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EFFECTS OF HANDS-ON ACTIVITIES AND LECTURE INSTRUCTIONAL STRATEGIES ON STUDENTS' ATTITUDE TOWARDS PHYSICS IN DELTA SOUTH SENATORIAL DISTRICT

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ABSTRACT

The study examined the effects of hands-on activities and lecture instructional strategies on students' attitude towards Physics in Delta South Senatorial District. Three research questions and three hypotheses guided the study. The quasi-experimental design was used, specifically the non-equivalent pretest posttest plan variation design. The population for the study was 58,190 Senior Secondary Class Two (SS II) students. A sample of 376 SSII physics students selected from six public mixed secondary schools in Delta south senatorial district was used for the study. The instrument for data collection was Attitude to Science Scale (ASS). The reliability of the instrument was established using Cronbach alpha, which yielded co-efficient index of 0.79. Data were collected by administering the AAS as pretest, posttest and post-posttest. The data obtained were analyzed using mean standard deviation, t-test, and Analysis of variance (ANOVA). The result showed that there was a significant difference in the mean attitude scores among students taught physics using hands-on activities instructional strategy and those taught using lecture method; there is significant difference in the mean attitude score between male and female students taught physics using hands-on activities instructional strategy. It was re-commended that physics teacher should adopt hands-on activities instructional strategy in teaching physics concepts.

Keywords: Hands-on activities, lecture instructional strategies, attitude, physics

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INTRODUCTION

The overall importance of education in general and science education in particular, to mankind cannot be overemphasized. No nation can afford to neglect science education at any level of education and hope to thrive in any field of human endeavor. Physics, according to farinele, Ehimetalor and Dada (2017) is that branch of science that deals with the behaviour, of matter in relation to energy.

Science education is imperative for useful living in any society. The resources required for the advancement of science, technology, and the socio-economic system are produced there. In order to prepare future scientists, we need science teachers who are competent, committed, and inventive. Governments have been able to create laws to improve science education in schools because of the significance of science. According to national policy on education (FRN, 2004) the aims of science should be directed at enabling students who are exposed in it, to acquire the following skills; observe carefully and thoroughly; report completely and accurately what is observed; organized formation acquired; generalize on the basis of the acquired formation; predict as a result of the generalization; design experiments to check predictions; use models to explain phenomena where appropriate; and continue the process of inquiry when new data do not conform to predictions. In order to achieve these aims students' active participation and interaction in the teaching and learning process paramount. Therefore, teaching approaches such as individualized instruction and cooperative learning instructional strategy that promotes students active involvement and self-discovery of facts should be adopted. Sadly, despite government efforts to encourage students to pursue science, particularly at the second cycle levels, many students continue to avoid it (Eminah, 2007).

One of the variables influencing students' poor performance and participation in science, according to O'Connor (2002), is the employment of ineffective teaching methods. Less effort is made by teachers to connect the concepts taught and their examples or illustrations to real-world circumstances, particularly when it comes to the context of the students' own lives and environments. Teaching methods are not practical enough.

This has a negative effect on student's interest and motivation to study science, technology, and engineering (STE) subjects. According to Danso (2010), teachers prefer knowledge-based, teacher-centered teaching strategies that don't provide students any opportunity to participate. According to research conducted at both the elementary and secondary levels, lecturing, question-and-answer sessions, walkthroughs of procedures, and note-taking are the most often employed teaching techniques (O'Connor, 2002).

When teaching science in schools, topics need to be conveyed in a way that is both an accurate portrayal of scientific principles and also understandably simple for students. The development of more efficient and scientifically aligned teaching methods for the fundamental physics ideas in high schools is necessary. Teichert and Stacy (2002) claim that several international studies that show how ineffective the lecture method of teaching physics is are the driving force behind this endeavour. More specifically, during the past two decades, researchers have discovered that students struggle to integrate their mental models of important physics topics into a cohesive conceptual framework because they lack a strong conceptual knowledge of these concepts.

According to Ekwueme, Ekon and Ezenwa-Nebife (2015), the hands-on approach is a method of instruction where students are guided to gain knowledge by experience. This entails allowing the children to handle the materials they are studying, such as plants, insects,

rocks, water, magnetic fields, scientific instruments, calculators, rulers, and forms. In actuality, it involves actively engaging in physics and science lessons in the classroom. A review of literature showed that hands-on activities help students to outperform students who follow lecture, text-based programmes (Turpin, 2000), if they should begin studies from a common intellectual cognition or entry point. Hands-on activities enhance students' understanding and replace their misconceptions with scientific conceptions (Unal, 2008). It develops student's attitudes toward science positively and encourages their creativity in problem solving (Bilgin, 2006). Additionally, it encourages their independence and enhances their reading, arithmetic computation, and communication abilities. Lebuffe (1994) emphasised that students learn better when they can touch, feel, measure, manipulate, sketch, and build charts, record data, and find solutions on their own rather than having them given to them in a textbook or lecture.

Ekwueme, Ekon and Ezenwa-Nebife (2015) again posit that the hands-on learning approach is learner-centered and involves the child in a total learning experience which enhances his ability to think critically. It is obvious therefore, that any teaching strategy that is skewed towards this direction can be seen as an activity-oriented teaching method. Through the hands-on-approach, students are able to engage in real life illustrations and observe The hands-on method enables students to participate in real-world examples and see how changes in various variables affect real-world situations. It provides realistic examples of ideas and improve students attitude. Obanya (2012), in his convocation lecture confirmed the above statement by adding that the average retention rate of learning by lecture is 5% while that of practice by doing is about 75%. It can be seen that retention rate increases progressively with the use of more interactive and activity-oriented teaching methods. In their study, Ekwueme and Meremikwu (2010) noted that some teachers object to the use of interactive activity-oriented methods, claiming that it takes too much time and does not allow for thorough coverage of the curriculum.

Lecture method of teaching is a teacher directive method of teaching where students' received instruction from the teacher with no participation of students' (march 2010). Ajaja (2009) referred to the lecture method as a talk chalk method. He further stated that the lecture method may be used for any class size but it is usually used for large classes. The lecture method is predominated in Nigeria schools classes (Nwabufo 2005). The lecture method is teacher- centred approach to teaching-learning in which the teacher is seen as authority giving knowledge to students who contributed little or nothing to the instruction. Lecture method has been addressed by Adegoke (2011) who said only hard working students can benefit from it.

The use of lecture method does not encourage good performance of students in science subjects.

Gagne (1997) define attitude as readiness to react towards or against a situation, person or things in particular manner students' attitude toward particular discipline affect learning outcome in that discipline. According to Partin and Hanney (2012) inherent attitude such as interest, beliefs may impact how students approach learning. Hands on activities instructional strategy have been endorsed for it role ensuring positive student attitude formation for physics. A study by Kin and Chin (2011) reported that Hands-on activities develop students mind.

Sex issues in science education have remained a point of interest for a number of researches. Some argued that sex is a predicator factor on achievement and attitude. It is the

researcher in mind that the use of hands-on activities instructional strategy will affect students' achievement and attitude uniformly and reduce score variation among students. It is on the background the studying focus to investigate the effects of comparing hands-on activities instructional strategy and lecture method on students' achievement and attitude towards physics in Delta south senatorial District.

Statement of the Problem

Physics as a science subject is the bedrock of any civilization and is expected to produce individuals that are capable of solving their problem as well as those of the society. Such an individual is expected to be autonomous, confident and self-reliant after his graduation from school. In recent times, there has been a confounder report of weak attitude among the Senior Secondary students toward physics result (Ovovwude 2017).

This persistent weak and poor attitude may be due to poor methods of teaching. the lecture method of teaching method adopted in Nigeria secondary schools may not be stimulated enough. Therefore, other alternative methods that may ensure students attitude is enhanced is hands-on activities instructional strategy where knowledge is transmitted to learner in fine form by the teacher. It is on the note that the present study investigates the effects of hands-on activities and lecture instructional strategies on students' attitude towards physics in Delta South Senatorial District.

Research Questions

The following research questions guided this study:

1. What will be the difference in mean attitude scores between students taught Physics using hands-on activities instructional strategy and those taught using conventional lecture method?
2. What is the difference in mean attitude score between male and female students taught Physics using hands-on activities instructional strategy?
3. What will be the effect of interaction of teaching method and sex on students' attitude towards Physics?

Hypotheses

The study was guided by the following hypotheses:

1. There will be no significant difference between the mean attitude scores of students taught Physics using hands-on activities and lecture instructional strategies
2. There will be no significant difference in mean attitude scores between male and female students taught Physics using hands-on activities instructional strategy.
3. There will be no significant interaction effect of teaching method and sex on students' attitude towards Physics.

RESEARCH METHOD AND PROCEDURE

The study adopted quasi-experimental design. Specifically, the pre-test posttest planned variation group design was used. In this design random assignment of subjects into varying groups was not possible. Rather, intact classes were used in order not to disrupt classroom teaching. The population for the study is 58,190; comprising 31,150 female and 27,040 males Senior Secondary School Class two (SS2) Physics students in Delta South Senatorial District of Delta State. The sample for the study comprised 376 physics students selected from six (6) public mixed senior secondary schools in Delta South Senatorial District of Delta State. The six schools for the study were selected using random Sampling technique Attitude to Science Scale (ASS) was the instrument used for this study.Theattitude to science

scale adopted from Baggaley (1973). The instrument is a 20-item likert-type instrument designed to assess students' attitude to science.The Attitude to Science scale was also face-validated by three experts in science education and research. Since the Attitude scale is an adoption of already standardized and universally accepted scale, the researcher deemed it unnecessary to go into further factorial validation of the instrument. The reliability of the AAS was established using the Cronbach Alpha.

The first step in the treatment procedure was the assignment of students into hands-on activities instructional strategy groups and lecture method group intact SSII classes from the six schools selected for the study were randomly selected to make up the experimental group (hands-on activities instructional strategy group). The three remaining intact SSII classes from the schools left served as lecture method group (control group). Both the experimental and control groups were exposed to the same physics student matter and learning environment. One group learned using hands-on activities instructional strategy while the other will be taught using lecture method.

The six teachers in the six selected schools were used as research assistants. They were trained on the skill of using hands-on activities instructional strategy method. Three teachers out of the six in the selected schools were trained on the skills of using hands-on activities instructional strategy. This lasted for five days. In the first day, the researcher sought the approval of the school heads (Principals) in order to use the teachers and students in the school for the study. On the second day, the researcher with the help of two expert instructors exposed the three teachers to the theories origin and features of hands-on activities instructional strategy. On the third day, the teachers were trained using the training manuals developed by the researchers on hands-on activities instructional strategy of teaching. The third day and fourth days were spent on practice and generation of ideas on how to apply hands-on activities instructional strategy in teaching the selected physics concepts. On the final day of the training, the researcher and the three other expert instructors constructively applied hands-on activities instructional strategy in teaching the selected concepts. The training came to a close.

The lecture method research assistants were not trained since they were used to the lecture method of instruction. The researchers only provided the three lecture method teachers with instructional units to use during treatment to avoid discrepancy in the lecture method group.

The treatment groups consisted of:

a) Experimental Groups A (hands-on activities instructional strategy) and
b) Control Group B (lecture method group)

The treatment lasted for a period of six weeks; a week before the start of treatment, the researcher distributed the instructional units for both experimental group and control group to the six research assistants. The instructional units contained physics contents which include; (i) Simple harmonic motion (ii) Linear momentum and (iii) Mechanical energy for senior secondary schools. The distribution of instructional units was done for two reasons (i) to familiarize the teachers with the subject matter contents and (ii) to ensure that all the instructional presentation followed the recommended format for the designated classes. Two days before the commencement of treatment, both the experimental and control groups were pre-tested with attitude to science scale. The teachers in this experimental group implemented the basic features of Hands-on activities instructional strategy

Two days after the end of the treatment, students in both groups were post-tested with attitude to science scale.

All the research questions were answered using Mean (X) and Standard Deviation (SD). Hypotheses 1, 2, 3 would be tested for significance using t-test while hypotheses 5 and6 were tested using Analysis of Variance (ANOVA). Hypotheses testing was done at 0.05 level of significance.

Presentation of Results

Research Question 1

What will be the difference between the attitude mean scores of students taught physics using hands on activities instructional strategy and those taught using lecture method?

Table 1: Attitude mean scores of students taught using hands on activity and those taught using lecture method

Source of Variation Mean	N	Mean	Std. Deviation	Std. Error
Hands-on	248	61.22	5.549	.352
Lecture	128	34,41	5.480	.484

From the table above, the mean score for hands-on activities (61.22) and lecture method (34.41) and standard deviation (5.55±5.48) shows significant variation. Therefore, there is significant difference in the attitude mean scores of students taught using hands on activity and those taught using lecture method.

Hypothesis 1

There will be no significant difference between the attitudes mean scores of students taught physics using hands-on activities instructional strategy and those taught using lecture method.

Table 2: Attitude mean scores of students taught using hands on activity and those taught using lecture method

Source of Variation Value	N	Mean	Std. Deviation	df	t	P-
Hands-on	248	61.22	5.549	374	44.57	0.000
Lecture	128	34.41	5.480			

From the table above, t (44.572) > P (0.000) which is significant, hence Ho_2 is rejected, therefore, there is a significant difference between students attitude taught using hands-on and lecture method in favour of hands-on activity.

Research Question 2

Is there any difference between the mean attitude scores of male and female students taught physics using hands-on activities instruction al strategy?

Table 3: Mean attitude scores of male and female students taught using hands-on activities

Source of Variation Mean	N	Mean	Std. Deviation	Std. Error
Hands-on	199	51.73	14.001	.688
Lecture	178	52.49	13.739	1.032

From the table above, the mean score for male (51.74) and female (52.50) and standard deviation (14.00±13.74) shows significant variation. Therefore, there is significant difference in the mean attitude scores between male and female students taught using hands on activities.

Hypotheses 2

There is no significant difference between the mean attitude scores of male and female students taught physics using hands-on activities instructional strategy.

Table 4: Mean attitude scores of male and female students taught using hands-on activities

Source of Variation Value	N	Mean	Std. Deviation	df	t	P-
Hands-on	198	51.73	14.001	374	.529	0.597
Lecture	178	52.49	13.739			

From the table above, t (-.529) > P (0.597) which is not significant, hence Ho_4 is accepted, therefore, there is no significant difference between the mean attitude scores of male and female students taught using hands-on activities.

Research Question 3

What will be the effect of interaction of teaching method and sex on students'attitude towards physics?

Table 5: Mean attitude scores of interaction of teaching method and sex on students'attitude towards physics.

Hands=1 Lecture=2	male=1 female=2	Mean	Std. Deviation	N
1	1	61.3750	5.39466	128
	2	61.0583	5.72815	120
	Total	61.2218	5.54948	248
2	1	34.3662	5.07723	71
	2	34.4737	5.99138	57
	Total	34.4141	5.48086	128
Total	1	51.7387	14.00116	199
	2	52.4972	13.73992	177
	Total	52.0957	13.86550	376

From the table above, the mean score for hands-on activities (51.74) and lecture method (52.50) for male and female with standard deviation (14.00±13.74) shows significant variation. Therefore, there is significant effect of interaction of teaching method and sex on students'attitude towards physics.

Hypotheses 3

There will be no significant effect of interaction of teaching method and sex on attitude in physics.

Table 6: Effect of interaction of teaching method and sex on students'attitude towards physics

Source	Type III sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	60679.272[a]	3	20226.424	659.137	.000	.842
Intercept	765799.169	1	765799.169	24955.784	.000	.985
Methods	60121.532	1	60121.532	1959.234	.000	.840
Sexxx	.916	1	.916	.030	.863	.000
Methods sexxx	3.766	1	3.766	.123	.726	.000
Error	11415.281	372	30.686			
Total	1092546.000	376				
Corrected Total	72094.553	375				

The graph of interaction in figure 2 shows an ordinary interaction because the line does not cross each other. From table 6, F-cal (659.137)> F-crit (0.000) shows that there is significant interaction effect between method and on student attitude towards physics. Thus, the null hypothesis of non-significant interaction effect was rejected.

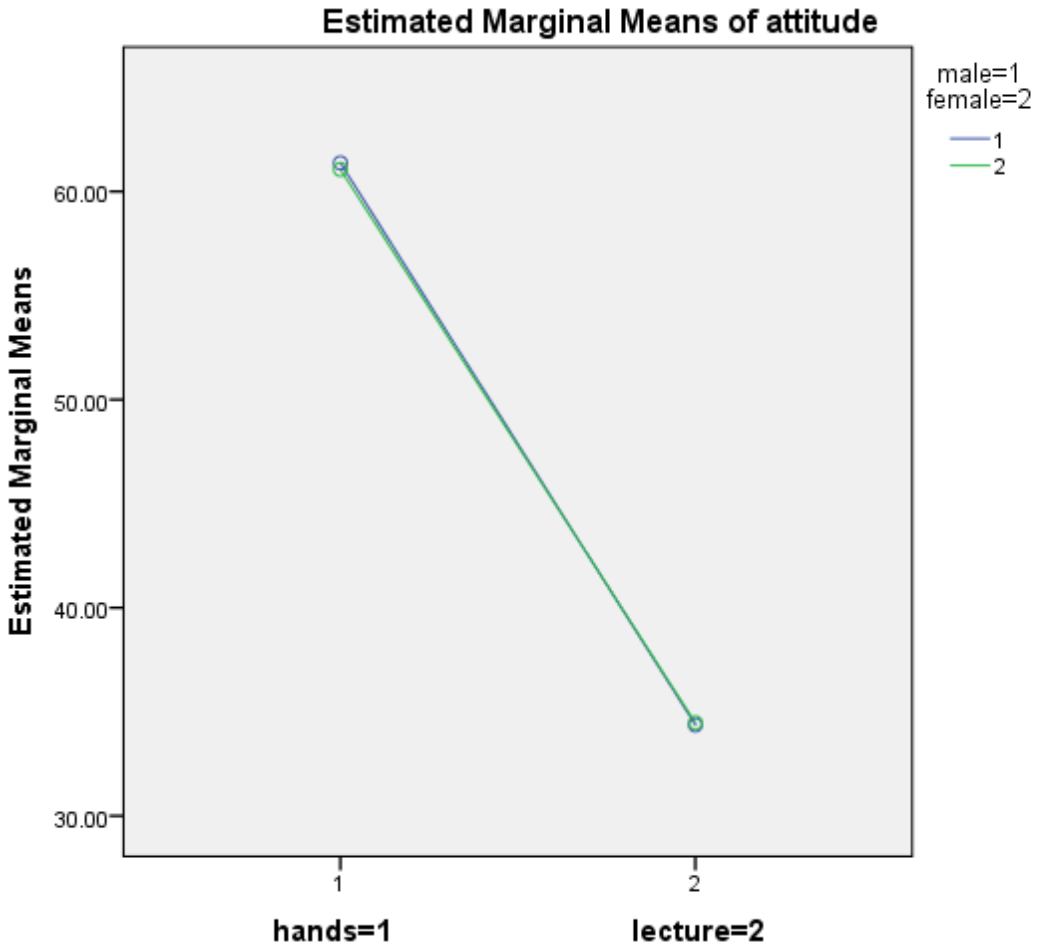

Figure 2: Graph illustrating significant interaction effect between method and sex on students' attitude towards physics.

Discussion of Results

The results presented in the tables above are discussed in this section. The discussion is organized under the following sub-headings

Hands-on Activities Instructional Strategy and Lecture method on Students' Attitude

Another finding of this study showed that there is significant mean attitude scores between students taught physics using hands-on activities instructional strategy and those taught with lecture method. This suggest that the students' in the hands-on activities instructional strategy group may have develop positive attitude in teaching learning process as well as increases the learners attitude than the students' taught physics using the lecture method. This implies that hands-on activities instructional strategy affect students' attitude towards physics. The findings concurs with Hina (2010), Idowu, Adeyinka and Kareen (2020) who revealed that hands-on approach increases students' attitude towards physics and any other science subjects.

Hands-on Activities Instructional Strategy and Sex on Physics Attitude

The fourth findings of the study revealed that there is no significant difference in the mean scores between male and female students taught physics using hands-on activities instructional strategy. This implies that hands-on activities instructional strategy enhances students' attitude equally. One possible explanation for this observation is that both male and female students' were actively involved during the teaching and learning process of the physics concepts seeking to understand it on their own. This will no doubt enhances both sex understand the concepts. According to Hina (2010) who revealed by his investigation that hands-on activities instructional strategy is gender friendly having equal effects on male and female attitude. This lent credence to that of Idowu, Adeyinka and Kareen (2020) who revealed that there is no significant difference between male and female attitude taught physics using hands-on activities instructional strategy.

Effect of Interaction between Sex and Physics Attitude

The study finally revealed that there is significant interaction effect of sex and teaching method on physics attitude. In other words, students' attitude in physics relative to the teaching methods is not influence by sex. Hands-on activities instructional strategy is not sex biased. The finding did not concur with the view of Hina (2010) who reported no significant difference between sex and teaching method and gender attitude. This finding is not also in line with that of Idowu, Adeyinka and Kareen (2020) who reported that there is no significant difference interaction effect of learning and gender on students' attitude.

Conclusion

The study concluded that hands-on activities instructional strategy enhance students achievement of physics concepts more than lecture method; hands-on activities instructional strategy enhances students attitude hands-on activities instructional strategy influences male and female students achievement equally; hands-on activities instructional strategy is not influenced by students sex.

Recommendations

In the light of the findings of the study and the conclusion drawn therefore, the following recommendations are made:

1. Physics teachers should adopt the use of hands-on activities instructional strategy in teaching physics in the senior secondary school level. This instructional strategy will lead to students' achievement in physics concepts and develop a positive attitude in them.
2. Government should provide enriched learning environment that will stimulate easy implementation of hands-on activities instructional strategy in the classroom teaching.

Contributions To Knowledge

The study contributed the following to knowledge:

1. The study established that hands-on activities instructional strategy significantly improves students' attitude towards physics.
2. The study established that there is a significant effect of interaction between sex and teaching method (hands-on activities instructional strategy) on students' attitude towards physics.

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