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Effect of Improvised Chemical Models in The Teaching and Learning of Chemistry Among Senior Secondary Student Achievement in Makurdi Local Government Area

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ABSTRACT*: This study investigates the effect of improvised chemical model in teaching and learning of chemistry in Makurdi Local Government of Benue state. Three research questions and one research hypothesis was answered and tested at 0.05 level of significant, there was a significant different between student taught with improvised chemical model and those taught without improvised chemical models. Study made use of descriptive survey and experimental design. The population of the students comprise of 30 students from two secondary school. The result of the findings revealed that the level of improvised chemical model for teaching and learning is very poor, since the improvised chemical model strengthen their verbal instruction and reduce the abstract nature of the chemical concept and the students perform very well when taught with improvised chemical models, therefore there is need for all the teachers to be involved in improvisation of chemical models for better understanding of their lesson.*

KEYWORDS: improvised chemical models, teaching, learning, chemistry, senior secondary student, Makurdi LGA

INTRODUCTION

Education, particularly science and Technical education is the factory for the production of the needed technologist, technicians and craft men as well as skill artisans who are required to turn the nation's economic around and usher in the desired technology advancement which is very much required for the elevation of Nigeria from a 'consumer nation' to a 'producer nation'; from a developing nation to a develop nation. Teaching and learning is considered to be as a result of the individual interaction with people and things in the world around them. In order to learn, the individual must be able to get his hand on the environment and manipulate it in one way or the other.by providing access to appropriate learning experience designed to "broaden skills and knowledge can increase productivity and significantly improve the fortunes of the unemployed, thereby reducing poverty and unemployment amongst our youth.

it is against the "background that science education has "been accorded a prime position worldwide. within the context of science education, chemistry has "been identified as a very important subject and its importance in scientific and technological development of any nation has been widely reported. it was

as a result of the recognition given to chemistry in the development of the individual and the nation that it was made a core subject among the natural science and other science related courses in Nigeria education system. it has been a pre-requite subject for offering most science oriented courses in tertiary institution and this calls for the need, in the teaching it effectively. chemistry has an impact in our society and the environment and students need to develop knowledge of the important positive values and practices in relation to the society and environs.

Chemistry is an exact and a core science subject in Nigerian secondary schools. Its teaching often requires creativity and improvisation. To make chemistry concepts comprehensible to students, chemistry teachers must employ creative teaching methods and be prepared to respond to queries and explain concepts in typical manner (Nbina, 2012). The he further pointed out that the widespread poor performance and the negative attitude towards chemistry from secondary school students have largely been ascribed to lack of proper teaching methods. Teachers who adapt appropriate improvisation materials in teaching chemistry will likely be more successful in imparting chemistry knowledge to the novice chemists in their classes.

Samba and Eriba (2011) see improvisation as the act of using alternative materials and resources to facilitate instructions whenever there is lack or shortage of specific first hand teaching aids. They said improvisation is as the choice of the best instructional material which enables the teacher to achieve some carefully specified educational objectives. Stiggins (2008) added that there are various methods used to increase class participation and performance among students and improvisation of instructional teaching materials is one of them. Chemistry as a discipline, in science according to Encarta dictionary (2008) is the study of transformation of matter, a branch of science dealing with the structure, composition, properties and reactive characteristics of a substance, especially at the atomic and molecular levels.To make learning more meaningful, lively, understandable and real, appropriate instructional methods must be applied (Ilarbor & Chukurdi, 2008). Mboto, Ndem and Stephen (2011) added that the use of improvised instructional model enhanced teaching of science and improved performance.

The need for their use was advocated based on the fact that the individual learns even when they are not presently there. The importance of instructional models or improvised chemicals model in teaching and learning of chemistry effectively lie on the unique power of the teacher to improvise that instructional model in question to facilitate that particular objective of learning (Anador 2005). For so many teachers and students the teaching and learning of chemistry means going into a well-equipped laboratory that is stocked with all the glittering and impressive apparatus and chemicals that are associated with their ideas of laboratory to depend on for their teaching and learning of chemistry. In view of the above, the study tries to investigate the effect of improvised chemical models in the teaching and learning of chemistry among senior secondary school student's achievement. Avector (2005) realized he need by science teachers for new and innovative ways of presenting their lessons without resorting to inexpensive imported apparatus. It is the responsibility of every teacher to realize the effect of chemical model in teaching and also to develop a way of making indigenous model which will enhance scientific laws and principles. Owo (2009) and

Nwagbo and Ugwuanyi (2015) observed that innovative pedagogical practices using technology and improvisation enhance teacher's effectiveness. Dike in Omiko (2015) noted that, if instructional materials are to be improvised, emphasis should be laid on using cheap and locally available materials. A chemistry teacher must be conversant with the types, characteristics and advantages of instructional materials before he/she could improvise. Omiko (2007) listed the benefits derived from the use of improvised instructional model to include;

(i) It makes students to participate in creative and analytical thinking when they are involved in making those needed instruments.
(ii) concepts taught using improvised materials become clearer to the students because those concepts are learnt through play-like activities.
(iii) It encourages a systematic integration of a variety of resources in a teaching-learning experiences. (iv) Being actively involved in improvisation, the working principles are learnt and in this way the students acquire problem solving skills, manipulative skills, scientific attitude and knowledge needed in solving the daily scientific and technological problems.
Based on the above stated benefits derived from the use of improvised model in teaching chemistry, it therefore becomes necessary to find out which of these instructional model that are available in our secondary schools and if teachers improvise and use the non-available instructional model in teaching chemistry and possible hindrances to these teachers' improvisation efforts. Thus, the need for this study.

Purpose of the Study.

I. To find out the mean achievement of chemistry students taught using chemical model.
II. To find out the mean achievement of chemistry students taught using teaching method.
III. To investigate the difference in the performance of students taught using improvised chemical model and those taught using teaching method

Research Question

The following questions were raised to help the study under investigation.

1. What are the mean achievements of chemistry students taught using chemical model?
2. What are the mean achievements of chemistry students taught using teaching method?
3. Is there any difference in the performance of students taught using improvised chemical model and those taught using teaching methods?

Research Hypothesis

The following hypothesis was generated and tested at 0.05 level of significance.
H_{01}: There is no significance difference between the performance of students taught with improvised chemical models and those taught using teaching method.

Empirical Studies

Several studies have been conducted on the use of improvised instructional materials and resources for science teaching. There has been little or no study done on students' produced improvised

instructional materials for science teaching. Onasanya and Omosewo (2010) citied out a study on the effect of using standard instructional materials and improvised instructional materials on Secondary School students' Academic Performance in Physics in llorin, Nigeria. The sample consisted of selected Secondary Schools in Ilorin Metropolis of Kwara State. The research employed a quasi-experimental design of the pretest -posttest non-randomized control group design. Two hypotheses were designed and tested at 0.05 level of significance. From the analysis, the following findings were made (1) there was significantly difference between the students taught with standard instructional materials and those thought with improvised instructional materials, i.e., mean scores on the posttest (t = 4.09, elf 14, p = 0.05), (2) there was no significant difference between the post test scores of the experimental group and control group. This shows that the improvised instructional materials in the comparison of the male mean scores of experimental and control groups were the same entry level with regard to academic ability (t = 1.23, elf 7, p = 0.05). The implications of improvised instructional materials were discussed. Recommendations for the manufactured equipment were used to teach experimental group l and 2 students on how to take measurements of voltage respectively while the control group was taught using alternative to practical (i.e. conventional method). Data was collected using Physics Achievement Test on Voltage Measurements (PATVM) were analyzed using ANCOVA. A significant difference existed between students taught voltage measurements using manufactured voltmeter, improvised voltmeter, and conventional method. The Scheffe tests carried out to determine the direction of significance show that the difference in means of students· achievement between those taught using manufactured and conventional method as well as those taught using improvised analogue voltmeters and conventional method were signi icant. However, the difference in means between the two experimental groups was not significant. The need for teachers to ensure practical experience as well as use of improvised models in the absence of the manufactured ones to teach physics was the major recommendations of the study. The aspect of standardization of the improvised instructional resources was completed and reported elsewhere. 8ased on the finding that improvised resources compare favorably with the manufactured ones, the present study assumed the usability of the improvised instructional materials.

Ugbe and Dike, (2012) carried out a study on the comparative effect of using improvised freefall apparatus and bomb calorimeter in teaching the concept of enthalpy in Nigeria Senior Secondary Schools Chemistry. The purpose of the study was to determine the effectiveness of using improvised freefall apparatus and bomb calorimeter in teaching the concept of enthalpy. The study was in response to the call for the deployment of materials within the learners' immediate environment as a means of finding a solution to persistent shortage of learning resources for the teaching of Chemistry in Nigeria Secondary Schools. A total of 93 Senior Secondary two (SS2) chemistry students were involved in the study. This number was made up of 48 females and 45 males from four secondary schools in Cal a bar Educational Zone of Cross River State of Nigeria. A pretest - posttest control group design was used for the study. Analysis of Covariance (ANCOV A) was used to analyze the data. From the finding, it was observed that improvised freefall apparatus as a resource for teaching the concept of enthalpy was more effective in enhancing students' academic performance in chemistry as compared to bomb calorimeter. The result also

showed an insignificant difference existing between the performance of male and female students when taught the concept of enthalpy using freefall apparatus.

Ibrahim (2012) investigated the effects of improvised and conventional instructional materials on pupils' academic achievements and attitude to Basic Science. Experimental design using pretest and posttest was adapted. Random sampling was used to select the 3 school sout of IO co-educational primary schools in Wase Supervisory Zone of Wase LGA Plateau State. The sample of 120 primary 5 pupils was selected through the use of table of random numbers. The selected schools were randomly assigned to experimental group I, experimental group II and control group. The experimental group l was exposed to improvised materials and experimental group II was taught with conventional instructional materials. The control group was taught with lecture method. The instruments used for data collection were Basic Science Achievement Test (BSA T) and Basic Science Attitude Questionnaire (BSAQ) with reliability co-efficient of 0.73 and 0,83 respectively. Three hypotheses were tested at P :::::; 0.05 level of significance using Analysis of variance (ANOVA), t-test and Wilxocon Signed Rank Test. The findings showed that pupils taught with improvised and conventional materials have no significant difference in their mean scores bur showed significant difference with the control group. In addition, no significant difference in the pupils' attitude before and after exposure to improvise and those exposed to conventional instructional materials. Based on this finding, it was recommended that Basic Science teachers should be trained through workshops on how to effectively design and used improvised materials in teaching Basic Science.

The researcher learnt from the study that despite the importance of the use of improvisation to enhance the academic achievement of students, it appears that many still do not use improvised equipment even in the absence of the manufactured materials and equipment. While some argue that improvisation, which makes use of local and sometimes substandard materials, would lead to substandard science teaching, others howevei: argue that in a situation where the manufactured materials are not available, a validated improvised model could be used. in the light of this argument, the following pertinent questions readily come to mind: Are improvised materials not able to serve the same purpose as the manufactured materials? Moreover, would improvised materials not enhance achievement better than the conventional method of teaching? The present investigation is an attempt to address these questions with particular reference to the effect of improvised chemical model on teaching and learning of chemistry in secondary school in Makurdi L.G.A of Benue State.

METHODOLOGY

The design for the study is quasi-experimental design. Specifically the study applied pre-test, post-test control group design with a population all SS II chemistry students from the two selected secondary schools in makurdi local of Benue State. The sample size of this study is 20 students from two intact classes in public schools in Makurdi Local Government Area of Benue State. To produce the sample, simple random sampling technique will be used to select two schools from

Makurdi LGA. The instrument for data collection for this study is Chemistry Achievement Test (CAT). Some items for the CAT was constructed by the researcher and some were adopted from West African Examination Council (W AEC) and it consists of twenty (20) multiple choice questions, The twenty-item Chemistry Achievement Test (CAT), was validated by three experts, two from Science Education Department and one Test and Measurement Expect, a reliability coefficient of 0.87 was determined. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOV A) was used to test the hypotheses at 0.05 level of significance.

RESULT AND DISCUSSION

Research Question 1

1. What are the mean achievements of chemistry students taught using chemical model?

Table one: Mean of student taught without chemical model

Group	Mean	N	Std. Deviation
conventional method	12.00	9	1.936
chemical model	15.20	20	2.966
Total	14.21	29	3.052

Table 1 above indicates a mean of 12.00 with S.D of 1.936 for students taught by way of conventional method while those taught with chemical model has a mean of 15.20 and SD of 2.969 with a cluster mean of 14.21.

Research questions 2: What are the mean achievements of chemistry students taught using teaching method?

Table 2 Mean of students taught without chemical models

Group	Mean	N	Std. Deviation
conventional method	8.67	9	3.041
chemical model	8.10	20	2.337
Total	8.28	29	2.534

Table 2 reveals that conventional method has mean of 8.67 and S.D of 3.041
While chemical model has mean of 8.10 and SD of 2.337 with a cluster mean of 8.28

Research question 3: Is there any difference in the performance of students taught using improvised chemical model and those taught using teaching method?

Table 3: difference in mean of student taught using teaching and chemical model

Group		pretest	posttest
conventional method	Mean	**8.67**	**12.00**
	N	9	9
	Std. Deviation	3.041	1.936
chemical model	Mean	8.10	15.20
	N	20	20
	Std. Deviation	2.337	2.966
Total	Mean	**8.28**	**14.21**
	N	29	29
	Std. Deviation	2.534	3.052

Table 3, revealed mean score of 8.28 for pre-test students who were taught with chemical model, while and post-test students had mean scores of 14.21. Students who were taught with conventional had mean scores of 8.64 and post-test mean score of 12.00.

Hypotheses

The hypothesis was tested using Analyses of Covariance. Summary of the analyses for the hypothesis is shown in table 4

Source	Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	76.843[a]	2	38.421	5.432	.011	.295
Intercept	293.607	1	293.607	41.507	.000	.615
Pre-test	13.284	1	13.284	1.878	.182	.067
Group	69.086	1	69.086	9.767	.004	.273
Error	183.916	26	7.074			
Total	6114.000	29				
Corrected Total	260.759	28				

a. R Squared = .295 (Adjusted R Squared = .240)

Table 4: revealed that significant F (1, 1.878) = .182, p > .05, the null hypothesis was therefore; rejected indicating that there is significant difference in the mean performance of students taught using chemical model and those taught using conventional method.

DISCUSSION OF FINDINGS

It has therefore, been discovered that the use of standard chemical model have the same importance in the teaching and learning of chemistry in makurdi metropolis. It is revealed from the results that there is significant difference in the performance of students taught with chemical model and those taught with conventional teaching method. Using improvised chemical model, assists the teacher

economically and also allows students interaction. It makes students use their intellectual ability during learning and teaching processes. More so, there is equivalence in the correlation coefficient of experimental group to that of the control group. This also shows that there is no significant impact on the performance test of the students taught with improvised chemical model.

Aguisiobo (1998) in S.A. Onasanya and E.O. Omosewo, 2011 expressed that learning is an activity that takes place in a contact and not in a vacuum. He reiterated that student with teaching aids do not have a bank mind but a consolidated and developed library of knowledge. Furthermore, the result of research hypothesis revealed that those who were taught with conventional teaching method performed equally better with those who were taught with improvised chemical model. This could be due to the fact that the improvised chemical models are also of high quality and standard. It can be deduced now that significant difference exist between student taught with conventional method and those taught with improvised chemical models during students exposure to the treatment conditions.

In other words students acquire more information through many instructional materials so as to bring deeper understanding of the topics under consideration. This result agreed with the view of Omosewo (2008) who stressed that science subject should be taught primarily as a practical subject. He further ascertained that in a modern science curriculum programme, students need to be encouraged to learn not only through their eyes, or ears, but should be able to use their hands to manipulate apparatus.

Conclusively, in order not to be stagnant as life is dynamic. One could find out that improvised materials had almost the same effects as standard materials. Therefore, there should be cordial relationship between our policy makers and teachers and by way of provision of funds available for improvisation especially that funds may not be available for importing chemical models. It is important to note that students require information through many instructional materials so as to bring better understanding of what they are being taught.

CONCLUSION

Based on the findings, the following conclusions were made the schools sampled for these studies make use of improvised chemical model for their lesson. Only few school that use convention teaching method in their lesson.

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