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Effect of Simulation Instructional Strategy on Students' Interest in Basic Science at Junior Secondary School in Ogun State

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Abstract

Basic Science serves as the background for higher science subjects like Chemistry, Physics and Biology. Despite the importance of secondary school science to build foundation for the study of science at tertiary levels of education for sustainable development, there is a major concern that students' interest in science keeps declining. In response to this concern of declining interest in science, the researcher sought to investigate the effectiveness of simulation instructional strategy on students' interest in Basic Science.

The research is a quasi-experimental design of 2x2 factorial matrix. Three research hypotheses guided the study. Purposive sampling technique was used to select two intact classes in Ijebu North Local Government Area. A validated Students' Interest in Science Questionnaire (SISQ) (r = 0.70) was used to collect data.

The result shows a significant difference in the post-test mean interest scores of students exposed to different instructional strategies. However, the result shows there is no significant interaction effect of gender on students' interest in Basic Science. Finally, the result shows there is no significant interaction effect of instructional strategy and gender on students' interest in Basic Science.

This study concluded that Simulation instructional strategy has the power of sustaining students' interest in Basic Science when compared with the conventional teaching method. It is therefore recommended that simulation instructional strategy should be introduced to the teaching and learning of Basic Science in schools.

Keywords: Simulation Instructional Strategy, Students' Interest, Basic Science

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Introduction

Basic Science, formerly known as Integrated Science is one of the core subjects in Junior Secondary Schools which introduces students to the world of science and prepares them for secondary education, Nigerian Educational Research and Development Council, (NERDC, 2009). It is a subject of study presented to learners in a way to gain the basic knowledge of science and commonality of approach to scientific problems. Baikie (2000) and Agbo (2008) stated that basic science is the bedrock to advance studies in science, technology and engineering. Basic Science plays vital role in Nigerian Science Education Program because it prepares students at the Junior Secondary School level for the study of core science subjects at the Senior Secondary School level which in turn brings about students' interest in science-oriented courses at the tertiary institutions (Oludipe & Oludipe, 2010).

According to NERDC (2007), the overall objectives of the Basic Science and Technology (BST) curriculum are to enable learners to:

a. Develop interest in science;
b. Acquire basic knowledge and skills in science;
c. Apply scientific knowledge and skills to meet societal needs;
d. Take advantage of the numerous career opportunities offered by science;
e. Become prepared for further studies;

However, despite these objectives, there is a persistent decline in post-compulsory high school science enrolment in and outside Nigeria. Societies are showing a growing need for individuals trained in scientific field but the number of students attracted to science is stagnating and, in some cases, declining (Organization for Economic Cooperation and Development [OECD], 2006; 2007). This gap, which many be described as students' loss of interest in science has been observed in many parts of the world, (Convert, 2005; Cotgreave & Davies, 2005; Dobson & Burke, 2013; Foster, 2010; Hannover & Kessels, 2004). Studies in science education in Senior Secondary Schools (SSS) in Nigeria showed that there is poor enrolment in science (Ogunneye & Lasisi, 2008) and poor interest/motivation (Achor & Orji, 2009; Adegoke, 2009; Agogo, 2011; Ogbeda, 2010). This situation is a threat to future science in Nigeria and therefore calls for urgent attention. Unfortunately, most attempts to find way out of this crisis have concentrated on higher education and Senior Secondary School (SSS) levels. This scenario could be attributed to the fact that it is possible that students at Junior Secondary School had no interest in sciences but had to offer the subject because it is compulsory at that level. This could probably affect their interest and performance in Basic Science at junior level and advance sciences at senior level of secondary school.

Godpower-Echie and Ihenko (2017), opined that there are some itemized problems that could, to a great extent, drastically reduce students' interest in Basic Science and their achievement in the subject. These problems include;

a. Lack of understanding of what science is all about.
b. Lack of well-equipped science laboratory
c. Lack of funds for the supply and maintenance of necessary equipment
d. Poor teaching strategies used by the teachers.
e. Lack of workshop centers
f. Lack of textbooks, journals and materials needed for professional growth

Erinosho (2013) observed that students enter secondary school with an equal liking for Biology and Physics, but over the period of secondary schooling, their liking for Biology remains reasonably stable, while their liking for Physics declines. Hence, students perceive Biology as more interesting than Physics. These challenges may be reduced by stimulating the interest of the students in Basic Science at junior secondary school and make for understanding of the topics that are labeled as difficult so as to reduce learning frustrations among students at early stage of learning sciences. When the teacher can properly sustain a student's interest, then the child can interact

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with the teaching and learning materials meaningfully (Agogo & Anchor, 2014).

Over the years, there are different methods for teaching and learning involving various innovative strategies in education and their effectiveness has been examined. Simulation method is most preferable because of its ability to situate classroom learning to its environment, which may stimulate interest of the students. Also, simulation instructional strategy typically incorporates free-play environments that provide the learner with experience in understanding how a set of conditions interact with each other (Kincaid & Westerlund, 2009).

Simulation strategy helps students to develop their own understanding of science concepts. It also helps the students to be independent problem solvers. Chen and Howard (2010) observed that the use of simulations to teach Chemistry gives positive results over time. Computer simulations give students the opportunity to observe a real-world experience and interact with it.

Simulations are useful for simulating laboratory activities that are impractical, expensive, impossible, or too dangerous to run; contribute to conceptual change; provide open-ended experiences for students; provide tools for scientific inquiry; problem solving experiences and potentials for distance education (Sahin, 2006). The use of simulation instructional strategy for enhancing students' interest has been investigated by researchers (Ajai, 2013; Aladejana, 2013; Chika & Okechukwu, 2016; Dolvin & Pyles, 2011). Simulation instructional strategy allow students to create and explore situations that they would not normally be able to witness.

Gender is any physical and behavioral difference between males and females, which are social culturally based (Ezeh 2013, Okeke 2008). Ogunleye and Babajide (2011) observed that science subjects such as Chemistry is given masculine outlook by many educationists. This implies that women and girls grapple with a lot of discriminations and difficulties (Okeke, 2008). Godpower-Echie & Ihenko (2017) reported that gender has a significant influence on the interest in Basic Science but does not have a significant influence on achievement of Basic Science students. There is inconsistency in report on the influence of gender on achievement and interest, thus gender was used as a moderator variable in this study.

Statement of the Problem

Basic Science serves as the background for higher science subjects like Chemistry, Physics and Biology. Despite the importance of secondary school science to build foundation for the study of science at tertiary levels of education for sustainable development coupled with efforts of various stakeholders in education to improve the standard of science teaching and learning, there is a major concern that students' interest in science keeps declining. This has been a source of concern to science educators. The study, therefore, sought to investigate the effect of simulation teaching strategy on students' interest in Basic Science at Junior Secondary School level in Ogun State. Also, the effect of gender was considered in the study.

Research Questions

a. What are the pre-test and post-test score of students' interest in Basic Science based on instructional strategy (simulation and conventional method)?
b. What are the pre-test and post-test score of students' interest in Basic Science based on gender?

Hypotheses

H_{O1} There is no significant main effect of Instructional strategy (simulation and conventional method) on Junior Secondary School Students' Interest in Basic Science

H_{O2} There is no significant effect of gender on Junior Secondary School Students' Interest in Basic Science

H_{O3} There is no significant interaction effect of Instructional strategy and gender on Junior Secondary School Students' Interest in Basic Science

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Methodology

Research Design: a quasi-experimental design involving a pre-test, post-test type was used. Two intact classes from two different junior secondary schools constituted the sample. The two classes were made up of 32, 18 students' respectively. The two intact classes were there after randomly assigned to experimental and control group respectively. Two junior secondary schools were selected in Ijebu North local government using purposive sampling technique.

The Criteria for selection of the sample were stated as follows:

a. They are public co-educational (mixed school).
b. Schools with professionally qualified teachers whose area of specialization is Basic Science
c. Schools with functional computer laboratories
d. Schools that are not close to prevent contamination
e. Readiness of the school authority to participate in the study
f. Readiness and willingness of the subject teachers of the schools to participate in the study

Instrumentation

The research instruments for the study consisted of:

a. Students' Interest in Science Questionnaire (SISQ)
b. Simulation Instructional Strategy Guide (SISG)

Student's Interest in Science Questionnaire (SISQ)

The questionnaire SISQ contains twenty-one (21) items. It comprises of two sections: A and B. Section A contained students' personal information while section B consisted of twenty-one (21) items eliciting information on students' interest in Basic Science. It was a four-point Likert scale questionnaire, ranging from Strongly Agree (SA), Agree (A), Disagree (D) to Strongly Disagree (SD). Students' Interest in Science Questionnaire (SISQ) was adapted from Danjuma (2015) and had reliability coefficient value of 0.82.

The adapted instrument was given to specialists in science education to determine the face validity of the instrument in terms of the language used in presenting ideas, clarification of ideas and the quality of each item as it measures what it ought to measure. Their suggestions and corrections were used to rework the final copy. The instrument (SISQ) was pilot-tested on fifty Basic Science students selected outside the sample coverage using test-retest method and a reliability coefficient value of 0.70 was obtained.

Simulation Instructional Strategy Guide (SISG)

Simulation Instructional Strategy Guide (SISG) consists of step–by step lesson plans supported with the use of computer on the concepts of Basic Science. The students worked in groups of two members on the computer and every member contributed his/her own ideas in the group. At the end of each lesson, each group responded to specific task on the topic while the teacher moderated them accordingly.

Procedure for Data Collection

For the purpose of the study, the researcher visited the selected schools and sought the permission of the school principals and Basic Science teachers. The schools were labelled simulation instructional strategy group and control group. Prior to the commencement of the experiment, the researcher provided the necessary equipment needed to carry out the study.

Data Analysis

The data collected was analyzed using both descriptive and inferential statistics. The descriptive statistics involved the use of frequency count, simple percentage, mean and standard deviation. Inferential statistics was used to analyze data to test the stated hypotheses. It involved the use of analysis of covariate (ANCOVA) and multiple classification analysis (MCA). The analysis was computed at 0.05 level of significance.

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Research Question 1

What are the pre-test and post-test score of students' interest in Basic Science based on instructional strategy (simulation and conventional method)?

Table 1: Students' Pre and Post-test interest in Basic Science based on Instructional Strategy

Instructional strategy		N	Mean	SD	Gain	% Gain	Min	Max
Simulation	Pre-test	32	72.13	8.49	6.03	8.36	49	84
	Post-test	32	78.16	6.78			62	86
Conventional	Pre-test	18	64.67	8.50	4.77	7.38	48	79
	Post-test	18	69.44	7.85			58	82
Total	Pre-test	50	69.44	9.15	8.27	8.00	48	84
	Post-test	50	75.02	8.27			58	86

The result in Table 1 shows students' mean, standard deviation, achievement gain, minimum and maximum interest scores in Basic Science based on instructional strategies. According to table 1, the group exposed to Simulation Instruction strategy recorded a post-test mean interest score of 78.16 (S.D. = 6.78, N= 32); while the group exposed to Conventional method recorded post-test mean interest score of 69.44 (S.D. = 7.85, N= 18). Furthermore, the result in the Table 1 shows mean gains across the experimental and control groups when the pre-test and post-test interest scores were compared. The group exposed to simulation strategy recorded a mean interest gain of 6.03 and a percentage mean gain of 8.36%, while the control group recorded a mean interest gain of 4.77 and a percentage mean interest gain of 7.38%. This implies that the simulation (experimental) group had higher interest gain than conventional (control) group.

Research Question 2

What are the pre-test and post-test score of students' interest in Basic Science based on gender?

Table 4.2: Students' Pre and Post-test interest in Basic Science based on Gender

	Gender		N	Mean	SD	Gain	% Gain	Min	Max
Simulation	Male	Pre-test	17	74	7.95	5.88	7.9	55	84
		Post-test	17	79.88	7.18			62	86
	Female	Pre-test	15	70	8.86	6.2	8.9	49	81
		Post-test	15	76.20	5.94			66	85
Conventional	Male	Pre-test	8	61.75	7.11	5.63	9.1	48	70
		Post-test	8	67.38	8.88			58	82
	Female	Pre-test	10	67	9.14	4.1	6.1	50	79
		Post-test	10	71.10	6.95			62	82
Total	Male	Pre-test	25	70.08	9.53	5.8	8.3	48	84
		Post-test	25	75.88	9.63			58	86
	Female	Pre-test	25	68.80	8.91	5.36	7.8	49	81
		Post-test	25	74.16	6.73			62	85
GRAND TOTAL		Pre-test	50	69.44	9.15	5.58	8	48	84

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Post-test	50	75.02	8.27	58	86

The result in Table 2 shows Student's Gender mean, standard deviation, achievement gain, percentage mean gain, minimum and maximum interest scores in Basic Science in simulation and control groups. According to the table, Male students had a post-test mean interest score of 79.88 and 67.38 for experimental and control groups respectively while female students had a post-test mean score of 76.20 and 71.10 for experimental and control groups respectively. When both groups are combined, Male students recorded a post-test mean interest score of 75.88 while Female students recorded a post-test mean achievement score of 74.16.

Moreover, Table 2 shows mean gains and percentage mean gains of students' gender when the pre-test and post-test interest scores were compared. In the experimental group, Male students had a mean interest gain of 5.88 and a percentage mean gain of 7.9% while female students had a mean interest gain of 6.2 and a percentage mean gain of 8.9%. This implies that female students had a higher interest gain than their male counterpart in the experimental group. In the control group, Male students had a mean interest gain of 5.63 and a percentage mean gain of 9.1% while female students had a mean interest gain of 4.2 and a percentage mean gain of 6.1%. This implies that male students had a higher interest gain than their female counterpart in the control group.

Overall, Male students had a mean interest gain of 5.8 and a percentage mean gain of 8.3% while female students had a mean interest gain of 5.36 and a percentage mean gain of 7.8%. This implies that male students had a higher interest gain than their female counterpart in overall comparison.

HO_1 There is no significant main effect of instructional strategy (simulation and conventional method) on Junior Secondary School Students' Interest in Basic Science

Table 3: Summary of Analysis of Covariance on students' interest in Basic Science based on Instructional strategies and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2228.240	4	557.060	22.367	.000
Intercept	707.947	1	707.947	28.426	.000
PREINTEREST	1184.200	1	1184.200	47.548	.000
STRATEGY	164.878	1	164.878	6.620	.013
GENDER	1.461	1	1.461	.059	.810
STRATEGY * GENDER	8.517	1	8.517	.342	.562
Error	1120.740	45	24.905		
Total	284749.000	50			
Corrected Total	3348.980	49			

a. R Squared = .665 (Adjusted R Squared = .636)

The result in Table 3 shows the main effect of instructional strategies on students' interest in Basic Science. The result shows significant outcome ($F_{(1, 45)} = 6.620$, $P < 0.05$). This means that there is significant difference in the post-test mean interest scores of students exposed to different instructional strategies. Hence, the null hypothesis is rejected. The difference in the post-test mean interest scores of Basic Science students exposed to simulation strategy (78.16) and Conventional method (69.44)

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could be responsible for the obtained significant main effect of instructional strategy.

The magnitude of the post-test mean achievement scores of the students according to order of magnitude is as presented in the multiple classification analysis (MCA) in table 4.

Table 4: Multiple Classification Analysis (MCA) of Students' interest in Basic Science based on instructional strategies and gender

Variables	N	Unadjusted Deviation	Eta	Adjusted for Factors	Beta
Instructional strategies					
Simulation strategy	32	3.136	0.511	3.104	0.506
Conventional method	18	-5.576		-5.518	
Gender					
Male	25	0.860	0.105	0.515	0.063
Female	25	-0.860		-0.515	
Multiple R					0.815
Multiple R squared					0.665

Grand mean = 75.02

The result in Table 4 shows the magnitudes of the post-test mean interest in Basic Science of the students exposed to instructional strategies. The MCA showed that with a grand mean of 75.02, the students exposed to simulation strategy recorded the highest adjusted post-test mean interest score of 78.124 (i.e., 75.02 + 3.104) while students exposed to Conventional method recorded an adjusted post-test mean interest score of 59.502 (i.e., 75.02 – 5.518). The outcome of the table shows that simulation strategy with highest post-test mean interest score has the highest power of enhancing students' interest in Basic Science when compared with the conventional method. Finally, Table 4 further showed that instructional strategy accounted for 50.6% (beta = 0.506) of the variance in students' interest scores while the instructional strategies and moderator variable jointly accounted for 66.5% (R^2 = 0.665) of the variance in the students' interest scores.

HO_2 There is no significant effect of gender on Junior Secondary School Students' Interest in Basic Science

The result in Table 3 shows the main effect of gender on students' academic achievement in Basic Science. The result shows no significant outcome ($F_{(1, 45)}$ = 0.059, P > 0.05). This means that there is no significant difference in the post-test mean interest scores of male and female students. Hence, the null hypothesis is retained. The difference in the post-test mean interest scores of both male (75.88) and female students (74.16) in Basic Science students could be responsible for the result of no significant main effect of gender recorded in table.

For the multiple classification analysis (MCA), Table 4 showed that with a grand mean of 72.02, male students recorded the highest adjusted post-test mean interest score of 72.535 (i.e. 75.02 + 0.515) while female recorded an adjusted post-test mean interest score of 71.505 (i.e. 72.02 – 0.515). This outcome showed that Male students with a higher post-test mean interest score had a higher interest in Basic Science than female students but the difference in interest based on the post-test mean interest scores is not statistically significant. Finally, Table 4 showed that gender accounted for 6.3% (beta = 0.063) of the variance in the students' interest scores.

HO_3 There is no significant interaction effect of instructional strategy and gender on Junior Secondary School Students' Interest in Basic Science

The result in Table 3 shows the interaction effect of instructional strategy and gender on students' interest in Basic Science. The result shows no

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significant outcome ($F_{(1, 45)} = 0.342$, $P > 0.05$). This means that there is no significant interaction effect of instructional strategy and gender on students' interest in Basic Science. Hence, the null hypothesis is retained.

Discussion

From hypothesis 1, there is significant difference in the post-test mean interest scores of students exposed to different instructional strategies. Simulation strategy has the highest power of enhancing students' interest in Basic Science when compared with the conventional method. The plausible reason is that, students in the experimental group were more actively involved in the learning process than their counterpart in the control group. The finding supported the report of Christine *et al*. (2012), Ajai (2013), Umoru and Ubom (2013), Sultan *et al*. (2017) who opined that simulation instructional strategy had significant effect on students' interest in a subject. However, the finding was contrary to the work of Dolvin and Pyles (2011) who opined that there is no significant difference in the interest of students exposed to simulation instructional strategy and the traditional method of teaching.

From hypothesis 2, there is no significant difference in the post-test mean interest scores of students based on gender. The reason is that Students irrespective of their gender had the same academic background. The finding corroborated the work of Jones *et al*. (2000), Sungur and Tekkaya (2003), Arigbabu and Mji (2004), Poripo (2008), Vekiri and Chronaki (2008) who opined that student's gender do not have significant effect on their interest. However, the findings were contrary to the findings of Ladson-Billing (2000), Kolawole (2007), Aguele and Uhumniah (2008), Chen and Howard (2010) who opined that there is a significant difference in the interest of students based on gender. Male students had more interest in sciences than their female counterparts.

Finally, there was no significant interaction effect of instructional strategies and gender on interest scores of Basic Science students. The finding corroborated the results of Jones *et al*. (2000), Sungur and Tekkaya (2003), Arigbabu and Mji (2004), Poripo (2008), Vekiri and Chronaki (2008), Dolvin and Pyles (2011) who opined that the interest of male and female students exposed to simulation instructional strategy do not significantly differ. However, the findings were contrary to the findings of Ladson-Billing (2000), Kolawole (2007), Aguele and Uhumniah (2008), Chen and Howard (2010), Christine *et al*. (2012), Ajai (2013), Umoru and Ubom (2013), Sultan *et al*. (2017) who opined that there is a significant difference in the interest of students based on gender and instructional strategies they were exposed to.

Conclusion

The results revealed that simulation instructional strategy has the power of sustaining students' interest in Basic Science when compared with the conventional teaching method. Also, students' gender did not significantly affect their interest of students in Basic Science. This means that both male and female students of Basic Science using the instructional strategies attained similar scores and sustained similar interest in Basic Science.

Recommendations

Based on the findings, it is recommended thatteachers should use computer simulation instructional strategy to teach Basic Science in Junior Secondary Schools in order to sustain their interest in science at large. Government should organise workshops and seminars for the teachers on the usage of simulation instructional strategy in order to improve the skills of the teachers on the usage of this strategy

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