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Effects of Improvised Standard Instructional Materials on Interest and Academic performance of Senior Secondary Biology Students' in Bauchi State, Nigeria

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This study investigated the Effects of Improvised Standard Instructional Materials on Interest and Academic performance of Senior Secondary Biology Students' in Bauchi State, Nigeria. Three research questions andhypotheses guided the study. The study was Quasi-Experimental design, it employed a pre-test post-test non-equivalent control group design was adopted in the study. The population for the study consist of all senior secondary school II students in all the thirty (30) Senior Secondary Schools in Bauchi Educational Zonal, which was nine thousand, six hundred and nine (9,609), The sample size was made up of 202 SS II Biology students obtained from random sampling. The instruments for data collection were the Biology Performance Test (BPT) and Digestive System Interest Inventory (DSI)constructed by the researcher and validated by three experts, one from measurement and evaluation and two from Biology Education, the instrument was Pilot tested with reliability coefficient of r= 0.84. Similarly, the Cronbach Alpha was used to determine the reliability index of Digestive System Interest Inventory (DSI) which was estimated to be r=0.75. The data collected using the BPT and DSI instruments were analyzed using mean and standard deviation in answering the research questions. T-test at an alpha level 0.05 was used in testing the hypotheses that guided the study. The result of the study indicated that students taught Biology using improvised materials performed better than those taught standard ones. Based on the findings, it was recommended that the state, federal government and other stakeholders in Education should help in training and re-training of science (Biology) teachers by organizing, conferences, seminars and workshops for both the old and newly recruited science teachers on improvisation of instructional materials.

Keywords: Improvised Instructional material, Interest, Academic Performance, Biology, Senior secondary students.

Background of the Study

The objectives of the Biology curriculum according to the National Policy on Education is to prepare students to acquire adequate laboratory and field skills in Biology, meaningful and relevant knowledge in Biology, the ability to apply scientific knowledge to everyday life in matters of personal and community health, agriculture and reasonable functional scientific attitude. In pursuance of the stated objectives, the contents and context of the curriculum places emphasis on field studies, guided discovery, laboratory techniques and skills along with conceptual attitude (Federal Ministry of Education, 2009). To achieve these grand objectives of the Biology curriculum, emphasis should be placed on the teaching and learning process which cannot be effectively carried out without interaction between the teacher, students and instructional materials in order to allow students develop their highest potentials (Pratoomtong, 2011). Instructional materials are materials used in teaching and learning situations to motivate, guide, and enhance teaching and learning. Instructional materials can be viewed as devices through which knowledge, skills, attitude, interest, ideas, beliefs and values are transmitted to the learner by the teacher in order to make teaching and learning process easier (Awolaju, 2016). Instructional materials are intermediate or mediating materials used in instruction or teaching learners to make the learning objectives clearer and teaching easier (Iyunade, 2014). That is why Oshinowo (2016) opined that instructional materials constitute one important media which teachers at all levels of education should employ to encourage and promote effective teaching and learning. Instructional materials facilitate teaching and learning activities when properly used. They include all forms of materials and equipment such as textbooks, workbook, chart, magazines, maps, journal, and periodical, pamphlets, newspaper and posters . Instructional materials also include non- printed materials like strips, slides, pictures, audio and video tapes, radio, televisions transparencies and globe, various science

apparatus, chemicals as well as computers and live specimens.

The importance of instructional materials in teaching and learning cannot be over emphasized. Otor, Ogbeba and Ityo (2015) recognized that teachers who use improvised instructional materials are likely to be more successful in impacting knowledge than those who do not, as they are indispensable tools in the teaching and learning process. Enohuean (2015) agreed with the fact that instructional materials enhance the quality of instruction and provide direct sensory experience of seeing, touching, hearing and smelling which are necessary ingredients for understanding and learning. Instructional materials are resources that make teaching and learning easy, stimulate interest of the learners and help teachers to impact knowledge to students without much stress, if adequately provided and used correctly.

Musah and Bah (2017) reported that resources for teaching Biology in secondary schools in Nigeria are inadequate. They further stated that the available ones are not usually in good conditions. Based on this, Muhammad and Lawal (2015) emphasized the need for improvisation of instructional materials to make-up for this inadequacy in teaching Biology. In general terms, improvisation of instructional materials is an attempt to adapt and make use of local resources in teaching-learning process when the standardized materials are not available or are in shortfall or not within the reach of users.

According to National Teachers' Institute (2009), improvisation is the making of substitutes from local materials found at home or school premises when the real or original materials/equipment are not available and that improvised materials should be able to convey special instructional messages just as the original material. Mberekpe (2013) opined that improvisation in the context of biology can be seen as the process of using alternative resources for enhancing biology teaching in the absence of standardized instructional materials. In the process of improvisation, the teacher initiates the production of the improvised instructional materials which is constructed by teachers, students or local artisans.

Ayanwu and Alafiatayo (2015) reported that less than average number of teachers improvised instructional materials for use when teaching. They also observed that male teachers' perception of improvisation of instructional material was significantly higher than their female counter part. Some teachers exhibited a negative attitude towards the use of locally made instructional materials for various reasons. To this category of teachers, the use of self-made materials is burdensome, time consuming and that such materials are of poor quality while those that perceive their use positively prefer them to the imported ones because they are relatively cheaper, often up-to-date in content, readily available, customized according to specification to meet the objective of the lesson as well as involve both teachers and students in realistic problem-solving activities (Ekpo-Eloma, Arikpo&Effiom, 2013).

The use of improvised instructional materials from resources available in the student's immediate environment for instruction could bring students to real world of activities by making them to be actively involved throughout teaching and learning process, also handling and use of these improvised instructional materials, could help them gain scientific skills. As stated by Federal Ministry of Education (2009) that the provision and use of improvised instructional materials for teaching will lay a sound basis for scientific and reflective thinking among students which will enhance understanding to boost students' participation during teaching and learning activities thus, increasing the likelihood of interest on the topic being discussed.

Adodo and Gbore (2012), found that interest in biology is the strongest factor for predicting performance among students in their different ability levels. Therefore, usage of good innovative methods by the teachers to stimulate and sustain students' interest is paramount to ensuring meaningful learning of Biology. Aggrawal (2010), defines interest as a powerful dictator and motivator in the learning process. He added that students are likely to pay attention to learn, remember, imagine and read more readily when their interests are positively provoked. Moreover, he identified factors known to affect interest of students to include personal, socio-economic and environmental factors. To Mazer (2012), students' interest can be triggered in the moment by certain environmental factors such as teachers' behaviour. He also discovered that positively provoked interest heightens a students' attention, which makes it easier to encode more information.

In view of the problems encountered by students in learning biology, a number of factors have been identified to be responsible for the poor academic achievement of students in Biology, from the various studies conducted in Nigeria. These include lack of motivation for teachers, poor infrastructural facilities, inadequate and improper instructional materials, attitude of students to learning, poor teaching skills and insufficient opportunities for professional development for science teachers, (Awolaju, 2016; Olayinka, 2016; Oshinowo, 2016). Shortage of fund for purchase of equipment and material for effective practical work especially in large class size, is also a major problem that is hindering the use of instructional materials in teaching and learning of biology. Some other researchers also attributed the low level of students' achievement in examination to non-availability or inadequate supply of teaching materials. Further studies show that "lack of resources for effective practical in science, teaching and learning could contribute to poor state of students' achievement in science subjects including biology (Oshinowo, 2016). In addition, gender is another factor that is also considered to have significant effects on students' academic achievements in sciences especially as it has to do with hands-on activities (Ajayi & Ogbeba, 2017).

Gender issue has been the concern of all classes and groups of people all over the world especially researchers and educators. The issue of gender is considered based on certain facts, such as social and cultural beliefs, pattern of life and priorities of individuals. In the colonial days, boys were allowed to attend school while girls remained in the house to

do house chores. Today, girl child education still suffers some setbacks due to some negative factors. Enohuean (2015) asserts that poor performance of some female students is attributed to certain factors such as negative and discouraging attitudes of parents to the ideas of women engaging in “male careers” such as engineering

Statement of the Problem

The teaching of Biology cannot be effectively carried out without interaction between the teacher, students and the instructional materials. This is because Biology as a subject is resource intensive and Biology curriculum is planned to enable the teacher use activity oriented, child-centered approach to teach (Igwe, 2013). However, the instructional materials required for effective teaching and learning of biology in our secondary schools are inadequate and in some cases; totally lacking. The available ones are obsolete and/ or non-functional (Musah& Bah, 2017). The concomitant effects of inadequate instructional materials are clearly seen in poor academic achievement in external examinations, decreasing interest on learning Biology at all educational levels and so many science students deserting science courses in tertiary level of education (Aina& Philip 2013; Isola, 2010; Esiobu, 2005; Hasni&Potvin, 2015 and WAEC Chief Examiner’s Report 2014-2017).

Although, studies have been conducted on improvisation and the effect of improvised instructional materials on academic achievement but to the best of my knowledge little or no studies have been conducted on Improvisation based on the Digestive system, as Students were unable to answer questions on Digestive System (WAEC Chief Examiners Reports, 2014-2017). In view of the above the researcher wishes to find out the effects of Improvised Instructional Materials on Interest and Academic performance of Senior Secondary II Biology Students’ in Bauchi State, Nigeria.

Research Questions

The following research questions were formulated to guide this study:

i. What is the influence of improvised instructional material on academic performance of SS II biology students?
ii. What is the influence of improvised instructional material on academic performance in Biology among male and female SS II biology students?
iii. What is the influence of improvised instructional material on interest of SS II biology students?

1.5 Hypotheses

The following null hypotheses were formulated and tested at $p \leq 0.05$ level of Significance.
$H0_1$: There is no significant difference between the mean performance scores of SS II students taught biology using improvised instructional material and those taught without instructional material.
$H0_2$:There is no significant difference between the mean performance scores of male and female SS II students taught biology using improvised instructional materials
$H0_3$:There is no significant difference in the mean interest scores of SS II students taught biology using improvised instructional material and those taught without instructional material.

RESEARCH METHODOLOGY
Research Design

The study was quasi-experimental design. Specifically, the study applied pre-test post-test non-equivalent control group design.

Area of study

The study was conducted in Bauchi State. Bauchi is the Capital of Bauchi State, in Nigeria. Its geographical coordinates are 10° 18' 57" North, 9° 50' 39" East and its original name (with diacritics) is Bauchi.

Population of the study

This study target population comprised of all SS II Biology students in all the thirty (30) Senior Secondary Schools in Bauchi Educational Zone. The population consists of nine thousand, six hundred and nine (9,609), (Bauchi State Ministry of Education, 2017/2018 academic records).

Instrument for Data Collection

The instrument for data collection for this study was the Biology Performance Test (BPT) and Digestive System Interest Inventory (DSI). Items for the BPT were constructed by the researcher and it consisted of thirty (30) multiple choice questions which is the most widely acceptable objective test because of its flexibility in measuring both simple and complex learning outcomes. The BPT was constructed based on Senior Secondary School Biology Syllabus in Digestive System, WAEC Syllabus and table of specification. This is because Students were unable to answer questions on Digestive System (WAEC Chief Examiners Report, 2014-2017). The Biology Performance Test was used to assess the students' academic performance while the (DSI) was used to determine the interest of the students on digestive system which was adapted from Ogbonna (2014).The instrument was a four (4) point likert scale type containing twenty five items. The rating scales were; Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1).

Development and Validation

The thirty Biology Achievement Test (BPT), which consists of two sections, Section A for personal information and B for Test items, was validated by three experts, Two experts in biology education and one in test and measurement in the department of educational foundation ATBU.

Data Analysis

Mean and standard deviation was used to answer the research questions while t-test was used to test the null hypothesis at P≤0.05 level of significance to compare the mean values of the experimental and control groups. The Digestive System Interest Inventory (DSI) coding was done using recoding of negatively worded statement in the Interest Inventory as follows. Strongly Agree (4) =1, Agree (3) =2, Disagree (2) =3 and Strongly Disagree (1) =4.

RESULTS OF THE STUDY

Research Question One

What is the influence of improvised instructional material on academic performance of SS II students?

Table 2: Post-Test Mean Scores of the Experimental and Control Group

Group	N	Mean	SD	Mean Difference
Experimental Group	104	18.49	4.7	3.92
Control Group	98	14.57	2.7	

Table 2 shows the result of post-test mean performance scores of experimental and control groups on digestive system. The result revealed that students in the experimental group had a mean score of 18.41 higher than that of their counterparts in the control group who had a mean achievement score of 14.57 after exposure to teaching using improvised instructional materials. The mean differential is high (3.92) indicating that improvised human digestive system improved students' performance in digestive system, in favor of the experimental group.

Research Question Two

What is the influence of improvised instructional material on academic performances in Biology among male and female SS II students?

Table 3: Post Test Mean Scores of Male and Female Students in the Experimental Group

Group	N	Mean	SD	Mean Difference
Male	53	15.60	4.37	5.89
Female	51	21.49	2.95	

Table 3 reveals that male and female students in the experimental group had mean performance scores of 15.60 and 21.49 respectively after being taught digestive system with improvised instructional material. The mean performance score for female in the experimental group is higher than that of male students in the experimental group. However, the females performed better than their male counterpart. This is attributed largely to the fact that they were taught digestive system using improvised instructional material.

Research Question Three

What is the influence of improvised instructional material on interest of SS II biology students?

Table 4: Post-Interest Mean Scores of the Experimental and Control Group

Group	N	Mean	SD	Mean Difference
Experimental Group	104	80.39	7.80	8.82
Control Group	98	71.57	8.69	

Table 4 Shows that Student in the experimental group had a mean interest scores of 80.39 after exposure to improvised instructional material. Similarly, the findings for the control group revealed that students had mean interest scores of 71.57, with a mean difference of 8.82 indicating that students' interest was improved using improvised instructional material during the instruction.

RESULTS OF HYPOTHESES TESTING

Hypothesis One

There is no significant difference between the mean performance scores of students taught Biology using improvised instructional material and those taught without instructional material.

Table 6: t-test Analysis of the Post-Test Mean Scores of the Experimental and Control Group

Variable	N	Mean	SD	t	Df	P	Decision
Experimental Grp.	104	18.49	4.75	7.15	200	.000	Sig
Control Group	98	14.57	2.70				

Decision Rule: reject H_0 if $p < .05$ otherwise accept

Table 6 shows the t-test results on the significant difference between the post-test mean scores of students' performance in digestive system after exposure to diorama. The result showed that P = 0.000, since P<0.05, it implies that the H_o was rejected. Based on this, the conclusion was that there is a significant difference in the mean scores of students' performance after exposure to improvised instructional material. Furthermore, since the probability value was (P= 0.000) was less than 0.05 (P<0.05), it implies that the treatment has a significant effect on students' performance in digestive system when exposed to improvised instructional material.

Hypothesis two

There is no significant difference between the mean performance scores of males and female SSII students taught Biology using improvised instructional material

Table 7: t-Test Analysis of the Post Test Mean Scores of Male and Female Students in the Experimental Group

Variable	N	Mean	SD	t	Df	P	Decision
Male	53	15.60	4.37	-8.02	102	.000	Significant
Female	51	21.49	2.95				

Decision Rule: reject H_0 if $p < .05$ otherwise accept

Table 7 shows the t-test results on the significant difference between the post-test mean scores of male and female students' performance in digestive system when exposed to improvised instructional materials. The result showed that P = 0.000, since the probability was less than 0.05 (P<0.05), it implies that gender has a significant effect on students' performance in digestive system when exposed to improvised instructional material. Hence, we can say that improvised instructional does increase students' performance scores in digestive system in favor of the female students.

Hypothesis 3

There is no significant difference in the mean interest scores of SS II students taught biology using improvised

instructional material and those taught without instructional material.

Table 8: Summary of t-test Analysis of the Post Interest Mean Scores of the Experimental and Control Group

Variable	N	Mean	SD	t	Df	P	MD	Decision
Experimental Group	104	80.39	7.80					
				7.60	200	.000	8.82	Significant
Control Group	98	71.57	8.69					

Table 8 revealed that the result of t-test for independent sample conducted on students' interest in digestive system in the experimental and control groups. From the result, statistically significant difference exists in the interest mean scores of students in the control and experimental groups. The mean interest scores for experimental group (Mean =80.39; SD = 7.80), control group (Mean = 71.57; SD = 8.69) with a mean difference of 8.82. Since the P-value (0.000) was less than 0.05 level of significance, the null hypothesis was rejected. It indicates that the mean interest scores of SS II biology students were statistically significant.

DISCUSSION OF FINDINGS

The findings of the study as revealed from the result of post-test means performance scores of experimental and control groups on digestive system. The result revealed that students in the experimental group had a higher mean score than that of their counterparts in the control group after exposure to teaching using improvised instructional materials, indicating that improvised instructional material of human digestive system improved students' performance in digestive system. This implies that students exposed to improvised instructional material did significantly perform better than their counterparts who were not with improvised material. Therefore, an improvised instructional material enhances students' achievement.

This study is similar to that conducted by Ogbole and Uka (2014); Otor, Ogbeba and Ityo (2015); Ikwuka and Usifoh (2016);Osinowoh (2016); Omiko and Oketa (2017); Ubawuike (2018) who reported that students who were taught with improvised instructional materials outperformed their counterpart who are not without instructional material. Likewise, Eze (2017) study showed that academic achievement was influenced by the use of improvised instructional materials.

Hence, it can be said that diorama does increase students' performance scores on digestive system. This study is also in line with Eze (2017) study that showed that academic achievement is influenced by the use of improvised instructional materials.

The result also reveals that male and female students in the experimental group had mean performance than those in the control group. Generally, the performance in the experimental group is better than the control group for both males and females. This is attributed largely to the fact that they were taught digestive system using improvised instructional materials. Meanwhile, the results indicate that female participants performed better than the males.

The finding is supported by that of Owodunni and Ogundola (2013); Okwara, Anyagh and Ikyaan (2017) who indicated that the female students performed better than male students in the test for retention of learning. However, researchers such as: Omwirhiren (2015), Daluba (2013); Otor, Ogbeba and Ityo (2015); Osinowoh (2016) had a contrary report that male students had higher mean achievement scores than their female counterparts in Biology while Bichi, Hafiz and Abdullahi (2017) added that gender difference exists in science achievement in general. Contrarily, Nbina and Avwiri (2014) reported that gender has no effect on students' achievement in science.

More so students in the experimental group had a higher mean interest scores than those in the control group after exposure to improvised instructional material. Similarly, Table 8 revealed that the result of t-test for independent sample conducted on SS II biology students' interest in digestive system in the experimental and control groups. From the result, statistically significant difference exists in the interest of the SS II biology students in the control and experimental groups. However, this indicates that interest of students in the experimental group is higher than that of the students in the control group which is in line with Adodo and Gbore (2012) who opined that, interest is a good predictor of students' academic performance.

With regards to the interest the study reveals that male and female students in the experimental group had a higher mean interest scores after exposure to improvised instructional material. Indicating that female students' had a higher mean interest than the males when exposed to improvised instructional material.

Also the t-test results on the significant difference between the post-test mean scores of male and female students' interest in digestive system when exposed to improvised instructional material implies that gender has a significant effect on students' interest in digestive system when exposed to improvised instructional material. Hence, we can say that improvised instructional materials do increase students' interest in digestive system.

The findings of this study is however contrary to that of Chinwe and Alphonsus (2014) who indicated that male students developed more interest in biology than female students. Also Audu (2018) reveals that students who were taught Biology using student centered teaching styles had a higher interest rating than those taught using the teacher

centered teaching styles.

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RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made.

a. That adequate orientation should be given to teachers on how to improvise alternatives to real objects in order to improve the quality of teaching.
b. The need to update teacher's knowledge on materials for teaching of Biology and acquaint them with other new innovations is also to be enhanced. This could be made possible by providing funds for teachers to attend seminars, workshops, conferences such as Science Teachers Association of Nigeria (STAN) and in-service training for Biology teachers.
c. The teachers should make use of different instructional materials as long as they are relevant to their lesson content.
d. There is also the need for the teachers to be resourceful in materials selection and planning. This is to reduce the cost of production and maintenance of instructional materials; local production and improvisation have always been a positive step towards the realization of this suggestion.
e. The government, non-governmental organizations (NGOs) and the PTA should contribute financially to the promotion of improvisation of instructional materials in secondary schools; colleges of Education and Universities

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