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Impact of Laboratory Practical Skills on Students' Achievement in Physics in College of Education Azare, Bauchi State, Nigeria

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Abstract. This study investigated the Impact of Laboratory Practical Skills on students' achievement in Physics in College of Education Azare, Bauchi State, Nigeria. This study was motivated due to the fact that students in colleges have been having problems in Physics Practicals which subsequently lead to poor acquisition of practical skills and under achievement in physics. Laboratory practical is an active ingredient in the teaching and learning of physics that leads to the acquisition of physics concept and scientific skills. This makes the production and development of quality professionals in the field of sciences, especially physics, a vital tool in achieving sustainable economic growth and technological development of the nation. The design used in the study was quasi experimental design. A sample of (60) NCE 2 students out of a population of 85 students in Physics Department College of Education, Azare Bauchi state were used in the study. Three research questions and two hypotheses were formulated. A purposive sampling technique method was employed and sixty (60) students were used as intact class. The laboratory practical skills achievement tests (LAPSAT) was made on ohm's law, Hook's law and determination of specific heat capacity with two questions under each and sub-questions distributed for both experimental and control group as pre-test; the same LAPSAT was also administered on both experimental and control groups as post-test after four (4) weeks of treatments. The data collected was subjected to mean and standard deviation and the ANCOVA methods of analysis at 0.05% level of significance. The findings showed that there was a significant difference between achievement of NCE 2 students that were exposed to practical strategy and those exposed to conventional strategy, there was no significance difference in the students achievement of physics practical according to gender. The result of the findings also rejected the null hypothesis which was confirmed by the analysis of covariance of F (1,59) = 38.927, P > 0.000 indicating there is significance difference in the mean scores of students exposed to practical skills and those not exposed to practical skills. The findings based on gender indicate significant implication of practical skills on student's achievement in learning physics. It was then recommended among others that physics teachers should use practical to enhance students' achievement in Physics.

Keywords: Physics, physics laboratory, laboratory practical skills & achievement.

1. Introduction

Colleges of education are teachers training tertiary institution in Nigeria established to train teachers for primary and junior secondary schools. National commission for colleges of education (NCCE) is the body saddled with a responsibility of coordinating the programmes of these colleges. The academy programmes of these colleges include physics education for prospective physics teachers. One of the aims of science education is to help students gain an understanding of as much of the established body of scientific knowledge as it is related to their needs, interests and capacities (Mankilik, 2011). This is in line with the general aim of teaching science as stipulated in

the national policy of education Federal Republic of Nigeria (FRN, 2004). Throughout the world, national education policies are geared towards creating generally scientific literate citizens. Specifically, the National Policy on Education (FRN, 2004) of Nigeria clearly stated in its aims and objectives that the learner would be given opportunity to acquired basic practical skills for self-reliance and employment.

Physics has been as the most utilized basic science subject in most technology and technology-related professions. Hence the role that physics plays in the socio-economic development of a nation must not be undermined. Boyo (2010) viewed physics as a course of study which is perceived to be experimental and that almost all aspect of life science, both living and non-living has something to do with physics ranging from engineering to Mathematics, Biology and Chemistry. The understanding of practical physics may help students to learn physics concepts. Such is necessary as modern society requires some understanding of the nature of scientific knowledge in order to evaluate claims that may affect their everyday decisions (for examples, about energy resources and environment) and to reach informed views on public policy matters (for examples, method of generating electricity).

Practical knowledge, according to James (2000), refers to that knowledge that is connected with reality rather than ideas and theories. It is the knowledge acquired through the practical approach to carrying out scientific investigation and teaching. In the words of Mankilik (2011), Practical approach means any teaching and learning activity which involves at some points the students (learners) in observing or manipulating real objects and materials. The term practical is used in preference to laboratory work because location is not a silent feature in characterizing this kind of activity. This means that observation and manipulation of objects could take place in a school laboratory (a specialized defined building equipment with apparatus) or in an out-of-school (outdoor laboratory) setting, such as the learners home (boiling and freezing of water, switching on/off light, A.C, T.V, Radio, Laundry, Making soap to bubble and foam, etc.), mechanic, blacksmith carpenters (workshops), industry, school from garden the environment etc. when studying aspect of chemistry, biology, physics, health science, basic science and so on. It then means that learning of physics is incomplete without the acquisition of practical physics skills.

Physics like other physical sciences is divided into two aspects which are physics theory and physics practical. Physics practical involves the ability of students to use physics apparatus, to implement experimental procedure and being able to draw conclusion successfully from this experimental procedure. Physics theory belongs to cognitive domain of learning while physics practical is in psychomotor domain. The two aspect are strongly related that is why any study on students' academic performance in physics must analyses the two aspect separately. According to Aina (2011), the educational subject of physics cannot be fully realized if students are not performing well in both physics theory and practicals.

Physics cannot be learned effectively without practical activities. Physics as a science course is activity-oriented and the suggested method for teaching it, which is the guided-discovery method, is resources based (NPE, 2004). In order to improve students' achievement and arouse their interest, students have to be taught physics with hands-on and different learning materials so as to enable them acquire the cognitive competence and process skills of physics that are necessary for passing physics. In the school system, the use of hands-on experiments in real-life physics situations cannot be totally abandon.

Practical activities in the 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 require mathematics reasoning ability. According to researchers (such as Adegoke, 2010; Kuti, 2012) familiarity with basic arithmetic operations are required to meaningfully learns physics cognitive and extension and to develop manipulative skills in practical activities. Therefore, the major task in this study centres on finding out the impact of laboratory practical skills on students achievement in physics in College of Education Azare, Bauchi State, Nigeria.

2. Statement of the Problem

The use of laboratory in the teaching of physics has come a long way but experience has shown that many teachers have abandoned this practice for the classroom. The laboratory and its equipment and materials are therefore left to be covered with dust in some cases in view of the predominance of the lecture methods of teaching physics and in view of the obvious fact that this method has not attracted many students to the subject. However, the reality on ground is that most

experiments are sterile, un-illuminating exercises whose purpose is often lost on learners. In many countries, practical work is ill conceived, confused and unproductive (Hodson, 1991). Whatever goes on in the laboratory has little to do with actual students learning of science. Demonstrations are usually carried out by the teachers who also often miss the point of the demonstration. Small group work is done, but the follow up discussion on the purpose of the study exercise are usually counterproductive. There is usually limited planning and formulation of hypotheses, mostly done by the teachers. In many cases, the experiments are derived from mostly irrelevant cultural settings with the attendant equipment disasters. Students follow a fixed program of experimental manipulations and observations set by the teacher, cookbook style. This study was designed to investigate the impact of practical skills on students' achievement in physics in College of Education Azare, Bauchi State, Nigeria

3. Purpose of the Study

The purpose of the study was to investigate the impact of laboratory practical skills on students' achievement in physics, in College of Education Azare, Bauchi State. The main objectives of the study were to:

- investigate the impact of practical skills on student's achievement in physics.
- determine the difference in the achievement of students in Physics practical skills according to gender.
- determine whether there was significant difference in the mean scores of students exposed to practical skills in physics and those not exposed to practical skills?
- determine the achievement of students in physics before and after exposure to practicals.

4. Research Questions

The study was guided by the following research questions:

- To what extent does NCE 2 students' practical skills affects their achievement in physics?
- To what extent does gender affects students' practical skills of NC2 in College of Education, Azare?
- What is the physics achievement mean scores of NCE 2 students that were exposed to practical skills and those not exposed to practical skills?

5. Hypotheses

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

- There is no significant difference between achievement of NCE 2 students that were exposed to practical strategy and those exposed to conventional strategy.
- There is no significant difference in the students achievement of physics practical skills according to gender.

6. Theoretical Framework

This study was anchored on the theory of Ausubel (1968). The theory state that learning of new knowledge relies on what is already known. That is, construction of knowledge begins with our observation and recognition of events and objects through concepts we already have. We learn by constructing a network of concepts and adding to them.

However, looking at the theory of Ausubel it is related to this study because if the learners have knowledge of physics practicals, it will help them to understand physics concept. Therefore, through the knowledge of practicals, students would be able to understand the theoretical aspects of physics very well.

7. Methodology

The research design that was used for the study is quasi-experimental research design. The study also utilized two group pre-test, post-test experimental design. The population of the study was made up of all the NCE physics students of school of science, in Physics Department, College of Education Azare Bauchi State (n = 80). The sample consisted of 60 students in NCE 2 out of 80 students drawn from various course combinations of the department that is, Physics/Computer, Physic/Mathematics and Physics/ISC.

The sixty students (60) in the selected level were later classified into experimental and control groups using simple balloting methods of sampling without intellectual age or gender bias. Therefore, 30 students served as the experimental group while another set of 30 students served as the control group. The instrument that was used for data collection or measuring the students acquisition of physics laboratory practical

skills was the laboratory practical skills achievement test in physics (LAPSAT). This instrument was developed based on the physics topics that were taught. The LAPSAT consisted of essay questions that were used for both pre-test and post-test to measure students' achievement on conducting physics practical's. Since the LAPSAT was in form of essay questions which consisted of two (2) questions, from each topic. Therefore, each question carries (16.52) marks making hundred percent (100%) in all.

The validation of LAPSAT was done by two specialists. A chief lecturer in School of Education, Department of Psychology, College of Education Azare and the principal lecturer in Department of Physics, School of Science, College of Education Azare. They were given LAPSAT together with essay questions. The lecturers examined the learning materials for content validity and appropriateness for the groups they were meant for. The content validity and appropriateness of LAPSAT was referred to a test and measurement expert for inputs.

The reliability of LAPSAT was determined using Test - retest technique and it was found to be 0.74 which was considered good enough for the conduct of this study. The pair of scores generated were then correlated using Pearson product moment correlation coefficient.
The data collected was analysed using mean scores, standard deviations of the students' scores in the pre-test and post-test for answering the research questions and testing the hypotheses. The Analysis of Covariance (ANCOVA) was used to compare the differences between the achievement of the experimental and control groups in pre-test and post-test at 0.05 level of significance.

8. Results

Research Question One: To what extent does NCE 2 students practical skills affects their achievement in physics?

Table 1: Pre and Post-test Mean Analysis of Students Practical Achievement Scores.

Group	N	Pre Test		Post Test		Mean Gain
		$\bar{X}_1$	SD	$\bar{X}_2$	SD	
Experimental	30	41.06667	18.69526	66.6000	12.19553	25.53
Control	30	40.6667	15.30457	55.7333	9.53373	15.07

Table 1 shows that the mean scores for students taught physics with practicals was 66.60 while that of the students taught with the conventional method was 55.73. Mean while the gain score for students taught using practicals is 25.53 while that of students taught with conventional methods is 15.07 . Therefore, students taught using practicals in the laboratory were found to achieved better than students taught using conventional method in physics.

Research Question Two: To what extent does gender affects students practical skills of NCE 2 in College of education Azare?

Table 2: Pre and Post-test Mean Analysis of NCE 2 Students According to Gender.

Gender	N	Pre Test		Post Test		Mean Gain
		□₁	SD	□₂	SD	
Male	25	42.64	19.35	67.16	12.80	24.52
Female	5	33.20	13.89	63.80	9.06	30.60
		9.44		3.36		6.08

Table 2 revealed achievement mean scores of 67.16 for male students, while female students had achievement mean score of 63.80. Male students therefore, slightly performed better than their female counterparts in physics. This by implication means that gender affects students' practical skills in physics.

Research Question Three: What is the physics achievement mean scores of NCE 2 students that were exposed to practical skills and those not exposed to practical skills.

Table 3: Presents the Post-test Mean and Standard Deviation for Experimental and Control Groups

Group	N	Mean	Std. Dev.	Mean Gain
Experimental	30	66.60	12.19	
				10.87
Control	30	55.73	9.53	

Table 3 revealed achievement mean score of 66.60 for students exposed to practical strategy while students that does not exposed to practical strategy had achievement mean score of 55.73. However, the mean difference of 10.87 shows that students exposed to practical strategy performed better than those exposed to conventional method.

Hypothesis One

There is no significant difference between achievement of NCE 2 students that were exposed to practical strategy and those exposed to conventional strategy.

Table 4: ANCOVA Analysis of Students Achievement using Practical and Conventional Strategies

Source	Sum of Square	df	□	F	Sig.
Corrected	6224.071[a]	2	3112.04	71.06	0.00
Intercept	14018.476	1	14018.48	320.10	0.00
Pretest	4452.804	1	4452.80	101.68	0.00
Method	1704.778	1	1704.78	38.93	0.00
Error	2496.263	57	43.79		
Total	233202.000	60			
Corrected Total	8720.333	59			

Data in table 4 shows that there is a significant difference in the NCE 2 students achievement that were exposed to practical strategy and those exposed to conventional strategy in physics, f(1,56) = 38.927, P < .000. The null hypothesis therefore, was rejected indicating that there is significant difference. The mean achievement score of students exposed to practical strategy was 66.60, while that for conventional strategy was 55.73. The difference was in favour of students exposed to practical strategy.

Hypothesis Two

There is no significant difference in the students achievement of physics practical skills according to gender.

Table 5: Students Achievement of Physics Practical Skills According to Gender.

Source	Sum of square	df	□	F	Sig.
Corrected Model	2536.780[a]	2	1268.39	19.28	0.00
Intercept	10357.403	1	10357.40	157.42	0.00
PRETEST	2489.740	1	2489.74	37.84	0.00
GENDER	7.944	1	7.94	121	0.73
Error	1776.420	27	65.79		
Total	137380.000	30			
Corrected Total	4313.200	29			

Data in Table 5 revealed non-significant main effect of gender on students achievement in physics (1,029) = .121, P > .731. The null hypothesis was therefore, not rejected indicating that there is no significant difference in the students achievement of physics practical skills according to gender.

9. Discussion of Findings

The finding of the study reveals that:

- Students that were taught using practical in the laboratory achieved better than students taught conventional method in physics, this is so because students find it easier to understand concepts that are related to their experience.
- Male students achieved slightly better than their female counterparts in physics practicals.
- The study also revealed that the students with skills of practical achieved far better than students without practical skills. Therefore, involving students in meaningful practical work contributes to improved performance in physics.
- Students that were taught using practicals achieved better than those taught using conventional method. This by implication means that students taught physics using practicals do performed better than those taught using conventional method.

10. Conclusion

In conclusion, the major findings of the study on impact of laboratory practical skills on students' achievement in Physics which has been observed by the researchers

through constant practice in the laboratory and inculcation of the theoretical aspect of physics to the selected students is that there was significant difference between achievement of NCE 2 students that were exposed to practical strategy and those exposed to conventional strategy. There was no significant difference in the students' achievement of physics practical skills according to gender. There was significant difference in the mean scores of students exposed to practical skills and those not exposed to practical skills. There was significant impact of practical skills on the students' achievement in learning Physics.

11. Recommendations

Based on the findings of the research work, the following recommendations were proffered:

- School administrators should encourage physics teachers by supplying the necessary equipment and apparatus. This is because school laboratory is very essential for proper science teaching in schools.
- Physics teachers should be up and doing, in hands on minds on activities as doing so would help to enhance students practical skills in physics.
- Physics teachers should cultivate the habit of teaching both theoretical and practical lessons in laboratory.

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