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Assessment of The Efficacy of Practical Activities on the Interest and Achievement of Senior Secondary School Students in Physics

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Abstract

This study assessed the efficacy of practical activities on the interest and achievement of students in senior secondary school physics. In pursuance of this study, two research questions were posed and two null hypotheses were formulated to guide the study. The instruments used for data collection were physics interest inventory (PII) and physics achievement test (PAT). Sample of the study comprised of 162 physics students drawn four schools within Nsukka Local Government of Enugu state. The research questions were answered using mean and standard deviation while the hypotheses were tested at 5% level of significance using ANCOVA. The findings of the study revealed that students taught physics using practical activities had higher interest and achievement than those taught without practical activities. The implication of the findings is that in the absence of practical activities during physics lessons, the interest of the students will not be improved and thus, their achievement will remain low. Based on the implication, it was recommended that practical activities should be encouraged in teaching and learning of science subjects especially physics.

Keywords: Assessment, Practical Activity, Interest, Achievement, Physics

Introduction

Today all the nations of the world give attention to Science and Technology in their development effort. This is because Science and Technology help in the economic improvement of a nation and serve equally as the only gate way to national development. In the age of fast developing technology, it has become imperative for all countries of the world, especially developing ones, to organize and improve the teaching of science throughout the school stage, since it is through science that we get the fundamental base to develop technology.

Technology according to Ali (2004) is the successful application of scientific ideas, principles, laws and theories for the purpose of developing techniques for providing goods and services as well as for improving technology itself. Science has been viewed as an instrument that can aid development in many countries. It plays important and dominant roles in spearheading technological advancement, promoting national wealth, improving health, and accelerating industrialization (Validya, 2003). Science and Technology have become an integral part of the world's culture. The combined influence of science and technology results in structural changes and unequalled modernization on process which amounts to a great increase in the productive capacity and specialization in the environment.

The contributions of science, which includes physics (as a major part) and technology to overall development of nations cannot be over-emphasized. Physics as a natural science depends on experiments, measurements and mathematical analysis, for the purpose of finding quantitative physical laws for everything. Therefore, physics is one of the basic sciences that are essentially needed for a nations' technological breakthrough. There is the need for effective physics education in Nigeria. It is worthy to note that physics finds its application in pharmacy, medicine, nursing, Engineering, geology and mathematics. All these disciplines are practical oriented. Despite the relevance of physics for the technological development of Nigeria, students perceive physics as one of the toughest subject that ever existed and the evidence of this could be seen in the high number of students' failure in WAEC every year.

Angell and Ogunniyi (2004) observed that many students have developed negative attitude towards the subject and hence find physics difficult because they have to contend with different aspects of the subject such as experiments, formulae and calculation, graph and conceptual explanations at the same time. Owolabi (2009) discovered that the rate of failure in the subject at the senior secondary school external examination is alarming and reduction in the number of students offering the subject over the years call for concern. Also, Ogundoju and Owolabi (2014) observed a general belief among students that physics is an abstract subject and hence too difficult to learn.

Students' failure in physics examinations can be attributed to a number of factors, some of which are related to the state of science education enterprise in Nigeria schools (Iloputaife, 2000). Ette (2002) also reported that the major problem in science education is that science is presented dogmatically in most schools as a series of disjointed facts and concepts, which students find difficult to relate to the real world. Ette went further to report that most secondary school libraries and laboratory are ill-equipped and as a result, students are denied that feeling of participation and reality which practical classes and demonstration present. All these things invariably militate against the development of science education of which physics is an aspect and thus demands adequate assessment.

Assessment as a process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences. According to Allen (2004) assessment is the use of empirical data on student learning to refine programs and improve student learning. In this paper, the researchers assessed the efficacy of

practical activities on the interest and achievement of students in physics.

Practical activity according to Maduabum (2001) is frequently employed as an activity which may be an experiment. Maduabum further stated that practical activity involves the students in observing, counting, measuring, experimenting and recording observations. The aim of practical activity/work according to Eze (2000) is to inculcate in the students the habits of drawing conclusions based on experimentation and observation. The activities are opposed to the theoretical work which involves listening to talk and taking down notes during such talks.

According to Abenuga (2000) quoting WAEC in the physics syllabus, the objective of practical examination is to determine how well the students understand the nature of science investigation and the use of apparatus in a controlled experiment to determine and answer questions. Thus it can be seen that practical is intended to enhance the effective and successful learning of the subject. Practical work means learning science and doing science that is giving the child the opportunity to approach learning from his own intellectual view point. According to Onwuka (1984), in curriculum development for Africans stressed that in demonstration, practical work methods, students learn to do and to know better by doing things. According to Onwuka the importance of practical are as follows: providing opportunity for pupils to carry out investigations on their own and thereby providing greater understanding, providing students with concrete learning experiences that reinforce the theoretical learning and helping students develop scientific attitude and learning by doing.

Johnson (2001) and Ugwu (2004) stated reasons why students need to engage in practical work as often as possible: it affords the students the opportunity to participate in the learning process, it trains them for adjustments in their lives, it helps them to be knowledgeable and appreciative of the world they live in among others. However, students' participation in practical activities depends to a large extent on the interest of students.

According to Kpolovie (2010) interest is a very powerful affective psychological trait and a very strong knowledge emotion as well as an overwhelming magnetic positive feeling. Kpolovie further stated that interest is a sense of being captivated, enthralled, invigorated and energized to cognitively process information much faster and more accurately in addition to most effective application of psychomotor traits like self-regulatory skills, self-discipline, working harder and smarter with optimum persistence. Kpolovie recommended the need for psychologists to execute research works for ascertaining the actual role that interest in learning plays in students'academic attainment at all levels of the educational system. The nature and strength of one's interest in learning and in schooling may represent an important aspect of personality (Anastasi & Urbina, 2007). From the view point of the student and what he intends to achieve educationally, a consideration of his interest might be of practical significance. The interest must be there for him to devote time for his study. Thus, study sought to determine the efficacy of practical activities on students' interest and achievement in senior secondary school physics.

Research Questions

The following research questions guided the study.

1. What are the mean interest scores of students taught physics using practical activities and those taught without practical activities
2. What are the mean achievement scores of students taught physics using practical activities and those taught without practical activities?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance to guide the study.

HO_1: There is no significant difference in the mean interest ratings of students taught physics using practical activities and those taught without practical activities.

HO_2: There is no significant difference in the mean achievement scores of students taught physics using practical activities and those taught without practical activities.

Methodology

This study adopted quasi-experimental research design specifically non- equivalent control groups design. This design entails the use of non- randomized groups where the researcher cannot randomly sample and assign his or her subjects to treatment groups. The study was carried out in Nsukka Local Government Area with a population of 1564 senior secondary two physics students (SS2). The sample for the study was 162 SS2 students selected from two secondary schools in Nsukka Local Government Area through simple random selection. In each of the two schools, two SS2 intact classes were randomly selected hence making a total of four classes. The instruments used for data collection are physics interest inventory (PII) and physics achievement test (PAT) developed by the researchers. The instruments were validated by two specialists from the department of science education, University of Nigeria Nsukka. The content validation of PAT was ensured using Table of specification. For the actual experiment, four classes were randomly assigned; two to experimental group (practical activity) and the other two to the control (Theory). Two classes were taught using pure theory approach (control group) and the other taught using theory and practical (experimental group). Data collected were analyzed using mean and standard deviation while analysis of variance (ANCOVA) was used to test the research hypotheses at 5% level of significance.

Results

The results were presented based on the research questions and hypotheses that guided the study.

Research Question One: What are the mean interest ratings of students taught physics using practical activities and those taught without practical activities?

Table 1: Mean and Standard deviations of interest ratings of the students before and after treatment

Group	Pre-Interest			Post-interest		
	N	Mean	SD	Mean	SD	Mean Gain
Experimental	32	16.10	4.91	42.87	19.06	26.77
Control	48	15.57	4.51	34.77	12.74	19.20

Table 1 shows that the mean interest rating of students who were exposed to practical activities during physics learning is 42.87 with standard deviation of 19.06 after the treatment as against their mean interest rating of 16.10 with standard deviation of 4.91 before the treatment. On the other hand, the students who were taught physics using only theoretical approach had mean interest rating of 34.77 and standard deviation of 12.74 after the treatment as against the mean interest rating of 15.57 and standard deviation of 4.51 before the treatment. Mean

interest gain ratings of 26.77 and 19.20 for the two groups respectively indicate that the students who were exposed to practical activities had higher interest rating than their counterparts.

Hypothesis One: There is no significant difference in the mean interest ratings of students taught physics using practical activities and those taught without practical activities.

Table 2: Analysis of covariance of the effect of practical activities on the interest of students in Physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2682.650[a]	2	1341.325	5.046	.008
Intercept	18377.513	1	18377.513	69.136	.000
Pre-interest	23.850	1	23.850	.090	.765
Group	2621.637	1	2621.637	9.863	.002
Error	42264.881	159	265.817		
Total	289792.000	162			
Corrected Total	44947.531	161			

a. R Squared = .060 (Adjusted R Squared = .048)

Table 2 shows that the calculated value of F (9.863) for the efficacy of practical activities on the interest of students in physics has an associated probability value of 0.002. Since the probability value of 0.002 is less than the 0.05 level of significance, the null hypothesis was rejected thereby accepting the alternative hypothesis. Thus, there is a significant difference in the mean interest ratings of students taught physics using practical activities and those taught without practical activities in favour of those taught using practical activities. This confirmed the efficacy of practical activities in improving the interest of physics students during teaching and learning.

Research Question Two: What are the mean achievement scores of students taught physics using practical activities and those taught without practical activities?

Table 2: Mean and Standard deviations of pretest and post-test of students' achievement in physics

Group	Pre-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Experimental	82	15.79	9.41	57.18	14.97	31.39
Control	80	15.56	5.76	33.48	12.58	17.92

Table 3 shows that the students who were exposed to practical activities during physics learning had posttest achievement mean score of 57.18 with standard deviation of 14.97 as against their pretest achievement mean score of 15.79 with standard deviation of 9.41. Similarly, the students who were taught physics using only theoretical approach had mean achievement score of 33.48 and standard deviation of 12.58 after the treatment as against the mean achievement score of 15.56 and standard deviation of 5.76 before the treatment. Mean gain scores of 31.39 and 17.92 for the two groups respectively indicate that the students who were exposed to practical activities had higher mean achievement score than their counterparts who were not so exposed.

Hypothesis Two: There is no significant difference in the mean achievement scores of students taught physics

using practical activities and those taught without practical activities.

Table 4: Analysis of covariance of the effect of practical activities on the achievement of students in Physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12518.441[a]	2	6259.220	38.645	.000
Intercept	65399.603	1	65399.603	403.779	.000
Pretest	4923.228	1	4923.228	30.396	.000
Group	4315.133	1	4315.133	26.642	.000
Error	25753.016	159	161.969		
Total	450100.000	162			
Corrected Total	38271.457	161			

a. R Squared = .327 (Adjusted R Squared = .319)

Table 4 shows that the probability associated with the calculated value of F (26.642) for the efficacy of practical activities on the achievement of students in physics is 0.000. Since the probability value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected thereby accepting the alternative hypothesis. Thus, there is a significant difference in the mean achievement scores of students taught physics using practical activities and those taught without practical activities in favour of those taught using practical activities. This confirmed the efficacy of practical activities in enhancing the achievement physics students during teaching and learning.

Discussion of the Findings

The findings of the study showed that students who were exposed to practical activities had higher interest rating than their counterparts who were not so exposed. Further analysis revealed that there is a significant difference in the mean interest ratings of students taught physics using practical activities and those taught without practical activities in favour of the experimental group. This confirmed the efficacy of practical activities in improving the interest of physics students during teaching and learning. The outcome of this study is not far from the reality for the fact that students' active participation during practical classes may have spurred their interest into the business of learning thereby having more interest than those who were not engaged in the practical activities. The findings of this study also corroborate those of previous works by Kpolovie (2007), Subramaniam (2009), and Eberly Center (2014) that interest in an activity, such as learning, could most probably be a very powerful affective psychological trait and a very strong knowledge emotion as well as an overwhelming magnetic positive feeling, a sense of being captivated, enthralled, invigorated and energized to cognitively process information much faster and more accurately to ensure good academic performance. Subramaniam (2009) concluded that the active participation of students in the learning context improves their interest. Thus, the implication of this finding is that when the students are not actively involved in an activity that concern them, their interest in such activity will not be enhanced

Also, the findings of this study showed that students who were exposed to practical activities had higher mean achievement score than their counterparts who were not so exposed. It was further confirmed that there is a significant difference in the mean achievement scores of students taught physics using practical activities and those taught without practical activities in favour of those taught with practical activities. This confirmed the efficacy of practical activities in enhancing the achievement of physics students during teaching and learning. This finding is real for the fact that the students who had higher interest as a result to the exposure practical activity also had

higher achievement. This shows that achievement depends on interest. The current findings equally tend to agree with the findings of Hidi (2001) and Renninger, Hidi and Krapp (2014) that interest, level of effort put in reading and learning style adopted might hold some influence on academic performance is confirmed by the present work which has shown that students' interest in learning overwhelmingly led to superior academic achievement of students who were exposed to practical activities in physics. Emerick (2007) also provided empirical support for relating the individual's perception of his inadequacy in school learning to the development of related interests, attitudes, and academic achievement. The results of Krapp, Schiefele and Winteler (2009) on the group of factors that influence achievement which is largely dominated by interest are also supported by the findings of this study. This finding implies that when students are taught physics in the convectional way without incorporating practical activity, their interest vis-à-vis achievement will not be improved.

Conclusion and Recommendations

The study has documented that students' engagement in practical activities in physics learning enhances their interest and achievement. It was thus recommended that;

1) Adequate arrangement should be made in every school to ensure that students are taught physics using the practical activity approach.
2) Government should also put in place adequate practical equipment in every school to ensure that the school laboratories meet the requirements for regular practical activity.
3) Physics teachers should be adequately trained on how to incorporate practical activities during physics classroom teaching.

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