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Sowunmi, Elizabeth Bolatito, Olagunju, Alice M. & Apata, F. Susan
Airforce Secondary School Ikeja, Lagos, University of Ibadan
National Open University of Nigeria, Abuja
sowumielizabeth@gmail.com

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Sowunmi, Elizabeth Bolatito, Olagunju, Alice M. & Apata, F. Susan
Airforce Secondary School Ikeja, Lagos, University of Ibadan
National Open University of Nigeria, Abuja
sowumielizabeth@gmail.com

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Abstract

This study dealt with enhancing students' attitudes toward Basic Science using Scenario-Based Learning Strategy (SBLS) in Lagos, Nigeria. Pretest posttest control group quasi experimental research design was adopted. Three Educational Districts were randomly selected, and two Junior Secondary Schools were randomly selected from each District. Intact class was used from each school and treatment was randomly assigned to the schools. The schools were assigned SBLS (241) and control (239) groups, totaling 480. Three research hypotheses were raised and tested in the study. The instruments used include Students' Attitude to Basic Science Questionnaire (SABSQ), Operational Guide on Scenario-based Analysis Instructional Strategy (OGSIS), Operational Guide on Conventional Strategy (OGCS) and Evaluation Sheet for Assessing Operational Guide (ESAOG). The treatment lasted seven weeks. The data collected were analyzed using ANCOVA, Estimated Marginal Means (EMM) and graphical illustration. The findings revealed that there was a significant main effect of treatment on students' attitude to Basic Science ($F_{(1; 479)} = 368.95$; $p<0.05$, partial $\eta^2 = 0.44$). Indicated that the main effect of gender on students' attitude to Basic Science was not significant ($F_{(1; 479)} = 1.85$; $p>0.05$). It revealed that the interaction effect of treatment and gender on students' attitude to Basic Science was significant ($F_{(1; 479)} = 6.86$; $p<0.05$, partial $\eta^2 = 0.01$). Based on the findings of this study, it is recommended that teachers should be encouraged to employ student-centered instructional strategies, such as Scenario-Based learning strategy which is activities based to promote creativity and enable the students to develop positive attitude to learning.

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Introduction

Basic Science is the bedrock on which other science subjects are built. It is the foundational subject that prepares the students for the learning of the core science subjects in the upper secondary school level in the Nigerian educational system. Basic Science is very important in basic education so it is being taught from the lower level of basic education (Primary 1-3), through the middle level of basic education (Primary 4-6) to upper basic (JSS 1-3) giving a total of nine years. The foundation of studying of core science subjects (Biology, Chemistry and Physics) in the senior secondary school is being laid by Basic Science (Afuwape and Olubuyi, 2019). Basic Science as a subject presents the concepts

of science in a unified form showing the unity in science thereby avoiding the unnecessary stress of showing their difference (Ogonnaya, Okafor, Abonyi and Ugama, 2016).

However, Basic Science is being taught with teacher-centered strategy that is leading to students' poor attitude to the subject. Science lessons should be delivered with student-centered approach to prevent the students from cramming the concepts taught (Nsengimana et al, 2017; Ojekwu and Ogunleye, 2020). Teaching strategy is a major factor in the process of learning science as it can affect among other things the attitude of students to the learning of science (Ogunleye & Ojekwu, 2019). Basic Science should be taught with students-centered strategies that will enable the students to actively participate in the learning process and reduce learning difficulties among students (Ogunleue, 2019).

Scenario-based learning (SBL) is defined by Kingley (2002) as learning that occurs in situation, context, or social framework. It is of the belief that knowledge cannot be known or fully understood independent of its context, but it is based on concept of situated cognition. SBL presents students with hypothetical situation gotten from real practice for students to work and find solution to the problem, SBL allows students to take active part in their learning and gives them opportunity to develop and practice real life skills that they need to solve problems in their environment. Scenario-Based Learning is a learning principle that puts more emphasis on context rather than content. It is believed that competencies are best realized when learning takes place in the context in which it will be applied, it means that students learn best when they learn with scenarios and will be able to apply a skill in scenario that requires it (Scenario-Based Learning, 2020). It further stated that Scenario-based learning guides the mind of the students through certain situations by using simulated scenarios which can be adapted based on the choices and responses of the students.

Scenario-based strategy engages learners in effective work to solve problems, which they are presented with. This is supported by Kindley (2002) that stated that Scenario-based learning brings authentic learning environment that is connected to the real world because tasks are based on real world problems and challenges which are related to learners' interest. When students are challenged and are interested in what they are taught it improves every aspect of their learning outcomes positively. In SBL Scenarios are designed to involve students in processes of critical thinking, decision making, generating perceptions and creatively assuming roles, responsibilities, dilemmas and challenges of the professional culture (Errington, 2010). Five steps for creating scenarios in a classroom were being identified by Clark (Clark, 2009)

Step 1: Identify the learning outcomes**:** The teacher should first identify what he/she wants the students to achieve after completing the scenario and then use the learning outcomes to create the situation that will lead to this learning working backwards.

Step 2: Decide on your format: Here the teacher decides on how the lesson is to be delivered and what is to be used in delivering the lesson. The teacher either delivers the lesson using face to face or online scenarios. The teacher decides the media to use if it is online and other materials needed if face to face scenarios are to be used.

Step 3: Choosing a topic: The teacher will choose challenging and critical situations that have occurred in the subject area remembering that non-routine task lend themselves to scenario-based learning.

Step 4: identify the trigger event or situation: The teacher creates the scenario, identifying where the students should make decision and important area where the teacher gives feedback and students reflection. The teacher can effectively do this by creating a storyboard.

Step 5: Peer reviews your scenario**:** The teacher asks colleagues to work through the scenario to ensure that it flows in the way it is expected and see if it achieves the intended outcomes.

Stokhof et al. (2018) conducted a study to investigate the effectiveness of scenarios on students' outcome in terms of attainment of circular objectives. The study was conducted using experimental approach. Pre-text and post-test mind maps were used to measure individual and collective learning outcome of student questioning, the result revealed that majority of the students progressed in learning the core curriculum and elaborated on it. Hacieminoglu, (2016) teaching of science by rote memorization from the textbooks using the traditional strategy leads to negative attitude from the students. Attitude is defined by Ngogo (2014) as the buildup of information about a person, object, experience or situation which forms an individual's predisposition or opinion about that thing. Students develop attitude to a subject through the information they get about that subject in the process of learning which maybe positive or negative but affect the student's learning outcome in the subject. Attitude can be defined as a favorable or unfavorable evaluative judgment that someone have and direct towards people or objects, which may be concrete or abstract (Elias, Smith, and Barney, 2012).

Learners are assessed through their attitude to the learning of Basic Science. It is important for science teachers to ensure that students have positive attitude to science subjects, studies have shown that students are not taught science in the way that it will be interesting to them. Attitude as defined by Hornby (2017) is the way someone thinks, feels or behave towards someone, idea or something. He further avers that attitude is an individual's predisposition in a favorable or negative way to any person or subject. In view of this, students with positive attitude towards learning did very well and are successful in their studies, had higher motivation and participated in the school and listened more carefully to the teacher while teaching (Erdogdu, 2017). Students' poor attitude toward science has led to improvements in the teaching of science with the use of teaching strategies that are students- centered which improve students' attitude to science subjects (Adejimi et. al, 2022). Attitudes expedite learning and it is also a product of students' learning (Smith et al., 2012). Student attitude is very important in the teaching and learning process and teachers should be concerned about their students' attitude toward the subject they teach. Borghans et al (2008) stated that it is important for teachers to effectively study students' attitude towards learning as it is volatile compared to their cognitive abilities. This is because attitude is difficult to form and becomes permanent when formed. For teachers to help their students to develop positive attitude to their subject they need to use effective strategy that will involve the students in the learning process.

Attitude is formed when people are exposed to some kind of learning experience, a positive attitude is formed if the experience is favorable, and a negative attitude is formed if the experience is unfavorable (Orunaboka, 2011). The attitude formed by people most times affects their predisposition to something or someone, so teachers should be concerned about the students' attitude for meaningful learning and where the attitude are negative or not good enough teachers should seriously work towards changing such attitude to a positive one. Attitude changes in couple of time

gradually and does not remain the same (Olashinde and Olatoye, 2014). Students' attitude in science will lead to their career choices (Bang and Baker, 2013; Fasakin, 2012). Positive attitudes can influence students' achievement and career-decision making (Hsu et al., 2019).

Gender is whether biological or socially influenced characteristics by which people define male or female (Myer, 2002). Gender imbalance has been a problem in learning science, and it has been reported that there has been a gap in the number of females studying and practicing science compared to their male counterparts. Gender gap as defined by UNESCO (2014) is the variance that occurs in the enrollment of male and female students in the discipline of science and technology or the differences that occurs in the participation and access in science and technology courses by male and female. There is social cry around the world that in higher education, women have been under-represented in the field of science and engineering (Breda and Ly, 2019; Corperate Planning and Policy Division, 2017). Whiley Online Library (2016) also reported that women are under-represented in STEM related academic and industrial prominent positions.

Students' attitudes towards science are influence by various factors which include gender differences (Acar, 2017). Studies have shown that majority of students especially girls currently pursue courses other than science (Pisa, 2015 and UNICEF, 2020). This trend is not good for any nation as science is the bedrock on which any national development is laid. This is supported by Akpan (2015) who pointed out that, globally nations' reliance on the fast-changing application of science and technology and its processes and products in all areas of human endeavor have it peremptory that without them any society risks being alienated from the global village. According to Blickenstaff (2005), women can contribute to a greater diversity of prospective in finding solution and help to solve problems in STEM if given the opportunity. Reinking and Martin (2018) gave three theories regarding reasons for gender gap in STEM in the society which are:

1. General societal belief that males are good in maths while females are good in the kitchen.
2. Influence from peer group
3. Professional typecasts of scientist as being introverts or socially obstinate.

Studies have shown the following, that girls prefer learning biology compared with boys (Almasri et. al 2021) while Oba and Lawrence (2014) discovered that gender has no effect on students' attitudes to learning physics. Sethi (2015) find no significant difference to students' attitude to science in respect of gender. This supports the findings of Sofiani (2017) who found no significant difference in male and female students' attitude to learning science.

Statement of Problem

Basic Science as the foundation of all Sciences needs to be well understood by the learners and for this to happen, students' need to actively learn the subject and also be able to define their learning. Basic Science program being relatively new, most teachers have challenges of teaching the subject with innovative strategies that are student-centered. Inability to use these innovative strategies in teaching had been developing poor learners' attitude to Basic Science. Innovative strategies allow learners interaction with each other and also allow teachers have time to help individual student. Aina and Ogundele (2015) stated that social interaction between the learners and the teacher and

between the learners themselves are very important in learning this promote effective learning so there is a need to use innovative strategies like scenario-based strategy for teaching Science. In SBL Scenarios are designed to involve students in processes of critical thinking, decision making, generating perceptions and creatively assuming roles, responsibilities, dilemmas, and challenges of the professional culture (Errington, 2010). Scenario-based learning provides opportunities to students to actively participate in the instructional activities and enables them to take ownership and responsibility of the process. It allows the learners to learn using real-life scenario and this enables the learners to remember and be able to apply what they have learnt to solve problems in the society. Moreover, it is evident from previous research (Ogunleye, 2011) that learners do not perform up to expectation in Science (Physics, Chemistry and Biology) at the senior secondary school level due to their poor background in Basic Science.

Research Methods

The pretest posttest control group quasi experimental research design was adopted for this study. The study adopted Jerome Brunner's constructivist theory and the self- determination theory by Edward and Deci. The variables are Scenario-based learning, students' attitude, and gender. In Lagos state of Nigeria there are six educational districts out of which three where randomly selected which are districts I, II and XI respectively. The sampling procedure employed in selecting participants for this study is multi-stage. First, all the public junior secondary schools in Lagos State were stratified into single-sex and mixed schools as gender is a variable. Lagos state was then stratified along the existing six educational districts I, II, III, IV, V, VI and educational districts I, II and VI were randomly selected from the six. Educational districts I, II and VI selected each has 46, 56, 52 junior secondary schools respectively from which the disproportionate stratified random sampling technique was used to select two schools from each district. This gave six schools in all. Then, one intact class of JSS2 students from each of the six selected schools was selected. An intact class in Lagos State School is made up of 70-80 students. Treatment was randomly assigned to schools in each educational district such that one of the two sampled school from each district was experiment group for Scenario-based Learning and the second served as control taught with the conventional instructional strategy.

Research Hypotheses

The study employed three null hypotheses. Tests of the hypotheses were at 0.05 level of significance.

Ho1: There is no significant effect of treatment on students' attitude to Basic Science

Ho2: There is no significant effect of students' gender on students' attitude to Basic Science

Ho3: There is no significant interaction effect of treatment and gender on students' attitude to Basic Science.

Four instruments were utilized for this study. They are:

1. Students' Attitude to Basic Science Questionnaire (SABSQ)
2. Operational Guide on Scenario-based Analysis Instructional Strategy (OGSIS)
3. Operational Guide on Conventional Strategy (OGCS)
4. Evaluation Sheet for Assessing Operational Guide (ESAOG)

Results

Ho1: There is no significant main effect of treatment on students' attitude Basic Science

Table 1: Analysis of Covariance (ANCOVA) of Post-Attitude by Treatment and Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	18021.265	4	4505.316	133.600	0.000	0.529
Intercept	20780.299	1	20780.299	616.214	0.000	0.565
PreAttitude	1787.764	1	1787.764	53.014	0.000	0.100
Treatment	12441.809	1	12441.809	368.947	0.000	0.437
Gender	62.251	1	62.251	1.846	0.175	0.004
Treatment x Gender	231.166	1	231.166	6.855	0.009	0.014
Error	16018.202	475	33.723			
Total	1778398.000	480				
Corrected Total	34039.467	479				

R Squared = 0.17 (Adjusted R Squared = 0.14) * denotes significant $p<0.05$

Table 1 revealed that there was a significant main effect of treatment on students' attitude to Basic Science ($F_{(1; 479)} = 368.95$; $p<0.05$, partial $\eta^2 = 0.44$). Table 1 indicated the effect size of 44.0%, meaning that 44.0% of the total variation observed in students' post-attitude scores to basic science in this ANCOVA model was due to the significant main effect of the treatment. Therefore, hypothesis 1 was rejected. In order to explore the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 2.

Table 2: Estimated Marginal Means for Post-Attitude by Treatment and Control group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Scenario-based Learning Strategy (SBLS)	65.54	0.38	64.79	66.29
Conventional Strategy (CS)	54.97	0.38	54.22	55.73

Table 2 revealed that students in the Scenario-based Learning Strategy (SBLS) treatment group had the higher adjusted mean score in their post-attitude to Basic Science (65.54) followed by those in the Conventional Strategy (CS) control group (54.97). This order is represented SBLS > CS.

Ho2: There is no significant effect of gender on students' attitude to Basic Science.

Table 1 indicated that the main effect of gender on students' attitude to basic science was not significant ($F_{(1; 479)} = 1.85$; $p>0.05$). Therefore, hypothesis 2 was not rejected. This means that gender had no effect on students' attitude to Basic Science.

Ho3: There is no significant interaction effect of treatment and gender on students' attitude to Basic Science.

Table 1 revealed that the interaction effect of treatment and gender on students' attitude to Basic Science was significant ($F_{(1; 479)} = 6.86$; $p<0.05$, partial $\eta^2 = 0.01$). The effect is 1.0%, implying that 1.0% of the changes in students' post-attitude scores to Basic Science was as the result of interaction effect of treatment and gender. Therefore, hypothesis 3 was rejected. This implies that treatment and gender had significant effect on students' attitude to Basic Science. In order to disentangle this significant interaction effect, Figure 1 presents the interaction in line graph.

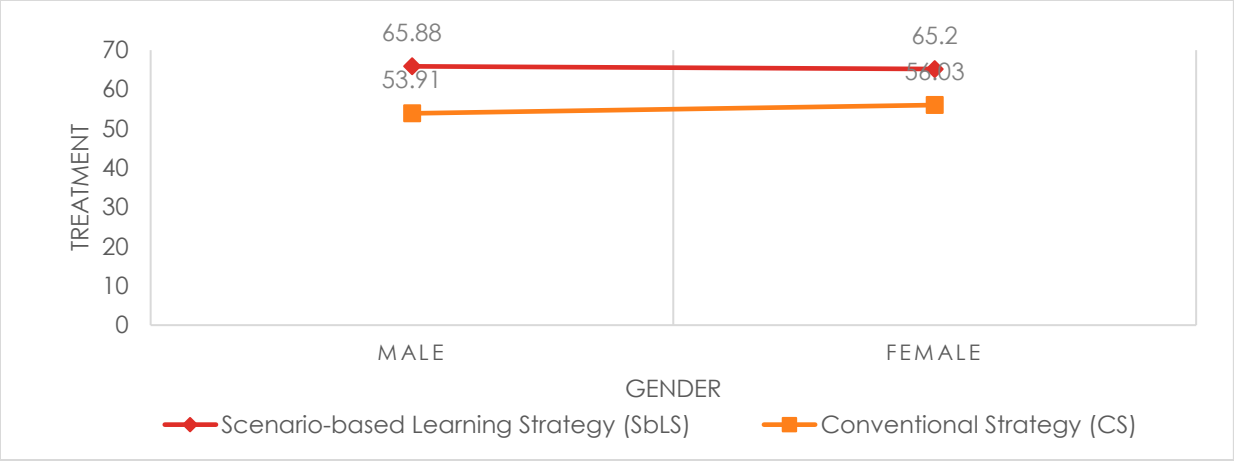

Fig. 1: Interaction effect of treatment and gender on attitude to Basic Science

Figure 1 showed that male students in the scenario-based learning strategy had the highest post-attitude mean score to Basic Science (65.88), followed by their female peers in Scenario-based Learning Strategy (65.33), male students in conventional strategy (56.03), and lastly, female students (55.91) in the conventional strategy. This interaction is ordinal. This means that it is same treatment group (scenario-based learning strategy) across gender that have better attitude to Basic Science.

Discussion of Findings

The finding indicated that the post-attitude mean score to Basic Science of students in the Scenario-Based Learning Strategy (SBLS) was significantly different from those exposed to the conventional strategy. Also, the dissimilarity in the post-attitude mean scores of students in SBL was significantly different from those exposed to the conventional strategy. This aligns with the findings of Partolo (2017) that reported that various factors influence the learning process such as attitude, learning achievement, motivation, aptitudes, personalities, anxiety, intelligent and age. This implies that attitude of the students is important in the process of learning as it can aid or hinder effective learning. Positive attitudes can influence students' achievement and career-decision making (Hsu et al., 2019). This implies that positive attitude stimulates students to put effort in their studies and this will lead to high achievement in that subject while nonchalant attitude towards a certain course makes learning difficult. Therefore, positive attitude could encourage higher performance in Basic Science. Likewise, the outcome of this investigation additionally goes in the direction of Hacieminoglu (2016) which revealed that learning strategy and students' attitude to science positively correlated as students with positive attitude to science better understood what they are taught. Also, Olagaju (2015) affirms that a learner's achievement largely depends largely on his attitude to instruction, showing connection between students' attitude and their understanding of what is taught. This implies that a person with positive attitude will learn effectively. Furthermore, Errington (2011) affirms that Scenario-Based Learning encourages students to participate actively during instructional process by allowing them to explore true-to-life tasks, making them to encounter real challenges and work-based role engagement. This will motivate the students to own and be responsible of their learning. He stated that scenario-based learning gives the students' opportunity to think over the problem and practice what they have learnt. This confirms the view of Kindley (2002) that Scenario-Based Learning promotes critical

thinking and reflection, stimulates, problematize, and arouse interest and evoke imagination, thoughts and feelings at the same time.

Studies have shown different result concerning gender differences in the learning strategies used. Anyachie and Anyodke (2012) researched on effects of self-instructional learning strategy on secondary school students' academic achievement and discovered no effect of gender on students' academic but discovered that a significant interaction effect between attitude and learning strategy. Oludipe (2012) in his study on gender differences in junior secondary school achievement in Basic Science in Nigerian using cooperative learning strategy and discovered no significant differences in the academic achievement of male and female students.

Implication of the Findings

The study evaluated the main and interaction effects of Scenario-Based Learning Strategy and gender on students' attitude to Basic Science in Lagos State of Nigeria. The findings of this study has uncovered the significance of teachers utilizing instructional strategies that are student centered to build cooperation of students during teaching and learning process and allow the students to take ownership of the learning; resulting in students having positive attitude to learning and understand the concepts taught.

Conclusion and Recommendation

From the findings of the effects of Scenario-Based Strategy on Junior Secondary School students' attitude to Basic Science the following conclusions could be drawn in Lagos, Nigeria. It is evidence that Scenario-based is more effective in enhancing the level of students' attitude in Basic Science than the Conventional Strategy. Scientific knowledge and skills of secondary school students are being nurtured when they are being guided by teachers and taught with strategies where learning and exploration are hands on and mind on. It is therefore recommended that:

1. Teachers should be encouraged to employ student-centred instructional strategies, such as Scenario-Based learning strategy which is activities based to promote creativity and enable the students to develop positive attitude to learning.
2. Necessary materials and teaching apparatus should be provided for teachers to use innovative strategies for proper delivery of their lessons. Likewise, teachers should improvise to supplement the available teaching materials.
3. Government should always train and retrain teachers in the use of innovative strategies for delivering of science classes through workshops, conferences and seminars.
4. Curriculum planners and developers in science subjects for secondary schools should emphasize the use of innovative strategies like Scenario-Based Learning for teaching of science subjects.

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