Effects of Teachers' use of Improvised Instructional Materials on Students' Academic Performance in Physics

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Abstract
This study investigated the effects of teacher use of improvised materials on students' academic performance in Physics in Kontagora, Niger State. The study is a quasi-experimental research design, which utilised a pre-test, post-test and non-equivalent control group. The sample consisted of two senior secondary schools and one school was randomly assigned an experimental and the other, a control group. Two research questions and two null hypotheses were set to guide the direction of the research and a researcher made Physics Achievement Test comprising 30 multiple choice questions was administered for pre and post- test. Statistical tools used to analyse data were the mean, standard deviation and the analysis of covariance (ANCOVA). The Study found that students taught with the use of improvisation performed better than those taught without it. Again it was found that gender bias did not affect students' performance. It was recommended among others, that the government should encourage teacher use of improvised instructional materials as a way to enhance learning and bridge gender gap in Physics performance.

1.0 Introduction

Physics education in Nigeria is expected to help learners acquire appropriate knowledge, skills and competencies needed in the modern world and also in the investigations to broaden the frontiers of science. It is through this that the learners are able to contribute in a meaningful way to the development of the society. The actualisation of theses noble goals is hinged on the fact that learners are engaged in active learning that involves the use of instructional materials in hands- on instructional atmosphere.

Researchers ; Bassey (200), Franzer, Okebukola & Jegede (1992), do all acknowledge that the teaching and learning of science is highly resource intensive and without their use in teaching, teachers professional qualification and competence are eclipsed and as a result, cannot be translated in initiating meaningful learning in the classroom. The age long teacher 'talking and chalking' has been labelled both traditional and didactic and only encourage rote and memorisation among students. This method is very much prevalent in science classrooms in Nigeria today and Ugwu, (1998), Okebukola, (1997) & Ogumade (2005) see their continual use as part of the reason for students' poor performance in School Certificate Science.
The use of standard science teaching materials is very indispensable in science investigations and their efficient use has continued to be in demand because they;

1. Encourage students' participation in the classroom
2. Encourage students' interest in learning by holding their attention in the classroom.
3. Appeal to the sense organs of learners
4. Makes the scientific principles, laws and concepts more real to students
5. Offers learners to opportunity to manipulate, measure, classify, interpret and deduce meaning from an investigation.(Chinedu, 2000)

Ogunleye (2002) reports that standard science instructional material are in short supply in schools and the few available are often not in good working condition to enable their use for teaching and learning. This inadequacy is been attributed to the current economic down turn in Nigeria and the concomitant high exchange rates for the dollar, which make the purchase of standard science equipment from the UK and China very expensive.

This ugly situation has therefore necessitated that teachers and students should endeavour to fabricate or improvise science instructional materials locally. Necessity as the mother of invention has propelled creativity, adventure and innovation in numerous other live situations. It is these attributes Adebimpe (1997) has enumerated as the needed ingredients for teachers and students to undertake improvisation of science instructional materials.

1.1. The Problem

The quest for technological advancement in Nigeria will remain a dream without an efficient study of Physics in our schools and colleges. This is so because Physics is said to be the bed rock of science and technology. Despite this noble importance of physics in national development, the performance of students at the School Certificate Examinations has remained poor. Any meaningful effort to improve students' performance in Physics should leave no stone unturned in ravelling all possible means of achieving a turnaround in this area. In the face of insufficiency of standard science equipment in schools, the use of improvisation of physics instructional materials could be a way of getting an improved Physics education. This researcher therefore seeks to find the effect of teacher utilization of improvised teaching material on the academic performance of students in Physics.

2.0. Literature Review

2.1. Physics related improvised instructional Materials

The Oxford Dictionary defines instruction as the process of teaching, educating or giving direction to an individual. Instructional material therefore means a material that can be used to direct, channel and order a learner to acquire knowledge. Isola (2010) defines instructional materials as materials used to elucidate instruction, and they may be visual, audio, audio-visual or simulation devices. Visual instructional materials consists of chalk board, motion pictures, charts, physics instructional materials such as pendulum, glass blocks, prisms, ammeters etc, transparencies and opaque projectors etc. Audio instructional materials on their own, includes those materials that appeal only to the sense of hearing. They are record players, tape players, resonance tubes, turning forks, etc. Audio – visual materials include all teaching aids that use both sight and hearing to facilitate learning. Examples are television, motion pictures, computers etc. Lastly the simulation devices used to stimulate the action of real life phenomena that we may not be able to bring into the classroom.

Improvisation in science education refers to the process of making alternative materials to teach learners. It is also a process of replicating a standard material to function like the original one by the use of locally sourced materials (Eniayaju, 1981; Akinmoyewa, 1992). Adebimpe (1997) reiterates the need to improvise science instructional materials because of the total absence of science teaching resources, gross in-adequate funding to purchase science materials, galloping inflation and overcrowded classrooms and poor equipment maintenance culture. In the face of these challenges, improvisation of instructional materials stands as the best way to keep the wheels of science teaching and learning moving by minimising and saving cost. (Cirfat, 1997; Wasagu, 2000)

2.2. Research Questions

The following research questions guided the study:

1. What is the effect of the teachers' use of improvised instructional materials on students' achievement in physics?
2. Will male and female students perform differently when improvised instructional materials are used in teaching physics?

2.3 Hypotheses

1. There is no significant difference in the mean academic performance of students taught with improvised materials and those taught without.
2. There is no significant difference in the mean academic performance of male and female students taught using improvised and those taught without.

3.0. Research Methodology

This study is a quasi-experimental, pre-test, post-test research design, involving intact classes that were randomly assigned to experimental and control groups. The sample of the study consisted of selected senior secondary school II physics students and teachers from two schools in Kontagora Metropolis; one school was taught with improvised instructional material (experimental group), while the other was not (control group). A physics achievement test comprising 30 multiple choice questions with four options A-D developed by the researcher was used to measure students' academic performance. For face validity, the instrument was given to three experienced senior colleagues of the researcher and their comments and suggestion were used to produce the final draft. Also, a reliability and internal stability of 0.89 and 0.74 respectively were established using the Spearman reliability coefficient and a test retest after a period of two weeks. Data analysis utilised the descriptive statistics of the mean, standard deviation in the answering of research questions, while analysis of covariance (ANCOVA) test was used to test the hypotheses at 0.05 level of probability.

4.0 Results and Discussions

To answer research question 1: What is the effect of the teachers' use of improvised instructional materials on students' achievement in physics?

From table 1 the mean achievement of students taught with improvised instructional materials is 54.23, and SD is 6.8, while those taught without is 36.45 and SD of 13.45 respectively.

Table1: The mean and standard deviation of academic performance scores of Physics students taught with improvisation and those taught without.

EXPERIMENTAL GROUP SCORE	Mean	SD	LEAST SCORE	HIGHEST
Experiment	54.23	6.80	37.00	74
Control	36.45	13.45	28.25	57

Research question 2: Will male and female students perform differently when improvised instructional materials are used in teaching physics?

Table 2. The mean and Standard deviation of physics students taught with improvised instructional materials and those taught without.

EXPERIMENTAL GROUP SCORE	MEAN	SD	LEAST SCORE	HIGHEST
(MALE)	61.15	7.18	45.00	69.00
(FEMALE)	41.33	9.62	30.00	54.00

The analysis of data and result on table 2 reveals that male students taught Physics using improvised teaching materials have academic performance mean score of 61.15 and standard deviation of 7.18, while female students taught using improvised instructional materials have mean score of 41.33 and Standard deviation of 9.62.

Hypothesis HO_1; There is no significant difference in the academic performance scores physics students taught with improvised material and those taught with the conventional method.

Table 3; The Analysis of Covariance (ANCOVA) Result of the academic performance of Physics students taught with improvised instructional materials and their counterparts taught with the conventional method

SOURCE OF VARIANCE		SUM OF SQUARE	DF	MS	FCRIT	SIG.	DECISION
Covariates	-	528.754	1	528.754	48.266	.000	
Pre-test	-	528.754	1	528.754	48.268	.000	
Main Effect	-	1297.152	1	12972.152	1.421.112	.000	
Treatment	-	12972.152	1	12972.152	1421.112	.000	
Explained	-	14202.608	2	6947.830	896.170	.000	
Residual	-	719.437	58	8.521			
Total	-	17162.935	60	180.921			

- Significant @ $p< 0.05$

From the above table treatment is said to be significant at 0.05 at probability of 0.000. The null hypothesis which states that there is no significant difference in the mean academic performance score of physics students taught with improvised materials and those taught with the conventional method is therefore rejected. This result means that students taught Physics with improvised instructional materials performed better than those taught with the conventional method. The use of improved instructional materials in teaching is efficacious in enhancing the learning of physics.

This finding seem to corroborate earlier research works done by Fakomogbon (2012), Isola 2010), Ayola (2015) and Medugu & Mustapha (2013), whose research found that improvised teaching materials enhanced the learning of science. Hence the aged old Chinese saying, "I

hear I forget, I do I understand" is still valid today and Physics teachers need to ensure that students do not only learn through their eyes and eyes but must be encouraged to create atmosphere that allows manipulation of instructional materials.

HO_2; There is no significant difference in the academic achievement of students by gender taught by the use of improvised physics materials and by conventional means.

Table 4; The Analysis of Covariance (ANCOVA) of Gender by treatment

SOURCE OF VARIANCE	SUM OF SQUARES	DF	MS	FCRIT.	SIG	DECISION
Covariates	528.754	1	528.754	1.946	.102	
Pre-test	528.754	1	528.754	1.946	.102	
Main Effect	215.012	1	215.012	-386	.266	
Treatment	215.012	1	215.012	.386	.226	
Explained	630.770	2	421.082	1.109	.165	
Residual	1396.200	58	319.541			
Total	1541.670	60	338.211			

Significant @ P< 0.05

The result from table 4 indicate that the difference in gender by treatment is not significant. Therefore the null hypothesis: HO_2 is rejected, showing that there is no significant difference in the academic performance of male and female physics students due to the treatment. The academic performance of male and female Physics students would improve from the use of improvised teaching materials rather than the conventional teaching method. Studies; Madugu & Mustapha (2013), Isola (2010) and Omebe & Akani,(2015) have also found that male and female Physics students taught with improvised instructional materials do not have any difference in their performance, therefore lending support for the above finding.

4.0 Conclusion and recommendations

The results of the above research finding naturally lend themselves to the following conclusions and recommendations.

The use of improvisation of instructional materials in the teaching of physics has efficacy to improve academic performance of physics students. The effective teaching and learning of physics in our schools requires the use of instructional materials rather than the old traditional methods such as lecturing and note- taking. Again, improvisation of instructional materials enables the teacher bridge gender gap in physics academic performance, since males and females benefit equally when improvised material are used in the teaching of Physics.

It is therefore recommended that

1. In the absence of standard instructional materials, teachers should be encouraged to use improvised materials for teaching Physics.
2. Workshops should be organised to train Physics teacher to be proficient in improvisation.
3. Attitude of teachers and students towards the use of improvised instructional materials should be boosted through counselling and provision of tools and resources for improvisation.

4. The government should improve funding for the study of Physics
5. Lastly, the government should restore the payment of hazard allowance to Physics teachers, since improvisation could sometimes be hazardous.

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