



## Effect of Physics Practical on Students' Attitude and Performance in Bauchi Educational Zone

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### ABSTRACT

The study investigated the Effects of Physics Practical on Secondary School Students' Attitude and Performance in Bauchi Educational Zone, Nigeria. In a bid to achieve the objectives of the study four research questions were raised and five hypotheses were postulated. The study adopted quasi-experimental research design. Specifically, the pre-test posttest control group design. The study population consisted of ten thousand two hundred and eighty SSII physics students. The sample of the study was made up of one hundred and Forty SSII physics students. Stratified random sampling technique was used for the study. The research instruments used for the study were Physics Students Laboratory Practical Performance Test (PSLPPT) and Physics Students Laboratory Attitude Rating Scale (PSLARS). The reliability of the instruments was determined using Cronbach alpha coefficient. The reliabilities stood at 0.76 for PSLPPT and 0.98 for PSLARS. Data were analysed using descriptive and inferential statistics and t-test. The results obtained showed that: Students have positive attitude toward physics laboratory practical, laboratory practical enhanced students' performance in physics. The findings also revealed that there is a significant difference between the performance of students exposed to laboratory practical and those not exposed to, both male and female students were at the same level of performance in physics after exposure to laboratory practical. It was then recommended among others that teachers should put more efforts in teaching students the practical aspect of physics as this would made the students to have positive attitude and have better performance in physics.

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### INTRODUCTION

Physics is one of the science subject that contribute to national development. It also contribute to the technological infrastructure and provides trained

personnel needed to take advantage of scientific advances and discoveries. Indeed, the knowledge of physics has led to so many inventions such as the production, application and utilization of integrated



circuits, production and use of machines and other devices. It also accounts for the discovery and production of hydro-electric power, gas turbine and thermos-nuclear power plant, mobile phones, refrigerators, electrical heaters, and cookers. Despite the importance of physics to the scientific and technological development of any nation, understanding of the subject has dwindled over the years and the performance of the enrolled students have not been encouraging (NERDC, 2009).. The enrolment in physics course at all levels is low in many African countries (Amunga, Musasia & Musera, 2011). Many reasons were advanced for this discrepancy which include: inadequate teacher preparations, weak mathematics background, lack of job opportunities outside the teaching profession, inadequate teacher qualification as well as possession of below standard pedagogical content knowledge (Semela, 2010). Many students find the subject boring, unemployable (Hirschfield, 2012) and as a result interest in high school physics is decreasing.

The WAEC Chief Examiners Report (2009) indicates that candidates show weakness in recording measured variables and evaluations to the required number of decimal places/significant figure, plot points correctly on graph to the required degree of occupancy, state precautions in precise Language among others. A study by Owolabi (2004) revealed that the performance of Nigeria students in ordinary level physics was generally poor which he attributed to many factors such as teaching strategies, inadequate number of learning facilities in schools as against consistent increase in number of students, attitudes of students towards physics, students' motivation to learn physics, students' ability to retain physics concepts among others. Generally, the way physics lessons are delivered in senior secondary schools in Nigeria is by expository method. The expository teaching

method is a teacher-centered, student peripheral approach where the teacher with or without the use of instructional materials delivers a pre-planned lesson to the students (Akinbobola, 2009). One of the utmost significant factors which affect students' academic success in physics is their attitude towards the subject. Delia Summers Dictionary (2008) defined attitude as the opinion and feeling that one usually has out something. Attitudes exhibited by physics students can distort the perception of physics concepts and affect the degree of their retention. The attitude exhibited by physics students in the teaching and learning of physics however could be positive or negative. Previous study by Cracker (2006) has shown that students who hold negative attitudes towards physics have lack of motivation of class engagement and also the students who have positive attitudes towards physics have motivation for class engagement. Adegoke (2011) attributed the poor performance of students in physics as due to inadequate laboratory equipment and teachers' competency.

For effective teaching and learning of physics, the teachers should strike a balance between the theoretical teaching, exposure of students to practical and applications of physics to real life situations. Unless the teachings of various aspects of physics principle are done practically, it will be very difficult for the students to internalize these concepts. Practical activities in physics laboratory are surrounded by topics that involve the use of equations and formulas, measurements, reading of values, manipulative skills, perception and logico-mathematical reasoning abilities. Therefore, learning physics in the classroom as well as in the laboratory required mathematical reasoning ability. The theory is relevant because during practical class the learner brings theoretical aspect including classroom demonstration to bear in order to accommodate and create



further knowledge by interacting with learning environment which in this study may be classroom environment and real life laboratory situations. Infact, one of the conditions for the use of Classroom Environment (CRE) and of course hands on laboratory practical is to know the effects of practical skills on student's attitude and performance in physics. Therefore, this study is aimed at finding out the effects of physics practical on secondary school students' attitude and performance in physics in Bauchi Educational Zone, Nigeria.

The performance of students in science has been poor over the years (Marut, 2001). Many factors have been identified as the causes of poor performance of students in science. Akinmade (2001) states that the poor performance of students in science could be attributed to lack of necessary laboratory equipment and facilities in schools. Also Akpan (2006) stated that over the years students have generally been performing poorly in science due to their non-challant attitude toward science. The research findings of Buari (2006) and Ajayi (2007) state that the laboratory equipment available in most schools are grossly inadequate. In physics teaching and learning, laboratory requirement plays a key role towards concretizing learning. Laboratory equipment make learning meaningful and help to improve students' academic performance in physics.

Senior School Certificate Examination (SSCE) and National Examination Commission (NECO) Syllabuses clearly specified practical and theoretical content of physics. In the practical aspect of the subject, students are expected to carry out experiment in the following broad areas; electricity, optics, heat, mechanics and sound. The researchers made personal visit to some schools in the area under research and found out that in most of the schools no period was allocated for physics practical. This becomes worrisome on how well

students are exposed to physics practical. Supporting this view WASSE Chief Examiners Report (2009) indicated that candidates show weakness in recording measured variables and evaluations to the required number of decimal places/significant figure, plot point correctly on graph to the required degree of accuracy, state precautions in precise language among others. Okoye (2008) stated that a boy who had a credit pass in physics in West Africa senior Secondary Certificate examination (WASSCE) was reported not to know how to fix an electronic bulb to a socket. Okoye further stated that it was because he had not acquired the necessary practical skills. This poor performance of students in physics has continued to be major concern to physics educators. Indeed, for students to perform well in physics there is a need to carryout practical activities by students themselves to enable them acquire skills, develop positive attitude towards physics, and enhance their performance in physics practical on students' attitude and performance in Bauchi educational zone, Nigeria. This study then will answer this broad question. What are the students' attitudes and performance in physics practicals in Bauchi Educational Zone.

### **Objectives of the Study**

The study intends to achieve the following objectives:

1. Determine whether there is significant difference in the level of performance of students when exposed to laboratory practical.
2. Find out the level of SSII physics students' performance before and after exposure to laboratory practical.
3. Determine the attitude of students towards physics practical.



4. Determine whether a significant difference exists between senior secondary school students' attitude and their performance in physics practical.
5. Compare the performance of male and female senior secondary school two students in physics practical.

**Research Questions**

The following research questions are formulated to guide the study:

1. What is the attitude of students toward physics before and after exposure to laboratory practical?
2. What is the level of SSII physics students' performance in physics before and after exposure to laboratory practical?
3. What is the physics performance means scores of senior secondary school two students that were exposed to laboratory practical and those not exposed to practical skills?
4. To what extent do gender has any effect on senior secondary two students' laboratory practical performance mean scores in physics?

**Hypotheses**

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

1. There is no significant difference between the performances mean

- scores of students exposed to laboratory practical and those not exposed to.
2. There is no significant difference between the physics mean performance scores of the female students taught using laboratory practical and their counterparts who were taught using the conventional lecture method.
3. There is no significant difference between the physics mean performance scores of the male students taught using laboratory equipment and their counterparts who were taught using the conventional lecture method.
4. There is no significant difference between the mean performance mean scores of students' before and after expose to laboratory practical
5. There is no difference between the attitude mean score of senior secondary two students before and after exposure to laboratory practical.

**METHODOLOGY**

This study adopted quasi-experimental research design, specifically, pretest and posttest non-randomized experimental and control group design. The population of the study comprise of ten thousand two hundred and forty students. The sample was make up of one hundred and forty students. Two instruments

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namely: Physics Students Laboratory Practical performance test (PSLPPT) and Physics Student Laboratory Attitude Rating Scale (PSLARS) were used to generate data for the study. All the two instruments were validated by three experts from University of Jos. The reliabilities of the two instruments were computed using Cronbach's alpha

coefficient and the result yielded reliabilities of coefficient of 0.76 and 0.98 respectively.

## RESULTS

**Research Question One:** What is the attitude of students toward physics before and after exposure to laboratory practical?

**Table 1:** Mean Analysis of Students' Responses on Attitude towards Physics Laboratory Practical

S/N	Statement N = 140	SA (5)	A (4)	U (3)	D (2)	S.D (1)	Total	Mean	Remarks
1	I like physics laboratory practical	85	49	1	5	0	634	4.53	Accepted
2	I like to prepare for physics laboratory practical in advance	36	83	7	12	2	554	3.96	Accepted
3	Physics laboratory practical are only understood by the bright students	20	18	8	48	46	338	2.41	Rejected
4	I will not advise any one to study physics	4	16	15	65	40	299	2.14	Rejected
5	Physics laboratory practical are difficult to understand	5	24	3	76	32	314	2.24	Rejected
6	I feel comfortable when I solve a new problem in physics laboratory	80	39	5	12	4	599	4.29	Accepted
7	Trying to understand physics laboratory practical is waste of time	2	3	1	86	48	245	1.75	Rejected
8	It is not attractive to solve physics laboratory practical	14	27	7	63	29	354	2.53	Accepted
9	I would not take physics laboratory practical if it optional	2	21	2	90	25	305	2.18	Rejected
10	I think that I cannot do physics laboratory practical by myself	50	40	3	35	12	501	3.58	Accepted
11	I enjoy discussing with my colleagues about physics laboratory practical after each practical	39	60	1	36	4	514	3.67	Accepted
12	I don't find it difficult to write a report on my physics lab practical	35	49	2	30	24	461	3.29	Accepted
13	I perform poorly in physics lab practical	12	27	6	57	38	338	2.41	Rejected
14	Succeeding in physics laboratory practical is important to me	73	32	1	20	14	550	3.93	Accepted
15	I feel uncomfortable when physics laboratory practical is mentioned	20	50	2	38	30	412	2.94	Accepted
16	Physics laboratory practical is a boring exercise	29	22	4	45	40	375	2.68	Accepted
17	I hate physics laboratory practical	16	17	2	40	65	299	2.14	Rejected
18	I enjoy physics laboratory practical	47	70	0	11	12	549	3.92	Accepted
19	I feel helpless while performing a practical in the physics laboratory	11	10	4	15	60	197	1.41	Rejected
20	Physics laboratory lesson is not an interesting lesson for me	9	12	4	55	60	275	1.96	Rejected



The analysis in Table 1, shows that all positive statements 1, 2, 6, 8, 10, 11, 12, 14, 15, 16 and 18 with means of 4.53, 3.96, 4.29, 2.53, 3.58, 3.67, 3.29, 3.93, 2.94, 2.68, and 3.92 were accepted by the students while negative statements 3, 4, 5, 7, 9, 13, 17, 19 and 20 with means of 2.41, 2.14, 2.24, 1.75, 2.18, 2.41, 2.14, and 1.96 were rejected. The students' responses show that

they have a positive attitude towards physics laboratory practical in Bauchi educational zone.

**Research Question Two:** What is the level of SSII physics students' performance mean scores in physics before and after exposure to laboratory practical?

**Table 2:** Analysis of SSII Physics Students' Level of Performance before and after Exposure to Laboratory Practical

Level of performance	Range score	Before No	Exposure %	After No	Exposure %
High	70-100	1	1.43	16	22.86
Average	40-69	32	45.71	44	62.86
Low	0-39	37	52.86	10	14.29
<b>Total</b>		<b>70</b>	<b>100</b>	<b>70</b>	<b>100</b>

The analysis in Table 2 shows that before exposure to laboratory practical only one student representing (1.43%) was high achiever, thirty-two with (45.71%) were average achievers and thirty-seven representing (52.86%) were low achievers. After exposure to laboratory practical, sixteen students representing (22.86%) were found to be high achievers, forty-four representing (62.86%) were average achievers and only ten representing (14.26%) were low achievers. This shows that before exposure to laboratory practical

the level of performance of most students was low but after exposure to laboratory practical, the level of performance of the students improved to high and average. This implies that the treatment administered was effective.

**Research Question Three:** What is the physics performance means scores of senior secondary school two students that were exposed to laboratory practical and those that were not exposed to laboratory practical?

**Table 3:** Analysis of SSII Students exposed to Laboratory Practical and those not exposed to Laboratory Practical

Level of Performance	Range Scores	Students Exposed to Laboratory Practical %	Students not Exposed to Laboratory Practical %
High	70-100	16 22.85	2 2.86
Average	40-69	44 62.86	28 40.00
Low	0-39	10 14.29	40 57.14
<b>Total</b>		<b>70</b> <b>100</b>	<b>70</b> <b>100</b>

The analysis in Table 3 shows that 16 students representing 22.85% were found to be high achievers, 44 representing 62.86% were average achievers and 10 representing 14.29% were low achievers, for

the students exposed to laboratory practical. For students that were not exposed to laboratory practical, only two students representing 2.86% out of seventy students were high achievers, 28 representing 40.00%



were average achievers and 40 representing 57.00% were low achievers. This shows that students that were exposed to laboratory practical performed better than the students that were not exposed to laboratory practical.

**Research Question Four:** To what extent do gender has effect on SSII students' laboratory practical performance mean scores in physics?

**Table 4:** Analysis of Male and Female Senior Secondary School Two Students' Laboratory Practical Performance Mean Scores in Physics

Gender	Number	Mean Score	Mean Score Diff.
Male	35	59.33	0.86
Female	35	60.19	
<b>Total</b>	<b>70</b>		

The analysis in Table 4 shows that the mean score of male senior secondary school two students is 59.35, while that of the female students is 60.19. A mean score differences of 0.86 in favour of female students. However, the mean score difference of 0.86 is too low and hence very insignificant. In conclusion, it could be

deduced that male and female SSII students were of the same level of performance in physics practical.

**Hypothesis One:** There is no significant difference between the mean performance scores of students exposed to laboratory practical and those that were not exposed to.

**Table 5:** t-test Analysis of Performance of Students exposed to Laboratory Practical and those not exposed

Group	N	$\bar{x}$	SD	df	Calculated t-value	Critical value ( $\alpha = 0.05$ )
Experimental	70	58.54	21.15	138	3.60	1.99
Control	70	49.16	21.46			

$P \geq 0.05$

The analysis in Table 5 shows that the tcal was 3.60 and the critical value was 1.99 at  $\alpha = 0.05$  and  $df = 138$ . Since the critical value is less than the calculated value, it means that the null hypothesis is rejected and the corresponding alternative hypothesis which states that there is a significant difference between the performance of students exposed to laboratory practical and those that are not exposed to was accepted. The mean

difference between the experimental group and the control group was computed and it was found to be 9.38 which implies that there is a significant difference.

**Hypothesis Two:** There is no significant difference between the physics mean performance scores of the female students taught using laboratory practical and their counterparts who were taught using the conventional lecture method.



**Table 6:** t-test Analysis of Mean Difference between Females in Experimental and Control Groups

Group	N	$\bar{x}$	SD	t-cal.	df	$\alpha$	t-value (one-tailed)	Decision
Experimental	35	60.19	19.93	2.15	68	0.05	2.000	Rejected
Control	35	49.59	21.35					

$P \geq 0.05$

Result in Table 6 shows that the calculated value of 2.15 is greater than the table value of 2.00 at 0.05 level of significance with a degree of freedom of 68, hence we rejected the null hypothesis, and therefore accept the corresponding alternative hypothesis which states that there is a significant difference between the physics mean performance scores of female students taught using laboratory equipment

and their counterpart taught using conventional lecture method.

**Hypothesis Three:** There is no significant difference between the physics mean performance scores of the male students taught using laboratory equipment and their counterparts who were taught using the conventional lecture method.

**Table 7:** t- test Analysis of Difference between Male in Experimental and Control Groups

Group	N	$\bar{x}$	SD	tcal	df	$\alpha$	t-value (one-tailed)	Decision
Experimental	35	59.33	20.26	2.14	58	0.05	2.000	Rejected
Control	35	48.73	21.24					

$P \geq 0.05$

Result in Table 7 above shows that our calculated value of 2.14 is greater than the table value of 2.000 at 0.05 level of significance with a degree of freedom of 58, hence we rejected the null hypothesis, and therefore we accept corresponding alternative hypothesis which states that there is a significant difference between the physics mean performance scores of male

students taught using laboratory practical and their counterpart taught using conventional lecture method.

**Hypothesis Four:** There is no significant difference between the mean performance scores of the students' before and after exposure to laboratory practical.

**Table 8:** t-test Analysis of Mean Difference of Performance Scores of Students' before and after exposure to Laboratory Practical

Experimental Group	N	$\bar{x}$	SD	$\alpha$	df	t-cal.	t-value	Decision
Before Exposure	70	38.93	45.68	0.05	138	2.67	1.99	Rejected
After Exposure	70	62.93	64.93					

$P \geq 0.05$

Result in table 8 above shows that our calculated value 2.67 is greater than the table value of 1.99 at degree of freedom of 138, therefore the hypothesis was reject and

accept the alternative hypothesis which state that there is significant differences between the performance of students





before and after exposure to laboratory practical.

secondary two students before and after exposure to laboratory practical.

**Hypothesis Five:** There is no difference between the attitude means score of senior

**Table 9:** t- test Analysis of the Difference between the Attitude of Senior Secondary Two Students before and After Exposure to Laboratory Practical

Attitude of SSII students toward physics practical	N	$\bar{x}$	SD	tcal	df	t-value	$\alpha$	Decision
Before Exposure	35	55.67	10.31	2.71	58	2.00	0.05	Rejected
After Exposure	35	67.67	13.73					

$P \geq 0.05$

Result in Table 9 shows that the calculated value of 2.71 is greater than the table value of 2.00 at degree of freedom of 138, therefore null hypothesis rejected and accept the alternative hypothesis which state that there is significant difference between the attitude of students before and after exposure to laboratory practical.

**DISUCSSION**

In this chapter, the findings of the study are correlated with each of the four research questions and five hypotheses presented in chapter one. Research question one attempted to find out the level of attitude of students toward physics before and after exposure to physics practical. The results of this study showed that senior secondary two students have positive attitude towards physics. The findings agrees with the findings of Talisayon (2006) who found that learner developed improved attitudes towards science as a result of laboratory exercises. Kim and Chin (2011) have reported that laboratory exercises was a significant tool for developing students' scientific knowledge, habits of mind and positive attitude toward science.

Research question two sought to find out the level of SSII physics students' performance in physics before and after exposure to laboratory practical. The results

of the study show that most of the students' level of performance before exposure to laboratory practical was low but after exposure to laboratory equipment, the level of performance of most of the students was average and high, and only a few of the students after exposure were still low achievers. Research question three sought to find out the performance means scores of senior secondary school two students that were exposed to laboratory practical and those that were not exposed to physics practical. The result of the study reveals that the performance means scores of students exposed to laboratory practical is higher than does that were not exposed to laboratory practical.

Research question four set to find out how do male and female senior secondary school two students compare in their performance in physics. The result of the study shows that the mean scores of male and female is too low and insignificant to compared and therefore it could be deduced that male and female senior secondary school two students are at the same level of performance in physics. This result is in contrast with that of Agbo and Manklink (2001) who found out that girls and boys have neutral attitude toward science. Also, hypothesis one of the study

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sought to find out whether there was no significant difference between the performance of students who are exposed to physics practical and not exposed to. The result of the study revealed that there is a significant difference between the performance of students exposed to physics practical and those not exposed to. The students who are exposed to physics practical performed significantly better than those not exposed to. Hypothesis two attempted to find if there was no significant difference between the physics mean performance scores of female students taught using laboratory equipment and their counterparts who were taught using the conventional lecture method. The result obtained from the study shows that there is significant difference between the physics mean performance scores of female students taught using laboratory practical and their counterparts taught using the conventional lecture method. The physics mean performance scores of the female students taught using laboratory equipment was much greater than the physics mean performance scores of the female students taught using the conventional lecture method. Hypothesis three was sought to find out whether or not there was a significant difference in the mean performance scores of male students taught using suitable laboratory equipment and their counterparts who were taught using the conventional lecture method. The result of the study shows that there is a significant difference in the physics mean performance scores of male students taught using laboratory equipment and their counterparts who are taught using the conventional lecture method.

It was found that the physics mean performance scores of male students taught using laboratory equipment was significantly higher than that of their counterparts taught using the conventional lecture method. This implies that male students who were taught

using laboratory equipment performed better than those who were taught using the conventional lecture method. Hence, the study concluded that the students exposed to laboratory equipment in learning physics performed better than those taught using the conventional lecture method. The finding of the study is in consonance with the findings of Akanbi (2003) who found that teaching students with physics laboratory equipment improves their performance in the subject. Hypothesis four was set to find out whether there is a significant difference between the physics mean performance scores on the students' before and after laboratory practical. The result shows that there is a significant difference between the physics mean performance scores of students after exposed to laboratory practical was much greater than the physics mean performance scores of students before exposure to laboratory practical. Finally, hypothesis five sought to find out whether or not difference exist between the attitude of senior secondary two students before and after exposure to laboratory practical. The result of the study shows that there is no difference between attitudes mean score of students before and after exposure to laboratory practical. The result reveals that before exposure to laboratory practical students have negative attitude toward physics and after exposure to laboratory practical students have positive attitude toward physics.

## CONCLUSION

It is very clear that teaching and learning of physics to a greater extent is anchored on laboratory activities due to the fact that it is a subject that should not be taught in abstraction. The more practical done, the more likelihood of students understanding the concepts principles and laws of physics. The study also concluded that students have a positive attitude towards physics laboratory practical and



that after exposure to physics laboratory practical, students' performance in physics improved significantly.

### RECOMMENDATIONS

Arising from the findings of the study, the following recommendations were made:

1. Teachers should endeavor to hold practical classes for every practicable topic that is taught in the class.
2. There is need for more qualified physics teachers who can use laboratory equipment effectively.
3. Teachers should put more efforts in teaching students both the theoretical and practical aspect of physics. Because doing so would help in improving their performance.

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