:

1. There is no significant difference in the mean academic achievement scores of students taught physics using simulation teaching technique and those taught using conventional technique.
2. There is no significant difference between the mean achievement scores of male and female students taught physics using the simulation teaching technique.

3.0 METHODOLOGY

The design used for the study is the quasi-experiential design of the non-equivalent group. Specifically, the researcher used a non-randomized pre-test post-test control group design. This work was carried out in Kogi East Education Zone. The zone is made of nine Local Government Areas, which are Idah, Ofu, Dekina, Igamela Udulu, Ibaji, Bassa, Ankpa, Olamaboro and Omala. The population for the study was 7920 senior secondary two students offering physics in Kogi East Education Zone, of Kogi State. The sample for this study was 294 (187 male and 107 female) SS2 students drawn from intact classes in six public schools. A multi-stage sampling technique was used because at different stages, different and appropriate sampling technique was employed. Kogi East Education Zone was randomly selected out of the three education zones in Kogi State using the simple random technique of balloting without replacement. Furthermore, random sampling of balloting without replacement was also used in selecting three Local Government Areas from the Nine Local Government Areas in the Zone.

The purposive sampling technique was used to select six public secondary schools from the secondary schools in the zone for this research. Physics Achievement Test (PAT) was used for data collection. Mean and standard deviation was used to answer the research questions. Analysis of Covariance (ANCOVA) was used to test the hypothesis at 0.05 alpha levels of confidence. The choice of ANCOVA was because the study adopted a quasi-experimental design, which involves the comparison of the mean of two independent variables affecting the dependent variable for subjects drawn from intact classes that are not randomized.

4.0 RESULTS

Research Question1

What is the difference in the mean achievement scores of students taught physics using simulation teaching technique and those taught using the conventional technique?

Table 1: Mean Achievement and Standard Deviation of Achievement Scores of Students Taught Physics Using Simulation and Conventional Techniques

Groups	N	Pre-test		Post-test		Mean Gain
		X	SD	X	SD	
Simulation	154	32.75	1.49	47.21	1.97	14.46
Conventional	140	32.10	1.44	38.42	2.36	6.32
Mean difference						8.14
Total	294					

Table 1 shows that in the pre-test, the simulation group had a mean achievement score of 32.75 with a standard deviation of 1.49, while the conventional group had a mean achievement score of 32.10 and a standard deviation of 1.44. The table also shows that in the post-test, the simulation had a mean score of 47.21 and a standard deviation of 1.97 while the conventional group had a mean of 38.42 and a standard deviation of 2.36. From the simulation and conventional group scores, the mean gain for the simulation was found to be 14.46 while the mean gain for the traditional was 6.32. The mean difference between the achievement scores gain of stimulation and the conventional group was 8.14. This shows that the stimulation group gained more achievement scores than their counterpart in the traditional group.

Research Question 2

What are the mean academic achievement scores of male and female students taught physics using simulation technique?

Table 2: Mean Academic Achievement Scores of Male and Female Students taught physics using simulation technique

Gender	N	Pretest		Posttest		Mean Gain
		X	SD	X	SD	
Male	187	49.52	11.52	73.44	13.72	23.92
Female	107	44.56	10.65	62.14	11.49	17.48
Mean difference						
Total	294					6.44

Table 2 indicates the difference in the mean academic achievement of male and female students taught physics using simulation technique. The table shows that 187 male students

and 107 female students were taught physics using the simulation technique. The table also reveals that the mean achievement scores of male students taught physics using simulation technique are 49.52 with a standard deviation of 11.52 during pre-test and 73.44 with a standard deviation of 13.72 in post-test, while the mean achievement score of female students taught physics using simulation technique are 44.56 with a standard deviation of 10.65 during pre-test and 62.14 with a standard deviation of 11.49 in the posttest, Table 2 further shows that the mean gain of male students that were taught physics using simulation is 23.92 while that of female students mean gain is 17.48. The difference between the mean gains of male and female students taught physics using simulation technique is 6.44.

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught physics using simulation teaching technique and those taught using conventional technique.

Table 3: Analysis of covariance (ANCOVA) of Mean Achievement Scores of Students Taught Physics Using Simulation Teaching Technique and Those Taught Using conventional Technique.

Source	Types III Sum of squares	DF	mean Square	F	Sig	Partial Eta Squared
Corrected Model	34555.088	2	17,277.544		337.090.000	.687
Intercept	75767.692	1	75767.692		1878.456.000	.879
Group	30521.662	1	30521.662		561.412.000	.687
Error	15735.286	291	51.255			
Total Corrected	585060.000	294				
Total	60240.374					

Table 3 shows that ANCOVA analysis of the data collected on mean achievement scores of students taught physics using simulation teaching technique and those taught using conventional technique. From the analysis, the F-ratio of 561.412 (1,291) significant at 0.000 level is less than the salvable of 0.05. Hence, the null hypothesis difference in the mean achievement scores of students taught physics using simulation technique and those taught using the conventional technique was rejected, and the alternative upheld, that the is a significant difference in the mean achievement scores of students taught physics using simulation technique and those taught conventional technique.

Hypothesis 2

Table4: ACOVA of Mean achievement Scores of Male and Female Students taught physics using simulation technique

Dependent Variable: PostPAT						
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6277.373 ^a	2	3134.6137	34.342	.000	.432
Intercept	7689.394	1	7689.394	74.829	.000	.446
PreTPPT	4404.902	1	4404.902	42.866	.000	.316
Gender	3491.152	1	3491.152	36.897	.000	.268
Error	9556.627	291	102.759			
Total	464008.000	291				
Corrected Total	16834.000	294				

a. R Squared = .432 (Adjusted R Squared = .420)

Table 4 reveals that $F(1,291) = 36.897$; $p = 0.000 < 0.05$. Therefore, the null hypothesis is rejected. This implies that there is a significant difference between the mean achievement scores of male and female students taught physics using simulation technique. Thus, it can be deduced based on evidence from data analysis that there is a significant difference between the mean achievement scores of male and female students taught physics using simulation technique. The partial Eta squared of 0.268 is obtained for the strategy meaning that 26.8% of students' achievement scores in Physics can be accounted for by the simulation technique employed in teaching physics.

5.0 DISCUSSION OF FINDINGS

The study revealed that there was a significant difference in the mean achievement score of students taught physics using simulation teaching technique and those taught using conventional technique. This, therefore, indicates that instructional technology is a significant factor in enhancing the students' knowledge of the subject matter, thereby boosting their academic achievement. This means the efficiency of the use of simulation teaching techniques in the experimental group leads to high achievement in physics. The simulation method develops social skills among the learners, and helps learners to participate actively and communicate effectively with more knowledgeable peers, leading to high achievement among the students. This finding is in agreement with Krulik (2016) who found that there was a significant difference in the achievement of students taught Biology using simulation strategy and those taught using conventional strategy. Krulik for the buttress that simulation permits the learner to manipulate variables or parameters and observe the consequences. Since each learner is an active participant, the shy ones are accommodated and tend to communicate effectively with peers. The result also agrees with Nwafor (2015) who found that the use of innovative instructional strategies had a significant effect on the students' achievement in Chemistry than those taught using the conventional method. A study of teaching behavior and students' achievement by Achor (2015) shares that student activities are better than teacher activities in promoting authentic learning in the physics classroom. In this regard, teachers should employ innovative and creative teaching techniques.

The result further showed that there is a significant difference between the mean achievement scores of male and female students taught physics using simulation technique. This implies that the use of simulation techniques is gender-sensitive. The finding agrees with Adebisi and Ajayi (2013) that there was a difference in the mean score of students taught using the analogy approach and those taught using cooperative strategy in favor of the male students in

analytical chemistry concepts. The finding also agrees with Lawal (2018) that there is a significant difference in the level of a conceptual shift in favor of male students. The simulation technique is used in this study as a necessary prerequisite for the formation of scientifically validated theories. The focus here is on learning rather than teaching, a sense that the basis for validating theories is important. The simulation technique is a package to help students learn and understand the right concept by questioning the already known concept that is in the same cognitive structure. Students' achievement can only be enhanced when they are made to acquire the right conceptions that are in line with the scientific conception or idea.

6.0 CONCLUSION

In this study, it was concluded that the simulation teaching technique is very rewarding to students' in enhancing their academic achievement in physics and possibly in other science subjects. Simulation is gender-sensitive, as it favors male students' achievement than female ones.

7.0 RECOMMENDATION

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

1. The physics teachers should be retrained to adopt simulation teaching techniques in teaching physics in order to enhance students' achievement.
2. The physics teachers should be provided with necessary instructional materials needed for effective and efficient implementation of simulation technique that enhances students' achievement.

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