



# Effects of Indoor and Outdoor Laboratory Instructions on Secondary School Students' Attitude and Achievement in Physics in Jama'are Educational Zone, Bauchi State, Nigeria

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## Abstract

This study ascertained the Effects of Indoor and Outdoor Laboratory Instructions on Students Attitude and Achievement in Physics. The study employed the quasi-experimental research design of the non- equivalent control group pretest-posttest type. Six research questions were raised and answered using the mean and standard deviation, while six null hypotheses were formulated and tested at 0.05 level of significance. t-test of independent sample was used for all the hypotheses. The target population consisted of 750 SS II Physics students (350 male students and 400 female students) in all the 10 co-educational secondary schools (8 public and 2 private schools). An intact sample of 80 SS II Physics students (32 male and 48 female) from two sampled co-educational secondary schools were involved in gathering data for the study. Two instruments were used to gather data for the study, they are; a 15 items Likert-scale Secondary School Physics Attitude Questionnaires (SSPAQ) and 40 multiple-choice Secondary School Physics Achievement Test (SSPAT). Each of the instruments was validated by three experts. The reliability coefficient of the SSPAQ was found to be 0.78 and the reliability coefficient of SSPAT was obtained as 0.95 using the Cronbach's coefficient alpha method on the Statistical Package for Social Sciences (SPSS) software version 23. Findings from the studies showed that the nature of the secondary school students' attitude and achievement to Physics is more positive after exposure to indoor and outdoor laboratory instructions; the male and female students taught with out-door laboratory method had a better positive attitude and achievement than those taught with indoor method. Based on the findings of the study, it was recommended that non-conventional teaching approaches such as out-door laboratory instruction, should be introduced into the teaching of Physics in the nation's secondary schools to reinforce the hitherto adopted conventional teaching method.

**Keyword:** Indoor, Outdoor, Laboratory, Instructions, Secondary School, Students, Attitude, Physics, Educational.

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## INTRODUCTION

Nations all over the world whether developed or developing recognize the vital role of science and technology in national development. In pursuance of these, the federal government stated that: special provisions and incentives shall be made for the study of the sciences at each level of the national education system involved in the promotion of the study of science subjects. In addition, the government is boosting the teaching of science subjects 'including physics in the secondary schools through building and equipping of science laboratories and staffing at schools with qualified science teachers (UBE Act, 2008). However, these efforts by the federal government and state government do not seem to be yielding the desired results judging from the persistent poor achievement of secondary school's students in science subjects in general and physics in particular, in public examinations West African Examination Council. Physics is one of the science subjects studied at the senior secondary level of education in Nigeria. It lays the foundation for further studies in physics and other physics-related courses at the higher education levels as well as national development).

Physics can also be defined as a branch of science that is concerned with the study of energy and matter and their interactions. Physics has contributed a lot to the development of the nation as it can be seen in every aspect of life. Medically, physics has done a lot in nation building by the use of technological inventions like the scanning machine, x-ray machines used for detection of broken bones, the production of drugs, making of artificial parts of the body which can be a substitute on the human body and even the making of test tube babies. Technological ideas of physics have made it possible for man to use incubators and hatcheries even in the production of animal feeds. In the area of transportation, physics has made a great mark in the production of airplanes, motor vehicles, motor cycles, space buses, ships, boats, life boats to mention few which have made it easier compared to the difficult way of transportation practiced by man earlier. Also in communication, physics has made it easier to communicate with the use of e-mail (computer), GSM pagers and other means of communication such as radio and television. The power sector was also developed through using the great inventions of physics in power generation. It is with the use of physics ideas that discoveries such as solar energy, bio-mars, nuclear energy (reactions) have been made known which today form the main sources of power in many nations.

In spite of the importance of physics to national development, there is disparity in the ability of students to perform specific tasks. Students are not the same especially when we find out the rate at which facts and principles in sciences are being assimilated. Several studies within the Nigerian environment have however, shown that learners are quantitatively different in their ability levels and in learning problems (Orulor, 2015). Some studies have also shown that method of instruction can influence the performances of low achievers (Amadalo, Ocholla, & Memba, 2012)

However, attitude and achievements of low ability students have been found to be lowest while that of high ability students was the highest (Welch, 2010). It has also been observed that outdoor laboratory instruction strategy was effective in teaching students of different ability levels (Festus, & Ekpete, 2015). Various activity-based teaching strategies have been employed for the purpose of improving the teaching/learning of physics at secondary school level. These are inquiry method, demonstration, process approach, cooperative learning and laboratory activity method. These teaching strategies usually took place within the classroom environment but in physics secondary level, there are topics which demand the use of outside classroom

investigations in form of outdoor laboratory activities. For example, various studies cited the teaching strategy employed by teachers is limited to the indoor laboratory investigations, at the expense of the outdoor laboratory. On the issue of gender, Toplis and Allen (2012) found out from their various studies that boys perform well in any 'rigorous' work, while girls show disposition for less rigorous work. While Bichi (2008) believed that girls perform better than boys in problem solving type of activities. However, if boys and girls are given equal opportunities, they will perform equally well (Bello, 2012).

Researches into the use of indoor and outdoor laboratory instruction seem to be limited particularly in Bauchi state. The researcher did not lay hand on any research that was carried out in Jama'are on the concept of energy, force, friction or simple machines. Against this background, this study set to investigate the effects of indoor and outdoor laboratory instructions on secondary school physics student's attitude and achievement in Jama'are Educational Zone of Bauchi State, Nigeria.

### **Statement of the Problem**

Science learning is expected to produce individuals that are capable of solving their problems as well as those of the society. Such individuals are expected to be autonomous, confident and self-reliant. Physics constitute Science and technology, the basis of advancement in nearly all fields of human endeavors yet, all is not well with physics instruction in Nigerian secondary schools because most teaching lays extreme emphasis on content and the use of "chalk and talk" method. This attitude of not adopting activity oriented method of teaching has led to abstraction which makes students less active and more prone to rote memorization. Based on this, a lot has been done to improve teaching of physics in secondary schools in Nigeria. In spite of that, students continue to perform poorly in physics. The situation has created the need for more effective teaching methods. It then becomes necessary to explore the efficacy of alternative methods of redressing the situation. Yet, there is no empirical evidence so far, on effect of indoors and outdoor laboratory instructions on secondary school physics students 'attitude and achievement in Jama'are Education zone of Bauchi State. Therefore, the problem of this study posed as a question is: What is the effect of indoors and outdoors laboratory instruction on secondary schools' physics students' attitude and achievement in Jama'are Education Zone of Bauchi State, Nigeria?

### **Objectives of the Study**

The major aim of this study is to determine the Effects of Indoor and Outdoor Laboratory Instructions on Secondary Schools' Students' Attitude and Achievement in Physics in Jama'are Education Zone, Bauchi State, Nigeria.

Specifically, the objectives of this study are to:

- Ascertain the effect of indoor and outdoor laboratory instruction on student's attitude in Physics in Jama'are Education Zone,
- Find out the effect of indoor and outdoor laboratory instruction on students' achievement in Physics in Jama'are Education Zone,
- Determine the effect of indoor and outdoor laboratory instruction on male and female students' attitude to Physics in Jama'are Education Zone,

- Ascertain the effect of indoor and outdoor laboratory instruction on male and female student's achievements in Physics in Jama'are Education Zone,
- Determine the interaction effect of indoor and outdoor laboratory instructions and gender on students' attitude in Physics in Jama'are Education Zone, and
- Find out the interaction effect of indoor and outdoor laboratory instructions and gender on students' achievement in Physics in Jama'are Education Zone.

## **Research Questions**

The following research questions were formulated to guide the study:

- What is the nature of the secondary school students' attitude to Physics before and after exposure to indoor laboratory instructions in Jama'are Education Zone?
- What is the nature of the secondary school students' attitude to Physics before and after exposure to outdoor laboratory instructions in Jama'are Education Zone?
- What is the achievement profile of the secondary school students' in Physics before and after exposure to indoor laboratory instructions in Jama'are Education Zone?
- What is the achievement profile of the secondary school students in Physics before and after exposure to outdoor laboratory instructions in Jama'are Education Zone?
- What is the nature of male and female secondary school students' attitude to Physics before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone?
- What is the achievement profile of male and female secondary school students in Physics before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone?

## **Hypotheses**

The following hypotheses were formulated and tested at 0.05 levels of significance:

- There is no significant difference between the Physics attitude mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone.
- There is no significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone.
- There is no significant difference between the Physics attitude mean scores of male and female secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone.
- There is no significant difference between the Physics achievement mean scores of male and female secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone.
- There is no significant interaction effect of method and gender on students 'attitude to Physics in Jama'are Education Zone.

- There is no significant interaction effect of method and gender on students 'achievement in Physics in Jama'are Education Zone.

## METHODS

The design adopted in this study was quasi-experimental design. Specifically, the non-randomized pre-test-post-test control group design was adopted for the study and intact classes of experimental and control groups were used. The target population of the study was 750 drawn from all the senior secondary two (SS II) students that were offering physics in secondary schools in Jama'are Educational Zone of Bauchi State, Nigeria. Eighty students were used as intact group. The 80 students represented 10.67% of the entire population. Out of the study sample, 32 were male and 48 were female. For the purpose of this research, public secondary schools in the Jama'are educational zone were used for the study. This is because as stated earlier, public schools have a harmonized programme which is uniformly coordinated and then monitoring and evaluation were anticipated to be easy. Two instruments were used for the data collection, the Secondary School Physics Attitude Questionnaires (SSPAQ) and the secondary school physics achievement test (SSPAT). Research questions were answered using the mean score and standard deviation of the experimental group and the control group for all the subjects in the research. Hypotheses 1 to 4 were tested using the student t-test for independent sample at 0.05-level of significance in order to find out the effect of the indoor and outdoor laboratory instructions on both male and female students' attitude and mean achievement in Physics. Hypotheses 5 and 6 were tested at  $p < .05$  probability level using Analysis of covariance (ANCOVA) to find out the interaction effect of method and gender on students' attitude and achievement. The data collected underwent various stages of preparation before the analysis using the Statistical Package for Social Sciences (SPSS) computer software version 23.

## RESULTS

The raw data that were used to answer the research questions and test the formulated hypotheses are provided in Appendix A7.

**Research Question One:** What is the nature of the secondary school students' attitude to Physics before and after exposure to indoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 1 shows a summary of the level of (SS II) students' attitude toward Physics before and after exposure to indoor laboratory instruction.

To answer this research question, Mean and Standard Deviation were used and the results are presented in Table 4.

Table 1: Pretest and Posttest Attitude Scores of Physics Students taught with Indoor Laboratory Instruction

TEST	N	Mean	SD	Mean Difference
Indoor Pretest	40	26.58	8.93	11.22
Indoor Posttest	40	37.80	13.86	

From data in Table 1, it is observed that students taught with Indoor laboratory instruction had pre-test mean of 26.58, standard deviation of 8.39, post-test mean of 37.86, standard deviation of 13.86 and a mean difference of 11.22. It means that the nature of the secondary school students' attitude to Physics is more positive after exposure to indoor laboratory instructions

**Research Question Two:** What is the nature of the secondary school students' attitude to Physics before and after exposure to outdoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 2 shows a summary of the level of (SS II) student's attitude toward physics before and after exposure to outdoor laboratory instruction.

To answer this research question, Mean and Standard Deviation were used and the results are presented in Table 5.

Table 2: Pretest and Posttest Attitude Scores of Physics Students taught with Outdoor Laboratory Instruction

TEST	N	Mean	SD	Mean Difference
Outdoor Pretest	40	44.60	9.27	10.65
Outdoor Posttest	40	55.25	7.45	

From data in Table 2, it is observed that students taught with Indoor laboratory instruction had pre-test mean of 44.60, standard deviation of 9.27, post-test mean of 55.25, and standard deviation of 7.45 and a mean difference of 10.65. It means that the nature of the secondary school students' attitude to Physics is more positive after exposure to outdoor laboratory instructions.

**Research Question Three:** What is the achievement profile of the secondary school students in physics before and after exposure to indoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 3 shows a summary of the achievement profile of level of Physics SS II student before exposure before and after exposure to indoor laboratory instruction. To answer this research question, Mean and Standard Deviation were used and the results are presented in Table 3.

Table 3: Pretest and Posttest Achievement Mean Scores of Physics Students taught with Indoor Laboratory Instruction

TEST	N	Mean	SD	Mean Difference
Indoor Pretest	40	15.78	5.94	5.75
Indoor Posttest	40	21.53	4.79	

From data in Table 3, it is observed that students taught with Indoor laboratory instruction had pre-test mean of 15.78, standard deviation of 5.94, post-test mean of 21.53, and standard deviation of 4.79 and a mean difference of 5.75. It means that the achievement profile of secondary school student in physics is higher after exposure to indoor laboratory instruction.

**Research Question Four:** What is the achievement profile of the secondary school students in physics before and after exposure to outdoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 4 shows a summary of the achievement profile of level of physics SS II student before exposure before and after exposure to indoor laboratory instruction.

To answer this research question, Mean and Standard Deviation were used and the results are presented in Table 4.

Table 4: Pretest and Posttest Achievement Mean Scores of Physics Students taught with Outdoor Laboratory Instruction

TEST	N	Mean	SD	Mean Difference
Outdoor Pretest	40	21.68	4.74	6.95
Outdoor Posttest	40	28.63	3.43	

From data in Table 4, it is observed that students taught with Indoor laboratory instruction had pre-test mean of 21.68, standard deviation of 4.74; post-test mean of 28.62, and standard deviation of 3.43 and a mean difference of 6.95. It means that the achievement level of secondary school students in Physics is higher after exposure to outdoor laboratory instruction.

**Research Question Five:** What is the nature of male and female secondary students' attitude in Physics before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 5 indicates the summary of the nature of the Physics SS II students' attitude before and after exposure to indoor and outdoor laboratory instructions.

Table 5: Pretest and Posttest Indoor and Outdoor Comparison of Physics Students' Attitudes based on Gender

Gender	NO	Indoor Pretest Outdoor Posttest				Mean difference
		Mean	SD	Mean	SD	
Male	32	45.09	9.91	58.25	4.47	13.16
Female	48	29.48	10.12	39.08	12.38	9.60
Total	80					

Table 5 shows that male and female students taught with out-door laboratory method had mean scores of 58.25 and 39.08 with standard deviations of 4.47 and 12.38 respectively while male

and female students taught with indoor method had a mean score of 45.09 and 29.48 with standard deviation of 9.91 and 10.12 and mean differences of 13.16 and 9.60 respectively. This means that the male and female students taught with outdoor laboratory method had a better positive attitude than those taught with the indoor method.

### Research Question Six

What is the achievement profile of male and female secondary students in Physics before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State?

Table 6 indicates the summary of achievement profile of the Physics SS II students before and after exposure to indoor and outdoor laboratory instructions based on gender.

To answer this research question, Mean and Standard Deviation were used and the results are presented in table 6.

Table 6: Pretest and Posttest Indoor and Outdoor Comparison of Physics Students' Achievements based on Gender

Gender	NO	Indoor Pretest		Outdoor posttest		Mean difference
		Mean	SD	Mean	SD	
Male	32	24.75	2.24	29.69	3.03	4.49
Female	48	14.71	4.27	22.00	4.48	7.29
Total	80					

Table 6 shows that male and female students taught with out-door laboratory method had mean scores of 29.69 and 22.00 with standard deviations of 3.03 and 4.48 respectively, while male and female students taught with indoor method had a mean score of 24.75 and 14.71 with standard deviation of 2.24 and 4.27 respectively and mean differences of 4.49 and 7.29 respectively. This means that the male and female students taught with out-door laboratory method had a better Achievement score than those taught with indoor method.

**Hypotheses One:** There is no significant difference between the Physics attitude mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State.

The Null hypothesis was analyzed using t-test statistics, and the summary of the analysis is shown in Table 7.

Table 7: Independent t-test for the Pretest and Posttest Attitude Mean Score of the Students exposed to Indoor and Outdoor Laboratory Instruction

GROUP		Mean	N	SD	DF	t value	p value	Decision
INDOOR	Pretest	39.20	40	4.80	39	17.603	0.000	Reject Ho
	Posttest	48.66	40	5.36				
OUTDOOR	Pretest	48.25	40	6.29	39	13.453	0.000	Reject Ho
	Posttest	57.10	40	4.63				

From the Table 7 above, the t value is 17.603 with degree of freedom 39 and P value of 0.000 for the Indoor group and t value for the Outdoor Group is 13.453 with a degree of freedom 39 and P value of 0.000. Since both the P values (0.000) are less than 0.05, we reject the null hypothesis and conclude that there is a significant difference between the Physics attitude mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions.

**Hypothesis Two:** There is no significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State

The Null hypothesis was analyzed using t-test statistics, and the summary of the analysis is shown in Table 8.

Table 8: t-test for the Pretest and Posttest Achievement Means Scores of the Students exposed to Indoor and Outdoor Laboratory Instruction

GROUP		Mean	N	SD	DF	t value	p value	Decision
INDOOR	Pretest	15.775	40	5.94	39	13.732	0.000	Reject Ho
	Posttest	21.525	40	4.79				
OUTDOOR	Pretest	21.675	40	4.74	39	15.206	0.000	Reject Ho
	Posttest	28.625	40	3.43				

$P < 0.05$

From the Table 8, the t value is 13.732 with degree of freedom 39 and P value of 0.000 for the Indoor Group and t value for the Outdoor Group is 15.206 with a degree of freedom 39 and P value of 0.000. Since both the P values (0.000) are less than 0.05, we reject the null hypotheses and conclude that there is a significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions.

**Hypothesis Three:** There is no significant difference between the Physics attitude mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State.

The Null hypothesis was analyzed using t-test statistics, and the summary of the analysis is shown in Table 9.

Table 9: Independent t-test Analysis of the Outdoor pretest and posttest Attitude Scores of Male and Female Students

GROUP		Mean	N	SD	DF	t value	p value	Decision
INDOOR	Male	45.09	32	9.91	78	8.60	0.000	Reject Ho
	Female	29.48	48	10.12				
OUTDOOR	Male	58.25	32	4.47	78	6.20	0.000	Reject Ho
	Female	39.08	48	12.38				

$P < 0.05$

From the Table 12 above, the indoor t value is 8.60 with degree of freedom 78 and P value of 0.000. The outdoor t value is 6.20 with degree of freedom 78 and P value of 0.000. Since the P values (0.000) are less than 0.05, we reject the null hypothesis and conclude that there is significant difference between the Physics' attitude mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions.

**Hypothesis Four:** There is no significant difference between the Physics achievement mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions in Jama'are Education Zone, Bauchi State. The Null hypothesis was analyzed using t-test statistics, and the summary of the analysis is shown in Table 13.

Table 13: Independent-t-test Analysis of the Indoor pretest and posttest Achievement Scores of Male and Female Students

GROUP		Mean	N	SD	DF	t value	p value	Decision
INDOOR	Male	24.75	32	2.24	39	17.603	0.000	Reject Ho
	Female	14.71	48	4.27				
OUTDOOR	Male	29.69	32	6.29	39	13.453	0.000	Reject Ho
	Female	22.00	48	4.63				

$P < 0.05$

From the Table 13 above, the indoor t value is 12.200 with degree of freedom 78 and p- value of 0.000. The outdoor t value is 8.49 with degree of freedom 78 and P value of 0.000. Since the P values (0.000) are less than 0.05, the null hypothesis was rejected, and we conclude that there is significant difference between the Physics achievement mean scores of male and female secondary students before and after exposure to indoor and outdoor laboratory instructions.

Table 15: Summary of ANCOVA result for hypothesis 5

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11869.545 <sup>a</sup>	2	5934.772	151.948	.000
Intercept	2031.475	1	2031.475	52.012	.000
PRE_TEST	4816.211	1	4816.211	123.310	.000
GENDER	596.752	1	596.752	15.279	.000
Error	3007.455	77	39.058		
Total	189722.000	80			
Corrected Total	14877.000	79			

**Hypothesis Five:** There is no significant interaction effect of method and gender on students' attitude in Physics in Jama'are Education Zone, Bauchi State.

The Null hypothesis was tested at .05 probability level using Analysis of covariant (ANCOVA), and the summary of the analysis is shown in Table 14.

From the table above, the 2- way interaction (Method, Gender) was significant. F Statistics is 15.276 with a P Value of 0.000. Since the P value is less than 0.05, we reject the null hypothesis and conclude that there is a significant interaction effect of methods and gender on students' attitude to Physics.

**Hypothesis Six:** There is no significant interaction effect of method and gender on student's achievement in Physics in Jama'are Education Zone, Bauchi State.

The Null hypothesis was tested at .05 probability level using Analysis of covariant (ANCOVA), and the summary of the analysis is shown in Table 16

Table 16: Summary of ANCOVA result for hypothesis 6

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1555.477 <sup>a</sup>	2	777.739	74.293	.000
Intercept	560.789	1	560.789	53.569	.000
Teaching Method	420.802	1	420.802	40.197	.000
Gender	27.737	1	27.737	2.650	.108
Error	806.073	77	10.468		
Total	52662.000	80			
Corrected Total	2361.550	79			

From the table above, the 2- way interaction (Method, Gender) was not significant. F Statistics is 2.650 with a p value of 0.108. Since the p value is greater than 0.05, we accept the null hypothesis and conclude that there is no significant interaction effect of methods and gender on students' achievement in Physics.

## DISCUSSION OF THE RESULT

This study is very significant in the sense that it has been able to demonstrate the usefulness of outdoor laboratory instruction in the learning of Physics particularly. The most important usefulness of outdoor laboratory instruction lies in the basic facts that it provided most realistic means of meeting organisms in their actual environment. This Unit presented explanation of results obtained from the research questions answered and hypotheses tested, and acknowledged the published works of other authors in the study. This study investigated the Effects of Indoor and Outdoor laboratory Instructions on Secondary School Students' Attitude and Achievements in Physics in Jama'are Education of Zone Bauchi State, Nigeria. It was discussed as follows:

The result from research question one, what is the nature of the secondary school students' attitude to Physics before and after exposure to indoor laboratory instructions, indicates that, from data in Table 4, with a mean difference of 11.22 in favour of after exposure, it means that the nature of the secondary school students' attitude to Physics is more positive after exposure to indoor laboratory instructions. This findings is in line with Otagbo (2010) who claimed that the indoor posttest (after exposure) is more effective than the indoor pretest (before exposure) in Physics concepts due to the fact that indoor posttest (after exposure) demands the students to handle, observe and collect on the spot information of a particular concept, unlike the indoor pretest (before exposure) in which materials are not brought to the classroom for students

to observe and make investigation within the limited classroom environment, but test at first instant.

Null hypothesis one: There is no significant difference between the Physics attitude mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions. From Table 10, considering the t value, degree of freedom, and p- value of, we reject the null hypothesis and conclude that there is a significant difference between the Physics attitude mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions. Some of the factors inhibiting the learning of Physics and leading to students' poor academic performances in Physics have been identified. These factors, according to Angell (2004), include; poor teaching methodology, students' negative attitude towards Physics, students' lack of interest in Physics, school location, gender inequality and poor quality of Physics teachers.

The result from research question two, what is the nature of the secondary school students' attitude to Physics before and after exposure to outdoor laboratory instructions? From data in Table 5, by comparing the mean, the standard deviation and the mean difference, it was observed that the nature of the secondary school students' attitude to Physics is more positive after exposure to outdoor laboratory instructions. Amunga, Musasia, and Musera (2010) reported that students' positive attitudes to science correlate highly with their science achievement. Similar students show more positive attitudes after been exposed to Outdoor laboratory instruction.

Null hypothesis two: There is no significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions. From Table 11, since both the p- values (0.000) are less than 0.05, we reject the null hypothesis and conclude that there is a significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions. This is similar with Philiat (2009) view. It was observed that there is a significant difference between the Physics achievement mean scores of the secondary students before and after exposure to indoor and outdoor laboratory instructions. The poor performance of students persists in Physics at secondary school level; this has been attributed to constant use of indoor classroom activity-based teaching strategies.

The result from research question three, what is the achievement profile of the secondary school students' in Physics before and after exposure to indoor laboratory instructions, indicates that from data in Table 6, it is observed that students taught with Indoor laboratory instruction had greater post-test mean scores, which means that the achievement profile of secondary school student in Physics is higher after exposure to indoor laboratory instruction. Philiat (2009) reported that students' high achievement to science correlate highly with their science achievement.

Null hypothesis three: There is no significant difference between the Physics attitude mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions. From the Table, the indoor and the p-values (0,000) are less than 0.05, we reject the null hypothesis and conclude that there is a significant difference between the Physics attitude mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions. Comparing the work of Ezema (2011) with this work, this is a positive correlation of males and negative correlation of females with interest in study of Physics. However, it was indicated that sex differences in students' performance are attributed to psychological issues.

The result from research question four, what is the achievement profile of the secondary school students in physics before and after exposure to outdoor laboratory instructions, indicates thus: from data in Table 7, it is observed that students taught with Outdoor laboratory instruction had higher mean score after exposure to outdoor laboratory instruction. This means that the achievement level of secondary school students' in Physics is higher after exposure to outdoor laboratory instruction. According to Fred (2017), students remember, 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they hear and see, 70% of what they say, 90% of what they hear, see, say and do. The above conclusion appeals to Physics teachers to employ as many senses as possible of their students while teaching. In other words, for permanent retention of the required knowledge, students should be made to see, hear, say and do in Physics classes.

Null hypothesis Four: There is no significant difference between the Physics achievement mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions. From Table 13, the t value is 12.200 with degree of freedom 78 and p-value of 0.000. Since the p- value (0.000) is less than 0.05, we reject the null hypothesis and conclude that there is significant difference between the Physics achievement mean scores of male and female students before and after exposure to indoor and outdoor laboratory instructions. On the other hand, Orulor (2015) attributed low academic performance of students to gender bias in Physics and Mathematics. References were being made to some courses as 'hard' and 'soft'. For example, physical sciences and technical courses which are dominated by male were regarded as hard while Biological sciences, Home Economics and Secretarial studies were regarded as soft and are dominated by female.

The result from research question five, what is the nature of the male and female students' attitude in Physics before and after exposure to indoor and outdoor laboratory instructions, indicates thus: from Table 8 shows that male and female students taught with outdoor laboratory method had a higher mean scores of 58.25 and 39.08 respectively compared with indoor mean scores of 45.09 and 29.48. This implies that male and female students who received instructions using outdoor laboratory method have more positive attitude than those taught using indoor laboratory instruction. However, attitude is a factor which depends on many variables. These include; time interval between learning and retrieval, experiences, specific subject involved, instructional strategies/materials and environmental situations.

Null hypothesis five: There is no significant interaction effect of method and gender on students' attitude to Physics. From the Table 14, the 2- way interaction (Method, Gender) was significant. Since the P value is less than 0.05, we reject the null hypothesis and conclude that there is a significant interaction effect of methods and gender on students' attitude to Physics

The result from research question six, what is the achievement profile of the male and female students in Physics before and after exposure to indoor and outdoor laboratory instructions, indicates thus: Table 9 shows that male and female students taught with outdoor laboratory method had mean scores of 29.69 and 22.00 compared to indoor with 24.75 and 14.71. This means that the mean achievement scores of male and female students who received instruction through outdoor laboratory instruction are higher than the mean achievement scores of male and female students taught with indoor laboratory instruction. However, achievement may be regarded as a behaviour exhibited at the end of a given period of time or within a given time range. Achievement result test enables one to obtain information on the extent to which a student has attained the criterion performance.

Null hypothesis six: There is no significant interaction effect of method and gender on students' achievement in Physics. From the Table 15, the 2-way interaction (Method, Gender) was significant. Since the p-value is greater than 0.05, we accept the null hypothesis and conclude that there is no significant interaction effect of methods and gender on students' achievement in Physics.

## **CONCLUSION**

Outdoor teaching strategy favoured the experimental groups due to the fact that the pre-requisite steps of activities in teaching of Physics concept were followed. This has stimulated students' attention and interest, which led to good attitude and achievement in Physics concept. The students on experimental group were taught with the strategy (outdoor) that required the use of basic science process skills i.e observation, identification, classification and manipulation of substances in the natural surroundings. The students in this group became more active and creative since they can see and manipulate organism in their natural surroundings. The mean achievement scores of male students in the post-test were higher than that of their female counterparts. This implies that there is male dominance in performance and males are taken for the nature of the job more than females. Also, the attitude scores of male students were higher than that of their female counterparts.

Generally, it was confirmed that there was high significant difference between the mean achievement of the experimental and control groups in Physics concept. There was also a high significant difference between the mean scores of the experimental and control groups in Physics concept on attitude and achievement. This further confirmed that the outdoor laboratory instruction has gained more than the indoor laboratory method of teaching. The study also revealed that there was significant interaction effect of method and gender on the experimental group students' attitude and achievement to Physics.

## **Recommendations**

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

- Curriculum planners should include outdoor laboratory method as one of the instructional strategies to be used in teaching of science subjects both in primary and post primary schools
- For the exercise (outdoor) to be successful, it has to be well-funded, by both school authorities and parents. As such the school authorities and parents should put cooperate to make outdoor teaching strategy at all levels of learning a successful one by proper funding at any designed time
- Bearing in mind the roles of workshops and seminars in the dissemination of knowledge and innovations, the study recommends that in-service training, workshops and seminars be organised for teachers to equip them with necessary skills in the use of outdoor laboratory.
- Government in collaboration with the ministry of education should ensure proper welfare of Physics teachers in order to encourage them towards discharging their duties effectively.

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