A STUDY OF THE EFFECT OF THE TRANSFORMER AS AN INSTRUCTIONAL MATERIAL IN TEACHING POWER SUPPLY IN PHYSICS

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ABSTRACT

The subject of Physics which is taught at the Senior Secondary School levels in Nigeria requires demonstration and praticalisation of some concepts. A concept of power supply in physics requires the use of transformer. The transformer is used as an instructional material to see if it affected achievement in Physics. Three research questions and three null hypotheses guided the study. One hundred students were sampled for the study. A quasi- experiment design was used and Physics Achievement test administered to collect data for the study. Analysis of result using independent t-test and chi-square indicated that students taught power with transformer as instructional materials performed significantly better than the counterparts. Findings imply that science is not really brought home if the instructional aids are not used and proper orientation should be given to teachers through seminars and workshops to promote learning and teaching.

INTRODUCTION

Physics is one of the basic sciences offered by science students from secondary school level to tertiary institutions. Physics is essentially a basic subject in the study of astronomy and astrophysics, cosmology and space. The understanding of physics helps in understanding the universe, earth, components of space, studies on space technology, satellite communications, computer technology and astronomy.

As a domain, physics studies matter (solids, liquids and gases). The domain of physics as matter includes solids, liquids, gases, plasmas, molecules, atoms and particles which atoms are made of. Energy includes all forms – mechanical, electromagnetic, nuclear and the manifestations of these basic kinds of energy in the form of heat, sound, light gravitational and chemical energy.

This may not clearly distinguish "physics from chemistry which equally deals with matter and energy. As Fink (2003) stated, physics is the oldest and most basic of the sciences because it attempts to explain the different kind of the particles and radiations which make up the universe.

The term "transformer" is a device which transfers electrical energy from one circuit to another by electromagnetism through inductively coupled conductors i.e the transformer coil "winding".

Apart from the air –core transformer, these conductors are commonly wound round a single iron-core or separate but magnetically- coupled cores. A varying current in the first

or primary winding creates a varying magnetic field induces a varying electromotive force EMF or "voltage:" in the secondary winding by an effect of mutual inductance.
In an ideal transformer, the Induced Voltage in the secondary winding Vs is in proportion to the primary Voltage Vp and is given by the ratio of the number of turns in the secondary (NS) to the number of turns in the Primary NP.

$$\frac{Es}{Ep} = \frac{Vs}{Vp} = \frac{Ns}{Ns}$$

It is possible by selection of ratio of turns to make an alternating current (AC) Voltage to be "stepped up" by making Ns greater than Np or stepped down by making Ns less than Np. The transformers are usually essential for high Voltage power transmission which makes long distance transmission economically practical, thus transformers are good instructional material in learning power supply in physics.

Anderson and Krathwohl (2001) stated that instructional material and learning activities are important to students and can weigh heavily in their course evaluations.

Mckagechi (2005) identified that student ranked the use of instructional material as most essential for the final grading of teaching and learning. Such concepts as transformer coil, motor are constructed while concepts like discussion, group project, homework, laboratory and experiments are activities that go with class exercise. Since we the educators now encourage methods that are student dominated instead of the expository teacher mediated; there is a need to make the learning experience concrete through use of appropriate instructional material.

The Problem

The regular classroom has been teacher dominated as the teacher is the sole-repository of knowledge. Recently efforts are geared towards integrating methods which will make the learners to be active participants in the classroom. The use and demonstration of physics concepts using instructional material will make the students active as they will partake.
The problem of this study is will students learn and apply power supply as a concept when taught with transformer as an instructional material.

The main purpose is to examine how the transformer as an instructional material will enhance student's achievement, in the study of power supply in physics. Specifically, the study sought to compare the mean achievement score in physics of students taught power supply using transformer as instructional material and those not taught.
Scope of Study: The study will cover concepts under transformers, step-up and step down and power supply and conversion.

Methods and Materials

Null Hypothesis: There is no significant difference between the mean achievement score in physics of students who were taught power supply with transformer as instructional materials and those not taught.

- There is no significant difference between the ability to use electrical appliances involving power supply of students taught with transformer as instructional material and those not taught

- There is no significant difference between the means of knowledge of safety precaution in the use of electrical appliances of science students taught Power supply with transformer as an instructional material and those not taught with it

METHODOLOGY

The design of this study was quasi-experimental design which involves selecting groups upon which variable is tested without any random trial-selection process; involves identifying a variable; dependent and independent variable.

The study was carried out in Ogidi Education Zone, Anambra State. The population for this zone consisted of 3,249 students in Senior Secondary Schools in Ogidi education zone. The population of this study consisted of 640 Science Students in Senior Secondary Schools in the Ogidi Local Government Area. One hundred (100) students were sampled for the study. There are thirteen schools which offer sciences in Ogidi LGA and a total of four schools were randomly selected for the study.

Experimental Procedure

The researcher taught the students the basic concepts of the generation of electricity and students were requested to identify the source of hydroelectric power. The researcher equally presented lessons with electrical experiment in winding of transformer.

Instrument for Data Collection

This consists of objective test instruments of which the students were asked to choose the correct option from a number of options and some open-ended questions designed to check the level of application and the measure of safety precaution by the students taught power with transformer as instructional material and those not taught

Validity: The validity of the achievement tests were ascertained by four physics teachers who had above 15 years experience in teaching physics. They validated the test for content and appropriateness.

Reliability: The split-half method of ascertaining reliability was applied. The computation of Pearson Product moment correlation coefficient yielded a coefficient value of 0.82. The administration of the test was solely the responsibility of the researcher administered at the end of the class. All the data collected form tests were kept and used for data analysis.

Method of Data Analysis

The mean value, the standard deviation is used to analyze the research questions while independent T-test was used to answer hypothesis one. Chi-square was used to answer the second and the third hypotheses. This is because hypothesis one is parametric analysis and hypothesis two are three are non-parametric hypothesis.

RESULTS/PRESENTATION

1. Research Question one:

To what extent does the mean achievement in physics of Science Students taught power supply using transformers as an instructional material vary from the mean achievement those who were taught without transformer as an instructional material?

Table 1:The mean value and standard deviation of students
Group statistics

	INSTRUCTION	N	MEAN	STANDARD DEVIATION	STANDARD ERROR MEANS
Achievement physics	Instruction Material	50	86.300	9.9903	1.4128
	No Instruction material	50	43.5000	10.2644	1.4516

Analysis in table1 Shows that the mean achievement score of students taught with instructional material is 86.3000 while the mean score of students not taught with instructional materials is 43.500.

Table 2: 2x 2 Contingency Table Chi-Square Test Instruction *Use Of Electrical Appliance

INSTRUCTION	COUNT	CROSSTAB * USE OF ELECTRICAL APPLIANCE		
		Incorrect	**Correct**	**Total**
	Instruction Materials		50	**50**
	No instruction material	50	50	**50**
	TOTAL	**50**	**50**	**100**

Analysis in table 2 show that no student who was taught power supply with instructional materials failed to use the electrical appliances provided for the test, while those who were not taught without instructional material were not able to use the electrical appliances provided for the test. This result is one hundred percent right or wrong of because there is no room for average, it is either you get it right or wrong.

Research Question Three:

To what extent does the knowledge of safety precaution in the use of electrical appliance of science student taught power supply with transformer as an instructional material vary from the knowledge of safety precaution in the use of electrical appliances of those who were not taught with transformer as an instructional material?

Table 3: 2 X 2 Contingency Table Chi-Square Test Instruction Knowledge Of Safety Precaution

INSTRUCTION	COUNT	CROSSTAB KNOWLEDGE OF SAFETY PRECAUTION		
		Incorrect	**Correct**	**Total**
	Instruction Materials		50	**50**
	No instruction material	50	50	**50**
	TOTAL	**50**	**50**	**100**

Analysis in table 3 shows that students who were taught power supply with instructional material knew how to observe precaution measures in handling electrical appliances while

those who were not taught with instructional material received injury in one way or the other which was parameter as to whether they had knowledge or not. Therefore the student who learnt with instructional material has knowledge of safety precaution whereas those students who did not learn with Instructional material did not know the safety precaution to be taken.

Null Hypothesis One: There is no significant difference between the mean achievement score in physics in the use of transformers as an instructional material and those who were not taught with it.

TABLE 4: Independent T-test for Hypothesis I

Independent sample Test

Leverne's test for Equality of variance T-

ACHIEVEMENT SCORE IN PHYSICS	**COUNT**	**LEVENE'S TEST FOR EQUALITY OF VARIANCES**					**T-TEST FOR EQUALITY OF MEANS**			
		F	**Sig**	**T**	**df**	**Sig. 2 failed**	**Mean diff**	**Std Error D/f**	**95%Conf. level of mean**	
									Lower	**upper**
	Equal Variances Assumed	0.020	0.888	21.129	98	0.000	42.800	2.027	38.7802	46.819
	Equal variances not assumed			21.129	97.926	0.000	42.800	2.057	38.7801	46.81

The analysis in the independent t-test presented in Table 4 reveals the significance value of .888. II indicates that there is no significant difference between student who were taught power supply with transformer as an instructional material and those not taught.

Null Hypothesis Two

There is no significant difference between the ability to use electrical appliances involving power supply of students taught power supply with transformer as an instructional material and those who were not taught it.

Table 5:Chi-Square Test Of Hypothesis 2

ITEM	Value	Df	2-sided	Sig. (2-sided	Exact Sig.(t-sided
Pearson Chi-Square	100.000	1	.000		
Continuity Correction	96.040	1	.000		
Likelihood Fisher's Exact Test	138.629	1	.000		
Fisher's Exact Test				.000	.000
Linear-by- linear	99.000	1			
N of Valid cases	100				

a. Computed only for a 2 xx 2 table
b. 0 cells (%) have expected count less than 5. the minimum expected count is 25.00

Null Hypothesis Three:- There is no significant difference between the mean knowledge of safety precaution in the use of electrical appliances of science students taught power supply with transformer as an instructional material and those who were not taught with it.

Table Six: Chi-Square Test of Hypothesis Three

ITEM	VALUE	DF	ASY SIG.	EXACT SIG.(2 sided)	EXACT SIG.(1 sided)
Pearson chi-square	100.000[b]	1	.000		
Continuity correction [a]	96.040	1	.000		
Likelihood ratio	138.629	1	.000		
Fisher's exact test				.000	.000
Linear – linear ass.	99.000	1	.000		
No. of valid cases	100				

a. computed only for a 2x2 table
b. 0 cells (.0%) have expected count les than 5. The minimum expected count is 25.00. Table shows significant value of .000 which indicated that there is no significant difference in knowledge of safety precaution of students taught power supply with transformer as instructional material and those who were taught without transformer as an instructional material.

DISCUSSION

The result shows that there is a significant difference between students taught power supply with transformer as an instructional materials as shown in the two hypothesis answered. The students taught power supply with instructional material they knew how to observe precautional measures in handling electrical appliances while those who were not taught had no knowledge of the application. This agrees with the views of Mckaechi (2005), Anderson and Krathwohl (2001) who emphasized on the need of the use of instructional material to drive home important concepts. Equally this will solve a lot of misconception of concepts in physics where Ivowi (1984) in his studies on misconceptions identified many areas in physics. This there is great need for instructional materials to be used to teach concepts in physics. This will lead to better understanding of concepts and better achievement in physics which in general will influence performance of students in internal and External Examinations

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