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Teacher's Improvised Instructional Materials and Physics Students" Academic Achievement in Electricity in Secondary School Physics in Uyo LGA

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Abstract
The study is carried out to determine the effect of teachers improvised instructional materials on students' academic achievement in Electricity concept in Secondary School Physics. A pretest post-test quasi-experimental design was adopted for the study. Data were collected using Physics Achievement Test (PAT) from a sample of 80 students, made up of 40 males and 40 females from two (2) public secondary schools. Independent t-test was used in analyzing the data. Findings revealed that there is a significant difference in students' achievement scores taught Physics using teacher's improvised materials and those taught without it, but there is no significant difference in Achievement scores of male and female students taught Electricity concepts with teachers improvised instructional materials. Based on the findings, it was recommended, among others, that officials of the Ministry of Education should organize seminars and workshops to sensitize physics teachers on the significance of teachers improvised instructional materials in physics teaching and learning.

Keywords: Physics, Teachers Improvised Instructional Materials

Introduction

The use of instructional materials is not new in the teaching and learning of science. Early scientists were able to discover many important things as well as teach science efficiently through equipment and other resources produced. Teaching of science requires the use of appropriate improvised instructional materials that will enable learners to understand, retain, and practice the concepts learnt. To achieve effective teaching and learning processes, especially in secondary schools where students assimilate based on what they see, there is a

need for the use of relevant materials, particularly in developing countries where economies are falling drastically (Ekhomien, 2019).

Improvised instructional materials contribute to effective, permanent, and transfer of learning. The teacher talks less while passing an intended message in the class in a more effective and meaningful manner (Ogbandani, 2018).

Improvisation is the process of using alternative materials for enhancing the teaching-learning process where there is an absence of standard instructional materials. According to Ada (2019), improvisation of instructional materials is an attempt to make use of local resources in the teaching-learning process when the ready-made (standard) materials are not available.

Merits of Improvisation

The merits of improvisation include:

i. It makes the lesson relevant to the child in his/her environment.
ii. It suits the learner's local background.
iii. It promotes creativity on the part of teachers and students.
iv. It helps students acquire and develop manual skills.
v. It stimulates students' interest in science.
vi. It reduces verbalization and provokes interest among students.
vii. It should be noted that improvisation requires creativity, curiosity, and perseverance on the part of the teacher (Esu, 2022).

The physics curriculum challenges students to solve problems, think critically, develop experimental and computational skills, and exposes them to several methods of teaching and learning. These include demonstration, lecture, discussion, discovery, laboratory, and activity-based learning depending on the aspect the teacher wants to teach (FME, 2017).

Physics is the study of matter, energy, and the interaction between them. The aim of physics is to understand how nature works by applying scientific methodologies.

The objectives of physics as identified by FME (2013) are to enable learners to:

1. Develop interest in science and technology.
2. Acquire basic knowledge and skills in science and technology.
3. Apply scientific and technological knowledge and skills to meet contemporary societal needs.
4. Take advantage of the numerous career opportunities provided by science and technology.
5. Become prepared for further studies in science and technology.
6. Avoid drug abuse and related vices.
7. Be safety and security conscious.

Attainment of these objectives is very crucial and required a teacher who use learner-centered teaching approaches since learning takes place when learners are actively involved during teaching/learning interactions. Hence, the challenges before the teacher is how to bring about meaningful teaching that will engender meaningful learning (Novak, 2002). In doing this task of teaching, the teacher should take into consideration the construction of instructional facility to help develop learners, higher intellectual skills and in turn serve as anchorage of the material to be learnt.

The physicist attempt to describe the interaction with the most fundamental and general law or principles possible. The aim of physics is to understand how nature works by applying scientific methodologies, to the understand the most fundamental principles of nature, matter and energy and how they interact.

The study of electricity as embedded in the senior secondary school curriculum is important because electricity plays a key role in the modern world. The workings of most modern appliances such as radio, television, computers, calculators, refrigerators, air conditioners, sound systems, and electric fans are possible as a result of electricity (Okeke, 2001).

This concept at the secondary school level is considered difficult, abstract, and symbolic. Students' ability to manipulate symbols and use them to reason is necessary for success in electricity concepts in physics (Fisher, 2018).

Electrical energy is a form of energy resulting from the flow of electric charge. Energy is the ability to do work or apply force to move an object. In the case of electrical energy, the force is is electrical attraction or repulsion between charged particles. Electrical energy may either be potential energy or kinetic energy, but it is usually encounter as potential energy, which energy stored due to the relative positions of charged particles or electric field. The movement of charge particles through a wire or other medium is called current or electricity. It may be potential or kinetic energy, but it is usually encountered as potential energy, which is energy stored due to the relative positions of charged particles or an electric field. The movement of charged particles through a wire or other medium is called electric current or electricity.

There is also static electricity which form an imbalance or separator of the positive and negative charges on an object. Static electricity is a form of electrical potential energy. If sufficient charge builds up, the electrical energy may be discharged to form a spark (or even lighting) which has electrical energy. By convention, the direction of an electric field is always shown pointing in the direction of a positive particles and would move if it was placed in the filed because the most common current carrier is an electron, which moves in the opposite direction compared with a proton.

Examples of electrical energy includes energy used for electric power, such as wall current used to light bulb or power a computer, is energy that is converted from electric potential energy. This potential energy is converted in other forms of energy such as heat, light

and mechanical energy. For a power utility, the motions of electrical potential. The battery is another source of electrical energy, except the electrical charges may be ions in a solution rather than electrons in a metal.

Biological systems also used electrical energy, for example, hydrogen ions, electrons, or metallic ions may be more concentrated on one side of a membrane than the other, setting up an electrical potential that can be used to transmit nerve impulse, move muscles and transport materials.

Specific examples of electrical energy include:

1. Alternating Current (AC)
2. Direct Current (DC)
3. Lightning
4. Batteries
5. Capacitors

Energy generated by electric cells, the SI unit of potential difference or voltage is the volt (V). This is the potential difference between points on a conductor carrying one ampere (IA) if current with power of one watt (1W). However, several units are found in electricity include

SI Units in Electricity

Quantity	Unit	Symbol
Electric Power (P)	Watt	W
Capacitance (C)	Farad	F
Inductance (L)	Henry	H
Electric Charge (Q)	Coulomb	C
Energy (E)	Joule	J
Energy (Electrical)	Kilowatt-hour	kWh
Potential Difference / Electromotive Force	Volt	V
Frequency (F)	Hertz	Hz

Physics as a subject involves problems soling and thus require more reasoning capabilities and abstract pattern recognition as well as manipulation os symbolic relationship (Gardener, 2013). This can only be acquired through the use of teacher's improvised instructional material because students would always, remember what they saw and also retain those concepts taught to them, students require some form of stimulus to activate, provide direction for and encourage persistence in their study and learning effort (Yusuf, 2023). Onarwie (2016) pointed out that there is a significant effect of teachers' improvised materials on students retention in physics classrooms.

On the influence of sex on academic performance in physics test, Mamdu, (2019) found that exposing students to teachers improvised instructional materials yield better academic performance and retention for male students than their female counterparts.

Gender issues and academic achievement have become an important issues among researchers. There is an acknowledge problem of female under achievement when compared with their male counterparts apparently under equivalent conditions and this problem of female underachievement appear to be more pronounced in science (Worgu, 2014).

Anaso, (2008) observed that there is a number of conflicting conclusions about gender-related difference in achievement in physics. Tyler (2015) in a separate study found out that boys, clearly performed better than girls in physics test. Macoly and Jacklin (2017) acknowledge the superiority of males over females when he noted that in all test, boys obtained higher retention scores than girls at 0.01 levels.

However, despite the significance of teachers made instructional material on students retention in physics the subject has been played with phenomenon of poor external results and this ahs become a source of worry to successive government and major stakeholders in education sector in the country (Mamdu, 2015).

In 2022, the percentage of students who passed WAEC with credit in physics was below 50% (Okpala, 2023). The same poor performance ratios were recorded in subsequent years of 2023 and 2024. This ugly trend has instigated the current worry among stakeholder as to the factors responsible for poor performance of students in physics and other inability to retain physics concepts embedded in the curriculum (Owolabi, 2018). Outside Nigeria, a smiliar trend of poor retention in pphysics has been observed (Oliver, 2008; Swatton and Taylor, 2014). The poor retention indicated that students have learning difficulties in acquiring physics thought-processes and skills. The evidence from these studies seem to suggest that physics classrooms may not be providing students with adequate physics skills to enhance their performance in the subject. the study seeks to answer the question; would physics students taught with teachers improvised instructional materials obtained higher retention scores in electricity concept than those taught without it?

Purpose of the study

The study seeks to examine the effect of teacher's improvised materials and physics students retention.

Research Hypotheses

The following null hypotheses were formulated to guide the study:

1. There is no significant difference in the retention scores of students taught electricity concepts in physics using teachers' improvised materials and those taught without them.

2. There is no significant difference between the retention scores of male and female students taught electricity concepts in physics with teachers' improvised materials.

Methodology

The study was carried out in Uyo Local Government Area of Akwa Ibom State. It has Akwa Ibom State capital since 1987. Uyo lies between 7º213 and 7º331 north and longitudes 8º 480 and 9º841 east, it has a population of over 350,000 inhabitants (National Population Census, 2006). It is bunded in the north by Itu, on the south by Ibesikpo Asutan, on the west by Nsit Ibom/Etinan and on the east by Uruan, the major indigenous language is Ibibio. The research design used for the study was quasi-experimental. In a particular the pretest and post-test design was used.

This is suitable because it provides the students with same assessment measure before and after treatment in order to determine if any changes can be connected to the treatment and also to make it possible for equivalent groups to be compared. The population of the study is made up of all 1009 senior secondary two physics students in all the public secondary schools in Uyo Local Government Area for the 2025/2026 academic year. Out of the thirteen (13) secondary schools in Uyo Local Government Area two schools were randomly selected with two streams per school. The criteria for selection were:

1. Presence of physics laboratory where meaningful teaching-learning could be carried out and
2. Quality of teacher teaching physics because only qualified teachers were used.

Furthermore, twenty (20) students in two intact classes were assigned to experimental (E) and control (C) groups. Experimental and control groups were made of 40 students each comprising of 20 males and 20 females respectively. Physics retention test (PRT) was constructed by the researcher and used for the study this was a twenty (20) item achievement test. The questions were drawn from the physics concept area of electricity. The questions were multiple choice test with options A to D. the PRT was validated by a three-man team of experts in science education department of the University of Uyo, Uyo to ensure the instruments measures what is supposed to measure the reliability of the instrument was detained using the test-retest method. The instrument was administered to twenty (20) SS2 students who were not part of the sample.

Pearson Product Moment Correlation (PPMC) analysis was used in establishing the reliability coefficient. The reliability index was 0.89. The PRT was scored by the researcher after administration. Each of the items on the PRT was scored 5 marks for a correct answer and the maximum obtained score for each respondent was 100 marks

Research Procedure

A pretest was administered to two groups. This was to determine the entry behavior of students in terms of what they had already know about what is to be taught and to determine

whether or not the two groups to be compared are equivalent. In each schools, two teachers were assigned to experimental and control groups to each students. For the experimental group, the teacher taught the students the concept of electricity using teacher improvised materials while the other teacher assigned to the control group taught the same concept but without teacher improvised materials.

The teaching period lasted for two weeks. At the end of the teaching period, a post-test was administered to the students. Then two week later, a retention test was administered on students which was meant to determine the amount of content materials the students were able to retain after a period of two weeks. A total of 40 SS2 students comprising 20 males and 20 females obtained in each school formed the sample in each of the schools. This made a total of 80 students in the two schools.

Results

t-test statistical techniques was used to test the two hypotheses formulated for the study at 0.05 level of significance.

Testing of Null Hypotheses

Null Hypothesis 1: There is no significant difference in the retention scores of students taught electricity concepts in physics using teachers' improvised materials and those taught without it

Table 1: Difference in the retention scores of physics students taught concept of electricity using teacher's improvised materials and those taught without it.

Group	N	X	SD	Df	S^2	t-cal	t-crit	Decision
Experimental	40	48	10.5		110.25	2.05	1.96	*
Control	40	42	11.3	78	127.69			

***NB:** * = significant at 0.05 level*

The result in Table 1 showed that calculated t-value of 2.05 was greater than the critical t- value of 1.96 for a degree of freedom of 78 at 0.05 level of significance. Hence, the hypothesis is rejected thus implies that there is a significant difference in retention of physics students taught electricity using the concept of teacher's improvised materials and those atught without it.

Null Hypothesis 2: There is no significant difference between the retention scores of male and female students taught electricity concepts in physics with teachers' improvised materials.

Table 2: Effect of gender on retention of students in electricity concepts when taught using teachers improvised materials

Gender	N	X	SD	Df	S^2	t-cal	t-crit	Decision
Male	20	51	2.9		8.41	1.22	2.04	NS
Female	20	45	3.5	38	12.25			

NB: *NS = No significant at 0.05 level*

The results showed that the calculated t-value (1.22) is less than critical t-value (2.04). Therefore, the hypothesis is upheld. This means that there is no significant difference in the retention scores between male and female physics students taught electricity concepts with teacher's improvised materials.

Discussion of Findings

Difference in the retention scores of physics students taught with and without a teacher improvised instructional materials.

Table I the results showed that the t-cal (2.04) was greater than the critical t-value (1.96). Thus, the hypothesis was rejected. The implication here is that there is a significant difference in the retention score of physics students taught electricity concept in physics using teacher's improvised instructional materials. The results is corroborated by (Ogbandani, 2018) who asserted that teacher's improvised instructional materials contribute to effective permanent and transfer of learning message in the class in a more effective and meaningful manner.

Influence of gender on students retention in physics

In Table 2, the test analysis carried out indicated that there was no significant difference in the retention scores between male and female physic students taught electricity concept with teacher's improvised instructional materials. The hypothesis was upheld. This implies that the male (51) and female (45) students mean scores obtained in PRT were not statistically different after learning electricity concept using teacher's improvised instructional materials. This is contrary to the study done by Macoby and Jacklin (2017) who acknowledge the superiority of males over females when he noted that in all test, boys obtained higher retention scores then girls at 0.01 levels.

Conclusion

Based on the results the study concludes that the physics students taught electricity concepts in physics using teachers improvised materials obtained higher retention scores than their counterpart taught with it. Also, male and female students taught electricity concepts with a teacher improvised materials do not differ in their retention scores in electricity concepts in physics.

Recommendations

The following recommendations were made:

1. The officials of Ministries of Education should organize seminars and workshops to sensitize physics teachers on the significance of improvised instructional materials in physics classroom.
2. Schools, parents, and communities must seeks ways of sustaining the performance of students' in this all-important subjects.
3. Physics textbooks should adopt more problem-solving approaches.

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