

Improvisation of Teacher-Made Instructional Media and Students' Performance in Primary Science in Nigerian Schools

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Abstract

The study examines the effect of improvisation of teacher-made instructional media on students' performance in some selected primary science concepts. Thus, a pre-test and post-test, non-randomized experimental design was adopted for the study. Three thousand, three hundred and sixty-eight (3,368) primary six pupils from 48 public primary schools in Akwa Ibom State formed the population while two hundred and nineteen primary six pupils from two schools formed the sample for the study. The two intact classes were exposed to standard and improvised science equipment. A Primary Science Performance Test (PSPT) instrument was used to collect data before and after each lesson. A t-test statistical analysis revealed that there is no significant difference of the post-test performance of intact classes exposed to improvised science equipment and those standard equipment indicating that pupils benefited equally from the standardized and improvised equipment with t-calculated score of 1.34 below the t-critical 2.92. It is recommended that the government should organize workshop on the use of improvised materials to change the orientation of the teacher centred instructional approach to teaching primary science.

Keywords: Instructional media; Research design; Skills; Lesson model; Curriculum; T-test.



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1. Introduction

The last few decades have witnessed several countries of the world either striving for scientific achievement and technological recognition or supremacy over one another. Scientific and technology exploits in global consideration continue to excite and remain the priority of Governments. Innovations in the development of technological tools and devices have been recorded in emerging technology oriented nations like India and Malaysia etc. In this regard, China and Japan for instance already qualify as the leading nations in Asia. Nations therefore, in the attempt to transfer these gains into national development target their students, guiding them to study varied science and technology courses to level up with required global standards and career requirements.

In Nigeria, the national objective for Science Education [FRN Federal Republic of Nigeria \(2004\)](#) include:

- (i) *cultivating, inquiring, knowing and developing rational mind for the good conduct of a good life and democracy*
- (ii) *produce scientists for national development, etc.*

It further states that "science and technology shall continue to be taught in an integrated manner in schools to promote in the students, the appreciation of basic ideas". Primary education in [FRN Federal Republic of Nigeria \(2004\)](#) is upheld as the foundation upon which the rest of the educational system is built. The objectives spelt out;

"The provision of opportunities for the development of manipulative skills which will enable the child to function efficiently in the society within the unit of its environment and capacity

The provision of diverse basic knowledge and skills for entrepreneurship, wealth generation and educational advancement".

In order to realize these goals, primary science was included as one of the core subjects in primary schools and at the end of primary education, a child is expected to among other things acquire knowledge in science through study, practice, observation and experimentation, to be able to explain natural phenomena. In the light of the above, primary school teachers need to provide unique learning experiences to pupils in the classroom at all times. This implies that primary science teachers must be up-to-date and innovative in the improvisation and use of learning resources to enable the learners interact and be acquainted with the science equipment and materials, to afford them opportunity to manipulate basic process skills of observation, measurement, inference, classification, prediction, communication, etc. This will help bridge gaps in course appraisals of contents, enrich existing curricula and replace teacher-centred instruction.

One of the instructional practices which has been of interest to some Nigerian educational technology educators for a long time has been the area of improvisation of instructional media for effective classroom teaching. As observed by [Ibe-Bassey \(2012\)](#), the issue of the design, development, production, use and the integration of instructional materials into teachers' lessons are something the teacher believes is for the college/university training. Teachers lack the instinct for improvisation of materials, but often rely on textbooks illustrations. Nkana in [Ibe-](#)

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Bassey (1988) believes that “strength in education” resides in the intelligent use of a variety of powerful innovative skills, and that by matching them to different goals and adopting them to different goals and students’ learning styles and characteristics, much of the ambiguities (ie. Problems) and complexities of the teaching situation will be removed.

In the study of primary science, however, the provision of instructional materials and laboratory equipment are most often inadequate in Nigerian schools.

This is mainly due to their expensive, scanty supply and sophisticated nature. In order to effectively promote teaching and learning of science in primary schools, pupils must be made to interact with and manipulate the simplified version of complicated science equipment and materials within our environment. Such equipment should be sourced and produced by both the teachers and pupils to help pupils’ development of manipulative skills for creativity. The teacher would select a teaching strategy that matches learners’ characteristics, experiences and aspirations.

The importance of instructional media/materials cannot be underestimated. Instructional media are a range of materials and equipment which make a visual impression on the students, assist the teacher in his task, helping him increase his effectiveness in the classroom. Media communicate information effectively, promote the acquisition and longer retention of knowledge, when they are systematically designed, reproduced, used and evaluated. Improvisation simply means to source, select, create, make, substitute, and provide local media and materials obtained within and outside the school environment in the absence of the original ones. Similarly, Eshiet (1996) stated that improvisation involves sourcing, selection and deployment of relevant instructional materials into the teaching-learning focus in the absence or shortage of standard materials for a meaningful realization of specified educational goals and objectives.

Earlier investigation by Flanders (1970), Johnson and Johnson (1974), revealed that students who were taught using improvised instructional media that were properly evaluated made significant gains in their studies. In Johnson and Johnson (1974) for example, studied three categories of science students, namely:

- (i) a group that learned science from textbooks,
- (ii) a group that used textbooks and laboratory materials, and
- (iii) an activity-centred group that dealt primarily with improvised instructional materials and laboratory equipment. They found out that all the groups with textbooks and laboratory materials were relatively behind the group, which was activity-centred, and this group developed the greatest positive attitudes toward learning. This may be as a result of being exposed to an area of new knowledge with greater student-to-technology improvisation resources contact.

According to recent studies by Abdelraheem and Al-Rabane (2005), Udosen (2011) and Ibe-Bassey (2012) some creation of improvised media of low technological materials and resource-centred learning can enlarge the limited knowledge base of any course of study and enrich instruction to a guaranteed quality. It can also promote strategies that ensure the integration of technology in the teaching and learning process of basic science education. Their findings are in agreement with the findings of Dodge *et al.* (1994) who observed that using technologies like simulation devices open new horizons for individual learning tools, the environment resources and services.

2. Examples of Local Sourced Science Equipment/Materials Using the Concept of Discarded Tools

Science apparatus and equipment can be improvised for use in the classroom through the use of discarded materials around the environment.

Such equipment as magnifying glass, beakers, funnels, electro-magnets, metre rule, concave and convex mirrors, test tube holders and temporary magnets are all materials that can be used to improvise useful primary science equipment in classroom. It is important to note that some science equipment cannot or should not be improvised. Complicated or precision instruments may not be improvised due to their costs and complicatedness. Some of the equipment are listed below:

- (1) **Test tube holder:** Discarded binding wire or short fresh wood split into Y-shape could be used as test tube holder.
- (2) **Magnifying glass:** An expired filament bulb can be carefully opened up at the head with pliers. Water is then put into the empty bulb and placed free on a table. The water in the open bulb acts as a magnifying glass.
- (3) **Concave and convex mirrors:** By cutting open an empty discarded insecticide cylindrical can at the base, the curved bottom acts as both concave and convex mirrors from both sides of the cut out bottom.
- (4) **Temporary magnets:** A flex wire wound round a 2” nail can be connected to the top and bottom of a dry touch light battery with both ends of the flex wire to top and bottom. The connection will turn the nail to a temporary magnet.

Practical experiment shall be done in the class in the course of teaching.

All the above among many are scientific materials that can be improvised for use in the classroom.

2.1. Objectives

1. Compare the pre-test and post-test mean scores of pupils taught with standard or direct science equipment and those taught with improvised science equipment.

2. Compare the pre-test and post-test mean scores of male and female pupils taught with improvised science equipment.

2.2. Hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the performance of pupils taught with standardized equipment and those taught with improvised equipment.
2. There is no significant difference in the post-test performance of male and female pupils in primary science taught with improvised equipment.

2.3. Significance of the Study

Any teacher who is concerned about his school children is bound to give thought to anything that would help them learn. The findings of this study are expected to benefit;

- (a) all primary/elementary science teachers in all Nigerian primary schools in assessing the potentials of improvisation of local technological instructional media and materials in enhancing students' curiosity for creativity, innovation and use of learning resource within the confines of the classroom and outside
- (b) Learners will interact with the science equipment and materials around our environment it will afford the learner the opportunity to manipulate basic process skills of observation and experimentation in the primary science course
- (c) improvisation of materials helps bridge gaps in course appraisals of contents, enrich existing curriculum and replace teacher-centred instruction
- (d) most of science materials and equipment are very expensive in terms of importation, purchase and maintenance, therefore their substitution with locally produced, inexpensive but effective materials, so as to bring about a reduction in educational cost are of the essence. This would ensure that our classrooms are not lacking in instructional materials.
- (e) Improvisation of materials are usually better suited to the climatic conditions of the local environment
- (f) As observed by [Ekpo and Ushie \(2010\)](#), improvisation would promote local sourcing of instructional materials thus encouraging and sustaining creativity and innovativeness among teachers and learners

2.4. Theoretical Framework

The theoretical framework underlying the design, improvisation and utilization of this study comes from

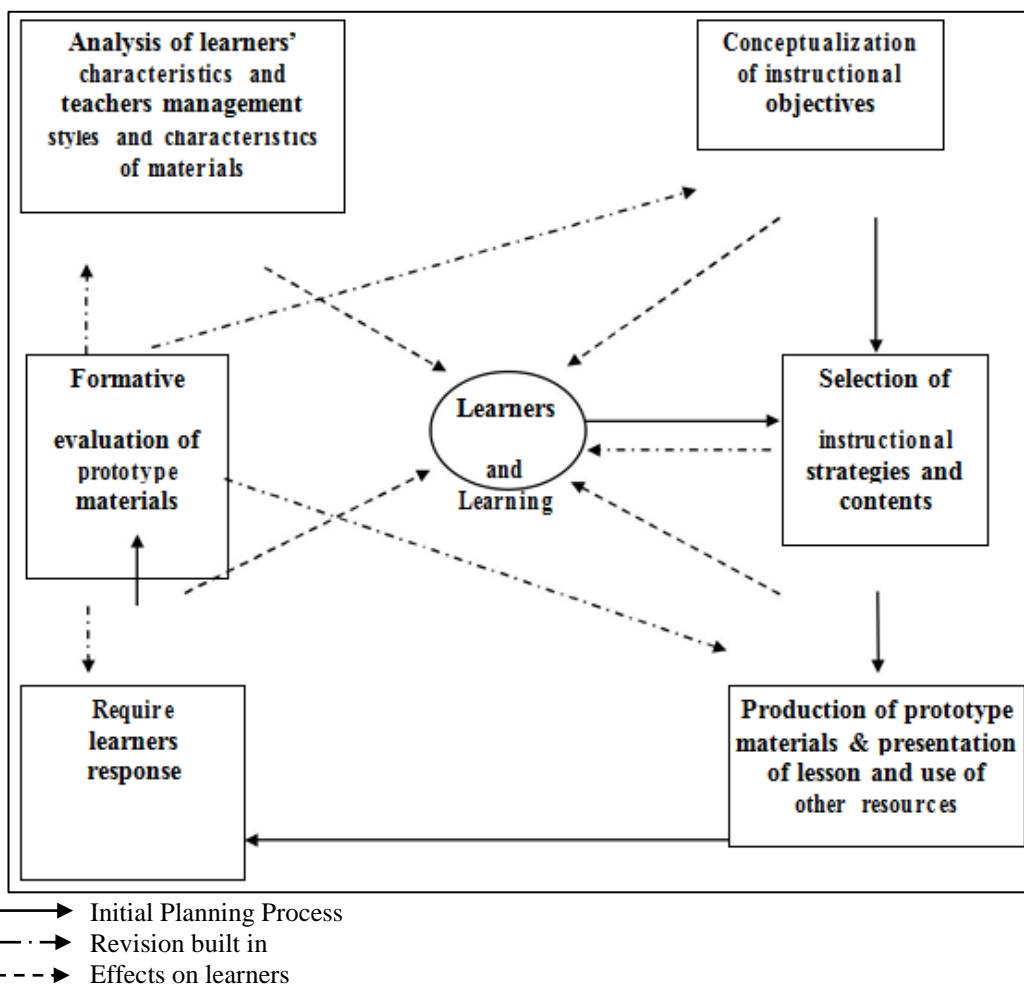
- (a) Application of psychological learning theory
- (b) Constructivist theory
- (c) The materials-first-rational model; an
- (d) The opportunity model of lesson plan.

Application of psychological learning theory: Application of psychological learning theory of relevance in primary science teaching is that of Jean Piaget. Piaget was interested in the theory of cognitive development of children from the ages of zero to a little above 11 years. According to [Piaget \(1970\)](#) in [Onwioduokit \(2013\)](#), children learn best through doing and actively exploring their environment. By implication therefore, science should be taught in such a way that children are occupied by useful activities. The researchers then feel that one of the ways primary pupils would explore and engage by useful activities in their natural environment is through participation in improvisation of low technological tools and device in learning science

Constructivism posited the notion that learners create or construct new knowledge ([Von, 1984](#)). According to ([Nwike and Chukwudum, 2011](#)), learning is therefore seen as an adaptive and experimental process rather than a knowledge transfers activity, ([Richardson, 2003](#)) opined that as learners access information through sense, the construction of new knowledge comes from an interaction of new knowledge between their existing knowledge and new experiences and ideas with which they come in contact in the natural world and their culture. This learning theory provides anchor to the present research since it involves creativity and construction of new knowledge.

2.5. The Materials-First-Rational Model; And the Opportunity Model of Lesson Plan

This study again is guided by the design and production model as described below. The materials first-rational model and opportunity model of lesson plan developed by [Belland \(1981\)](#), revised by [Ibe-Bassey \(1988\)](#) which stipulates that the teacher must organize resources which would facilitate learning among the learners. It encourages the use of events of instruction. The model states that the systematically designed and produced materials can teach on their own. It helps pupils develop the right habit of performing all learning activities in their logical sequences



Materials first rationale model of instructional system component design. Adapted from Ibe-Bassey (1986).

3. Research Design

An experimental research design was used for this study. Specifically, the non-randomised control group pretest-posttest design with an intact class was used. This was appropriate due to the homogeneity and size of the classes under study.

The population for this study included all the primary six pupils in Akwa Ibom State, Nigeria. There are forty-eight public primary schools in Uyo urban with an estimated number of three thousand, three hundred and sixty-eight primary six pupils in the 2011/2012 school year. (State Universal Basic Education Board).

The sample consisted of a total of 219 primary six pupils. Criterion sampling technique was used to select two schools from the target population for the study. The criteria includes:

- (i) Schools with no science laboratory and recommended science equipment
- (ii) Schools with similar geographical locations in terms of urban settings
- (iii) A high population of pupils for two intact classes.

There are two types of instrument used for the study. The first one was the researcher-made lesson notes on primary science developed with an integration of science equipment on some selected topics. The topics and equipment are listed below:

(1) Measurement: Improvisation of scale pan for weighing. Eureka and calibrated beakers for measuring the volume of irregular solids.

(i) Simple laboratory experiments with improvisation of funnels, tripod stand, wire gauze, round bottom flask, retort stand, Bunsen burner and filter paper.

(2) Magnets: Improvisation of nails, discarded wires and battery to make temporary magnets.

(3) Lens: Improvisation of concave/convex lens, magnifying lens using old bulb.

The second instrument was the Primary Science Performance Test (PSPT) which consisted of a total of twenty objective-type questions with five test items from each selected topic. Each multiple type question had four options A – D.

The Notes of Lesson on selected primary science topics were validated by primary science education experts for general expression, depth of content coverage and instructional technique. The Primary Science Performance Test (PSPT) was validated for face, criterion and content by experts in Test and Measurement. The inadequacies were effected in the final form of the instrument. This had to do with the complexity of the test items.

The researcher conducted a test using the split half with odd and even number items as the basis for dividing the items into two groups. The result of gotten from the split half testing was tested using Spearman Brown formula which yielded a reliability coefficient of 0.86 which was accepted as an appropriate coefficient for the study.

3.1. Procedure for Data Collection

The researcher got a letter of introduction from their institutions for the head teachers of the schools selected for the study. The primary six teachers were given orientation on their role in the research and in the utilization of the science equipment. They were given opportunity to utilize the equipment in a pilot study with a different set of pupils not slated for the study. The exercise lasted for four days based on one lesson for each day, since they were four topics. The two intact classes were randomly identified as experimental and control groups. The teacher in the experimental class taught the pupils with the improvised equipment while the teacher from the control groups taught the pupils with the standard equipment. Based on the design of the study, items pertaining to each of the topics on the PSPT instrument was administered on the pupils before and after every lesson. A similar exercise was conducted in the two different schools selected for the study. The data collected from the pre-test and post-test were statistically analyzed using t-test to determine the difference in mean scores. Thus the two hypotheses were tested at 0.5 level of significance.

3.2. Hypotheses One

There is no significant difference in the performance of pupils taught with standardized equipment and those taught with improvised equipment.

Table-1. t-test distribution of mean scores and standard deviation of pupils' post-test performance by type of equipment

Type of Equipment	N	X	SD	DF	t-cal	t-crit	Decision
Standardized (Control group)	114	63.19	9.56				
				2	1.34	2.92	NS
Improvised (Experimental group)	105	62.78	8.79				
<i>NS = Not Significant at 0.05 alpha level</i>							

An examination of [Table 1](#) reveals that the t-calculated (1.34) is less than the critical t-value of (2.92) at 0.05 alpha level. This result shows that the Ho1 which stated that there is no significant difference in the performance of pupils in Primary Science taught with standardized equipment and those taught with improvised equipment is retained.

3.3. Hypothesis Two

There is no significant difference in the post-test performance of male and female pupils in primary science taught with improvised equipment.

Table-2. t-test distribution of mean scores and standard deviation of pupils' post-test performance based on gender

Gender	N	X	SD	DF	t-cal	t-crit	Decision
Male	88	61.46	7.92				
				2	2.12	2.92	NS
Female	131	58.33	8.54				
<i>NS = Not Significant at 0.05 alpha level</i>							

An examination of [Table 2](#) reveals that the t-calculated (2.12) is lower than the t-criteria (2.92) at 0.05 alpha level. This result shows that the Ho2 which stated that there is no significant difference in performance of male and female pupils in the experimental group is retained.

3.4. Findings

The primary objectives of this study was to compare the performance of pupils when taught with standardized and improvised equipment and also compare difference in performance based on gender in the experimental group. The t-test analysis in both cases has shown that there was no significant difference in performance of pupils taught with standardized and those taught with improvised equipment.

The findings of this study confirms the fact that the improvised science equipment utilized under selected topics for this study can add equal value to learning just as standardized equipment as demonstrated in this research. This is in line with [Abdelraheem and Al-Rabane \(2005\)](#), [Udosen \(2011\)](#) and [Ibe-Bassey \(2012\)](#) on the issue that the creation of improvised media of low technological materials and resource control learning can enrich instruction to a guaranteed quality. The problem according to [Ibe-Bassey \(2012\)](#) lies with the teachers' lack of instinct for improvisation of instructional materials.

The findings on gender also indicate that both male and females can benefit from the use of improvised equipment.

4. Conclusions

The following conclusions are arrived at based on the findings from this study.

1. Teaching primary science with improvised instructional materials can add equal value to pupils' performance as the standardized equipment.
2. Both male and female pupils can perform equally under exposure to the use of improvised science equipment.

Recommendations

The following recommendations are advanced for consideration based on the findings of the study:

In primary science, the idea of every classroom teacher teaches all subjects including science whether or not he/she has any knowledge of science, thus, building an improper foundation at that level, should be discouraged.

- (i) Primary school teachers should be given adequate orientation and exposure towards the improvisation of science equipment at the primary school level.
- (ii) The natural resources abound within the school environment should be sourced and kept in laboratories for utilisation by resourceful teachers in teaching primary science in Nigerian schools.
- (iii) The government should organize workshop and exhibition for primary school teachers to equip them with the skills of improvising science equipment at the primary school level.
- (iv) The idea of teaching primary science without practical demonstrations should be discouraged through government intervention, school monitoring and reports.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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