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EFFECT OF INSTRUCTIONAL SIMULATION STRATEGY ON JUNIOR SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN BASIC SCIENCE

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Abstract
The main purpose of this study was to determine the effect of instructional simulation strategy on Junior secondary school students' academic achievement in Basic Science. A quasi-experimental research design was adopted and a multi-stage sampling technique was used to select Emohua Local Government Area. Simple random sampling by balloting was carried out in two rounds to select two schools and a sample size of (270) JSS 2 students. Basic Science Achievement Test (BSAT) instrument which was subjected to face and content validation of experts in science education was trial tested on 20 students of central education zone Rivers State. The reliability coefficient of 0.79 was obtained by using the Cronbach alpha formula. Analyses of the data collected were done by using mean and standard deviation to answer all the research questions while Analysis of Covariance (ANCOVA) was used to test all the hypotheses at a .05 level of significance. The result found that there was a significant difference between the mean score of those exposed to simulation and the lecture method in favour of simulation strategy. Gender does not have a significant effect on the mean scores of students exposed to simulation strategy. The study recommends the use of simulation strategy and equal opportunities to all students in the class.

Keywords: Instructional Simulation, Strategy. Achievement, Basic Science

Introduction

The relevance of scientific literacy for a nation to fit into world affairs cannot be overemphasized. The sporadic knowledge explosion in the world today has made every nation strive to meet up with the trend. This purpose cannot be achieved without the laying of a basic foundation for future scientists that can improve the nation's science and technological growth. In line with this drive Iwuji, (2012) cited in Awodun (2018) stated that Basic Science was introduced in schools for purpose of giving foundation skills and knowledge for science studies at the higher level. The acquisition of appropriate skills that will uplift the mental and physical development of individuals as well as the attitudinal abilities and competence that will make them function and contribute to the development of society is the prime concern of Basic Science.

However, over the years academic achievement of students in Basic Science is not yielding the required results, as there is still consistent students' poor academic achievement in Basic Science (Ekuadayo, 2012 cited in Agbo, 2019). The poor achievement may be due to the method used in the teaching and learning of Basic Science (Maduabum, 2011). Furthermore, science is seen as a holistic approach in the study of nature, which makes it necessary for science educators to shift teaching and learning strategy from the conventional lecture method that is teacher centred to learner centred strategy. The learner activity centred strategies that focus on students creative thinking abilities and interaction with the environment can boost achievement in science (Wagbara, 2020).

Ukpai, Gabriel, Okechukwu and Ugoma (2016) stated that Basic Science is a subject that forms the foundation for the take off of other sciences such as; Biology Chemistry and Physics at Senior Secondary school level. To ensure competency based and sustainable science education in any nation of the world, it now becomes a

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necessity to diversify and innovate modern methods of teaching Basic Science in schools. The instructional approach that will inspire the learner by making them resourceful and skillful in understanding the concept and content of the subject matter becomes very important. Hence, the use of simulation methods becomes pertinent as its usefulness in teaching cannot be undermined. This is because teaching students a topic in class without using an innovative strategy may not be able to achieve desired objectives. A simulation is a form of experimental learning that floats an instructional scenario in which the learner is placed in a world defined by the teacher.

The teacher controls the parameters of the world and the user is required to achieve the instructional result. Simulation promotes the use of critical and evaluative thinking. The open-ended nature of simulation encourages students to contemplate the implication of the scenario. The scenario makes the task real and creates more active engagement of the students to interact with the materials available for them to ensure the required result is achieved. Motivating activities that could be enjoyed by students of all ages could be in the form of games, role-play or other formulated activities, career or profession. Also, students must decide within its context. Instructional simulations are typically goal-oriented and focus learners on specific facts, concepts or applications of the system or environment (Ordu, 2016).

Adesoji (2008) cited in Ordu (2016) identified three main types of simulation; live, virtual and constructive. Live simulation deals with (live-action), virtual simulation is primarily used for training purposes, while the constructive simulation is used to view and predict the outcome. Constructive simulation is the type that is carried out using rules, data and procedures designed to predict an actual or assumed real-life situation like wargame used in the military operation. Each of those types of simulations is based on some form of reality and is intended to provide the user with pseudo-experience without the danger, expense or complexity of real life. It promotes critical reasoning and encourages enjoyable motivating activities (Ajeyami & Owoyemi, 2014).

Above all, simulations promote concept attainment through experimental activities that increase the engagement of students. And it helps them to effectively understand details of the concepts involved in the subject matter. Also, the fact that Basic Science was introduced to give foundation skills and knowledge for further sciences at higher education level (Isa, 2000 cited in Iwiji, 2012). It becomes pertinent to investigate the effects of instructional simulation strategy on the academic achievement of students in Basic Science.

Purpose of the Study

The main purpose of the study was to investigate the effect of instructional simulation strategy on Junior secondary school students' academic achievement in Basic Science. Specifically, the study sought to determine:

(1) Comparative effect of the use of instructional simulations strategy and lecture method on academic achievement of students in Basic Science.

(2) Gender effect of the use of instructional simulation strategy on academic achievement of students in Basic Science.

Research Questions

1. What are the mean achievement scores of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method?
2. What are the mean achievement scores of male and female students taught Basic Science by the use of instructional simulation strategy?

Hypotheses

The following null hypotheses which were tested at a 0.05 level of significance guided the study:

1. There is no significant difference between the academic achievement of students taught Basic Science by the use of instructional simulation\ strategy and those taught by the use of lecture method.
2. Gender does not have any significant effect on the mean score of students taught Basic Science by the use of instructional simulation strategy.

Materials and Methods

The quasi-experimental research design was adopted for the study. The research study was carried out in Rivers State central educational zone in Nigeria. A sample size of two hundred and seventy (270) JSS2 Basic Science

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students comprising (120) males and (150) females participated in the study. The multistage sampling was carried out in three stages namely, zonal level, local government level and school level. Simple random sampling by balloting was used to select one zone out of the three educational zones in Rivers State. The second round of simple random sampling was carried out to select one local government area out of the nine local government areas in the zone. The local government area selected was the Emohua Local Government area. Random sampling on basis of school location, (in Emohua) was carried out to select 2 UBE schools out of 24 UBE Junior Secondary Schools in Emohua local government area. One of the two selected schools was assigned an experimental group (simulation group) while the other was assigned a control (lecture method) group. Two intact classes of JSS 2 Basic Science students were used for each of the groups (to form a total of 4 intact classes) for the study. The instrument used for data collection was the Basic Science Achievement Test (BSAT) which was subjected to face and content validation of experts in the fields of science education. The instrument was trial tested on 20 Basic Science Students of the central education zone of Rivers State and a reliability coefficient of 0.79 was obtained by using the Cronbach alpha formula which indicates that the instrument was reliable. The data collected were analyzed by using mean and standard deviation to answer all the research questions while the Analysis of Covariance (ANCOVA) was used to test the hypotheses at a .05 level of significance.

Results

Research Question 1: What are the mean achievement scores of students taught Basic Science using instructional simulation strategy and those taught by the use of lecture method?\

Table 1: Mean achievement and standard deviation scores of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method.

Strategies	N	Pretest		Posttest		Mean Grain
		Mean	SD	Mean	SD	
Lecture	68	36.09	11.89	55.53	7.50	19.44
Simulation	67	38.15	12.07	79.42	6.34	41.27
Mean Diff.				23.89		

Table 1 shows the mean achievement scores of students exposed to the two instructional strategies (lecture and simulation). In Table 1 the mean achievement scores of 36.09 and 38.15 with associated standard deviation scores of 11.89, and 12.07 respectively were obtained for students taught with lecture method and instructional simulation strategy in the pretest group. While in the posttest group, mean achievement scores of 55.53 and 79.42 with associated standard deviation scores of 7.502 and 6.344 were obtained for control and experimental groups respectively. A mean gain of 19.44 was obtained for the lecture method while 41.29 was obtained for those exposed to Instructional Simulation Strategy (ISS). The students taught by the use of instructional simulation strategy in the posttest group had a mean of 79.42 with an associated standard deviation of 6.344 while those taught by the use of lecture method had a mean score of 55.53 with an associated standard deviation of 7.502. The mean difference of 23.89 was obtained in the post-test group with the students exposed to instructional simulation strategy having a higher mean than those of the lecture method. Also, the higher standard deviation of those exposed to the lecture method indicates that their scores deviated more from the mean than that of those exposed to simulation. Hence, the high mean of those exposed to simulation strategy may be real as it appears.

Hypothesis 1: There is no significant difference between the academic achievement of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method.

Table 2: Analysis of Covariance (ANCOVA) of the difference between the mean achievement scores of students taught Basic Science by the use of ISS and those taught by the use of LM.

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	21379.856[a]	2	10689.928	327.690	.000
Intercept	37842.889	1	37842.889	160.039	.000
Pre test	2121.126	1	2121.126	65.021	.000

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Group	18026.741	1	18026.741	552.593	.000
Error	4306.114	132	32.62		
Total	638689.000	135			
Corrected total	256885.970	134			

a. R Squared = .832 (Adjusted R. Squared = 830)

The result in Table 2was used to determine whether there was a significant difference between the academic achievement of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method. Table 2 shows that an F-ratio of 552.593 with an associated probability value of 0.000 was obtained. The probability value .00 as compared with .05 level of significance and it was found to be significant because .00 was less than .05 ($p < .05$). The null hypothesis one (HO_1) was therefore rejected and inference is drawn that, there is a significant difference between the academic achievement of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method.

Research Question 2: What are the mean achievement scores of the male and female students taught Basic Science by the use of instructional simulation strategy?

Table 3: Mean and standard deviation scores of male and female students taught Basic Science by the use of instructional simulation strategy.

Gender	N	Pretest Mean	SD	Post test Mean	SD	Learning Gain
Male	30	39.93	12.07	81.13	4.49	41.20
Female	37	35.57	13.53	79.03	7.42	43.52
	Mean Diff					2.32

Table 3 shows that, mean achievement score of the male students taught Basic Science by the use of instructional simulation strategy was 39.93 with an associated standard deviation of 12.07 in the pretest group. Whereas the mean achievement score of the male students taught Basic Science by the use of simulation strategy was 81.13 with an associated standard deviation score of 4.439 while the mean achievement score of the female students was 79.03 with an associated standard deviation score of 7.422 in the posttest group. The experimental favoured the female students more than the male students.

Hypothesis 2: Gender does not have any significant effect on the mean score of students taught Basic science by the use of instructional simulation strategy.

Table 4: Analysis of Covariance (ANCOVA) on the effect of gender on mean achievement score of students taught Basic Science by the use of instructional simulation strategy.

Source	Type III sum of squares	df	Mean square	F	Sig.
Corrected model	520.189[a]	2	250.095	7.845	.001
Intercept	34868.281	1	34868.281	1051.759	.000
Pre test	446.689	1	446.689	13.474	.000
Gender	23.024	1	23.024	.694	.408
Error	2121.751	64	23.152		
Total	431122.000	67			
Corrected total	2641.940	66			

a. R Squared = 1.97 (Adjusted R Squared = 1.72)

The result in Table 4 was used to determine whether gender has a significant effect on the mean score of students taught Basic Science by the use of instructional simulation strategy. Table 6 shows that an F-ratio of 0.694 with an associated probability value of .408 was obtained. The probability value of .408 was compared with .05 and it was found that there is no significant effect of gender on the mean achievement scores of the students because .408 is greater than .05 ($p > .05$). The null hypothesis three (HO_2) was accepted and inference

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was drawn in that, gender does not have any significant effect on the mean achievement score of students taught Basic Science by the use of instructional simulation strategy.

Discussion

Table 2 shows that an F-ratio of 552.593 with an associated probability value of 0.00 was obtained. The result of this study in Table 2 shows that there is a significant difference between the use of instructional simulation strategy and lecture method in mean scores of students in Basic Science as $P < .05$. Hence, the null hypothesis one which states that there is no significant difference between the academic achievement of students taught Basic Science by the use of lecture method and instructional simulation strategy was rejected. The findings of this study were in line with the findings of Ordu (2016) as he states that is a significant difference in academic achievement between students exposed to the simulation game method and those taught using the lecture method. Hence, this study has confirmed that there is a significant difference between the academic achievement of students taught Basic Science by the use of instructional simulation strategy and those taught by the use of lecture method.

The result of Analysis of Covariance (ANCOVA) used in testing hypothesis two (HO_2) in Table 4 yielded an F-ratio of 0.694 with an associated probability value of .0408 which was compared with .05 and it was found not to be significant as $p> .05$. Hence, null hypothesis three (HO_3) was accepted and the hypothesis stated gender does not have any significant effect on the mean achievement score of students taught Basic Science by the use of instructional simulation strategy. The findings of this study agree with the findings of Awodun (2018) as he states that, the achievement of the males and females did not differ as they were exposed to simulation strategy.

However, the findings of Poripo (2008) and Ordu (2016) disagree with the findings of this study as they stated that, there was a significant difference in the achievement of the males and females exposed to the simulation game method in favour of the female students. the result of this study has confirmed that gender does not have any significant effect on the mean achievement score of students taught Basic Science by the use of instructional simulation strategy.

Conclusion

The students exposed to instructional simulation strategy did better than those exposed to the lecture method. This indicates that the students are more engaged in interesting activities that could uplift their achievement in Basic Science. This implies that effective use of instructional simulation strategy by Basic science teachers can improve students' academic achievement in Basic Science.

Recommendations

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

1. The use of instructional simulation strategy is necessary to diversify the old method of teaching Basic science that is not innovative, active-oriented and student-centred. Simulation is in line with a modern science teaching method that enhances problem-solving approach that can boost academic achievement in Basic Science.
2. The Basic Science teachers should encourage collaboration among male and female students strategy in teaching the students. This will enable students to exchange ideas that will improve their academic achievement in Basic Science.

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