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Towards Improving The Performance Of Senior Secondary School Students In Physics Practicals Using Individualized And Group Methods Of Experiences In Askira/Uba Local Government Area, Borno State

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ABSTRACT
This study investigated students' performance in practical physics through the use of individual and group methods of teaching, in Askira/Uba Local Government Area (LGA), Borno State. The researcher adapted a Quasi- experimental design for this study, randomized Pre-test -posttest experimental design. Thirty (30) senior secondary school I (SSI) physics students were selected using stratified random sampling technique. Two (2) research questions were answered and Two (2) null hypotheses were posited and tested at 0.05 significant level of confidence. 'Reporting Physics Practical Package' (RPPP) and 'Test on Verification of Robert Hook's Law (TVRHL) were used as instruments for data collection in the research. By using a test-retest method, and statistical formula of Pearson Product Moment Correlation coefficient, a reliability coefficient of 0.79 was obtained for TVRHL. The obtained data were analyzed according to research questions and the research hypotheses using the mean, percentage, standard deviation and Analysis of Covariance (ANCOVA). The findings of the study indicated that the students that used group method performed better than the students that used individual method in physics practical. Based on the above findings, the following recommendations were made: there is need for physics students to use group methods for performing practical in physics class. It also makes students to understand physics better than in individual method. Physics teachers should encourage group and equal participation in the practical sessions in the study of physics.
Keywords: physics practical, students, methods of teaching, secondary schools

INTRODUCTION

Physics has developed into one of the greatest and most influential field of human endeavor. Today, physics has many branches, such as; Heat and thermodynamics, mechanics and properties of matter, Nuclear physics, Astrophysics, Modern physics, Classical physics, Atomic physics, Geophysics, Acoustics, optics, **etc.** Physics in general shapes the way we understand the universe, planet, ourselves and other living and non- living things around us. According to Awotua et al (2015), Physics has become an integral part of human culture, and any country that ignores this fact is risking the potential aspiration of her future generation. It is therefore worthy to note that the development of any nation depends to a large extent, on the level of physics education of her citizens.

In Nigerian New national Policy on Education, it is geared towards creating generally scientific literate citizens with the Aims and objectives that the learner would be given greater and equal opportunity to acquire basic skills for self – reliance and employment. National Policy on Education, FGN (2004). In realization of these stated objectives, practical activities should form an integral part of the teaching and learning of physics especially at the senior secondary schools level. Awotua emphasized that first- hand information of science knowledge come from the practical approach, and if scientific training is to yield it's most effective results, then it must be from the practical.

Physics is the study of physical properties of matter and its interaction with energy. It is typically and experimental subject, that means the effective practical activities in physics are very important because these enables the learner to build up a sort of link between what they see, hear and handle (hands-on) and the scientific ideas account for their observations (brain- on). Practical experience in physics ensures student centered learning, allowing effective interaction between the students themselves and the learning materials Gbamanja (2002).In explaining physics concepts to a learner, a teacher should not be inclined towards abstract information in the name of 'physics is difficult subject' instead, a teacher must be careful that students understand what they learn in concrete ways. This reflects the strong view of relevance of practical activities and how physics can be directed. It is expected therefore that upon completion of the secondary school physics programme, the learner should have acquired essential scientific skills and attitudes as a preparation for the Technological application of physics in our everyday life.

It is quite unfortunate that the current trend of students' performance in physics practical as a results of lack of laboratories and scientific equipment for higher rate of content retention, creativity, originality of thought and the inability to report appropriately practical activities has adversely affected students' performance in physics especially at the secondary school level (Adolphus & Aderonmu 2013). Physics will remain an abstract subject to teachers as well as students so long as they are exposed to its real application in daily life. Group work generally encourages learning among students, it increases the interest of young people especially in science so as to promote equality in learning, scientific literacy and choices of scientific career, UNESCO (2013). Although several schools in Nigeria have not subscribed to group methods of teaching physics practical, in light of this, the study was carried out to determine the performance of students at senior secondary school level in physics practical through the use individual and group methods of teaching and learning practical physics.

The Purpose of the Study

The purpose of the study is to determine the impact of individual and group methods of teaching practical physics on students' performance in practical physics. The specific objectives of the study are to:

1. Compare the performance of students in individual practical work and that of group work.
2. Investigate the performance of students in mechanics practical.
3. Evaluate the skills of students in handling scientific equipment in performing practical.

Research questions

The following research questions were posited for the purpose of the study

1. How does the individual method of teaching practical physics affect the performance of the students?
2. What are the relative significance of group method of teaching practical physics on students' performance?
3. Is there any significant difference between the performance of male and female students working in group and working as an individual in physics practical?

Research hypotheses

$H0_1$: There is no significant difference between the mean performances of students working as a group and those working as individuals in practical physics.

$H0_2$: There is no significant difference between the mean performance of individual students and group of students in graphical skills.

H_3: There is a significant relationship between the performance of students working as an individual and those working as a group in practical physics.

METHODOLOGY

The study was a Quasi- experimental study adapting **a ran**domized Pretest- Posttest experimental design. The population of the study consisted of all senior secondary I (SSI) physics students in Askira/Uba Local Government Area of Borno state. A stratified random sampling was employed to obtain a sample size of 30 participants which consisted of boys and girls who offer physics practical. These students further grouped in experimental (individual) group and control (group work) group. The experimental group

consisted of 12 students comprising male and females students. While the control group consisted of 18 students also made up of male and female students.

Instruments for data collection

The instrument for data collection was developed by the researcher titled "Performing and Reporting of Physics Practical Package" (PRPPP) and Test on Verification of Robert Hook's Law (TVRHL). PRPPP consists of a lesson note that was taught on conducting and reporting of physics practical. While TVRHL was made up of practical activity questions developed on the verification of Hook's Law using Load verses extension principles. Test on verification of Hook's Law was used for both pre- test and post-test to measure students' performance on conducting physics practical. The instruments were validated by two experts from physics education department and one from curriculum studies. Test on verification of Hook's law was subjected to a pilot test applying the test- retest method for an interval of one week to ten (10) physics students outside the area of study. Data obtained was analyzed using the Pearson Product moment Correlation Coefficient and a reliability index of 0.79 was obtained making the instruments reliable for the study.

Procedure for dada collection

The collection of data was systematically organized in three different phases, these are: Pre-treatment phase, Treatment Phase and Post- treatment phase.

Pre-treatment phase*:* The intention of the researcher was made known to both the groups of students involved in the study. This was done to obtain cooperation from the teachers and the laboratory assistants. The instrument such as masses in 10 and 20 grams, retort stand and clamp, helical spring, meter rules, pointers, hungers rulers, graph papers, etc were distributed to both groups of students for a general pre-test.

Treatment Phase*:* The treatment phase involved the teaching session for both groups on how to conducting and reporting of physics practical. This consisted of physics practical demonstration using the apparatus with the students in groups and to other set of the students on individual bases. Two (2) periods per week of 40minutes per period for two weeks was used for the treatment phase of the study.

Post- treatment phase*:* After the treatment, the Test on verification of Hook's law was administered to the groups as post –test.

Method of Data analysis

Simple means, percentages and standard deviation were used for the research questions. While Analysis of Covariance (ANCOVA) was used for the testing of the hypotheses

RESULTS

Research Questions 1 and 2: *1. How does the individual method of teaching physics practical affect the performance of students? 2. How does the group method of teaching physics practical affect the performance of students in practical physics?*

Table 1: Performance of students using individual and group method of teaching physics practical

Treatment	Test	N	Mean	Mean gain	Mean gain %
Individual method	pre- test	15	22.345		
				7.934	21.865
	Post -test		33.426		
Group method	pre-test	15	22.642		
				13.244	38.523
	Post-test		37.231		

Source: Researcher's field work. 2019

From table 1 above, it is shown that the students that had group method had a gain of 13.244. while those that used individual method had a gain of 7.934 when the pre-test and the post-test were compared. The percentage mean gain also revealed that students that used group work method had a percentage mean gain of 38.523. While those that used individual method had a percentage mean gain as 21.865. Based on

the analyzed data on the above table, students that used group work method in conducting mechanics practical to verify Hook's law performed better than those that used individual method.

Research question 3. *Is there any significant difference between the performances of male and female students working as an individual or group in physics practical?*

Table 2. The performance of male and female students that used individual and group methods of performing practical in mechanics to verify Hook's law

Treatment	gender	Test	Mean	Mean gain	Mean gain %
Individual method	male	pre-test	25.322		
				8.274	28.618
Post-test			36.125		
	Female	pre-test	20.345		
				7.960	32.643
		Post-test	22.913		
Group method	male	pre-test	21.983		
				16.452	46.291
		Post-test	38.772		
	Female	pre-test	15.865		
				11.405	46.988
		Post-test	29.221		

Source: researcher's field work, 2019

The result shown in table 2 above reveals that the post- test mean value in terms of gender and using individual and group methods were higher than pre-test mean values. The performance gain of students who used individual method for male was 16.452 while that of female was 11.405. This indicates that male students used individual method performed better than their counter female students. The table also shows that the performances of both male and female students that used the group method. The male students had a gain of 8.274 while the female students had a gain of 7.960 indicating that the male students that used group method performed better than the female students.

Hypotheses

$H0_1$and $H0_2$: There is no significant difference between the mean performance of students working in group and those students working as an individual in practical physics.

Table 3i: The independent variable analysis of mean performance of students that used individual and group method of teaching practical Physics

Source	Type III sum of squares	Df	Mean square	F
Corrected model	5332.623	2	2261.763	49.326
Intercept	20069.432	1	19627.350	299.231
Treatment	150.243	1	150.243	4.612
Test	4882.475	1	4882.475	136.314
Error	2992.213	77	35.512	
Total	33426.986	80		
Corrected total	21928.665	79		

i. R squared = 0.465 (adjusted R squared =0. 452).

As shown in table 3i above, the calculated value F1, 77 value is 4.612 at degree of freedom 1. 77 and probability level of 0.05 against the critical value of 3.840. Since the calculated value F is greater than the table value, the null hypothesis is rejected and the alternative hypothesis is accepted. This indicate that there is significant difference between the mean performance of students who used individual and group methods of performing physics practical at senior secondary school level.

Table 3ii. dependent variable; performance

Treatment	mean	Standard error	95%confidence interval Lower bound	upper bound
Individual method	29.332	.634	26.473	24.667
Group method	32.881	.631	29.561	27.981

Based on the estimated marginal means at 0.05 level of significance, table 3ii indicates that students that used group method contributed most the significant difference between the two teaching methods (individual and group methods)

Table 4. Univariate analysis of mean performance of male and female students who used individual and group methods of performing practical physics

Source	Type III sum of square	Df	Mean square	F
Corrected model	6114.851	4	1528.713	29.136
Intercept	3054.217	1	3054.217	58.211
Test	5853.960	1	5853.960	111.572
Gender	62.786	1	62.786	1.197
Treatment	117.717	1	117.717	2.244
Gender* treatment	95.188	1	95.188	1.814
Error	3935.099	75	52.468	
Total	175852.000	80		
Corrected total	10049.950	79		

Source: Awotua-Efebo, Williams and Aderonmu (2015).
R- squared = .608 (adjusted R squared = .588)

From table 4 above, it was shown that the interaction between gender and treatment is not significant since its calculated F1,75 value is 1.814 at degree of freedom of 1,75 and probability level of 0.05 against the F1,75 critical value of 3.840. Since calculated F value is less than the F table value the null hypothesis is upheld. This shows that there is no significance difference between the men performance of male and female students in mechanic practical considering individual and group methods of performing practical physics.

DISCUSSION OF FINDINGS

The finding of this research agrees with the result of Bradley and Vermaak (1996). Who mentioned that students usually show positive attitudes towards practical in group than in an individual manner. Yoo, Hong and Yoon (2016) confirmed that high school chemistry students perceived that group method of carrying out practical activities. And it is more convenience as well. Njoku (2001) confirmed that girls believe that science courses are too difficult for them and not important for their future. Montalba and Reiss 2011 is in agreement with the statement that boys are generally more positive towards practical work than the girls. And even spend more time in the laboratory doing practical investigations, and more opportunities to test out their ideas than their female counter part.

Contrary to this statement, Macmillan (2013) found that there was no significant difference between in the mean achievement score of male students exposed to practical physics and that of their female counterpart exposed to the same practical physics. The study of Croxford (2002) is contrary to this particular study because, He believed that girls can perform better that boys because the intellectual potential of girls is an untapped labour resource for science and Technology, as such they tend to do better than their male counterpart.

RECOMMENDATION

From these findings, the following recommendations were made

- There is need for physics students to adapt group method of carrying out practical physics. This provide practical experiences and understanding of new concepts in physics,
- It enhances cooperation among the students towards achieving same objective.
- It gives room for passive students to participate and become active in learning process
- Physics teachers should give attention to participatory teaching so the female students tackle same tasks as their male counterpart.

CONCLUSION

Using group activities in the teaching and learning physics provide the learner with new skills, increase understanding of concepts and stimulate their interest to do more experiments

Group experiments encourage proper observations which eventually lead to accurate results of findings through experiments.

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