JOSTMED 9 (2), APRIL, 2013 ISSN: 0748 – 4710

# JOURNAL OF SCIENCE, TECHNOLOGY, MATHEMATICS AND EDUCATION (JOSTMED)

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jostmed@futminna.edu.ng
Phone: +234-816-680-7534

Technology for Empowerment

PUBLISHED BY:
DEPARTMENT OF SCIENCE EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA,
NIGERIA, AFRICA

# EFFECTS OF IMPROVISED HUMAN LIVER MODEL ON ACADEMIC ACHIEVEMENT IN BIOLOGY AMONG SENIOR SECONDARY STUDENTS IN KONTAGORA, NIGER STATE, NIGERIA.

**Idris, U. S. B.**
Science Education Department,
School of Technology Education,
Federal University of Technology, Minna
**Phone No:** +2348065378781
**E-mail:** haumar2008@gmail.com

**Abstract**
*The study sought to investigate the effects of improvised human liver model on academic achievement in liver structures and functions among senior secondary schools in Kontagora, Niger State. Three co-educational schools were purposefully selected for the study among the 14 senior secondary schools in Kontagora Local Government Area. Pre-test, Posttest, Experimental and Control Group Design was used for the study. One hundred and twenty Senior Secondary (SS) Year III students comprising of forty students (20 males and 20 females) were randomly selected from each sampled school which gave a total number of 60 males and 60 females from the population of 2.392 (SS III) students. Sixty students (30 males and 30 females) were randomly assigned to the experimental group and the same proportion to the control group. Two hypotheses were formulated and tested at 0.05 level of significance. Experimental group was taught with the improvised model while the Control group was taught with the conventional method. Posttest results revealed that there was significant difference in the mean achievement between the experimental ($\bar{X}$=17.78) and the control ($\bar{X}$=11.08) groups ($t_{cal}$ =-10.47, df = 118, p < 0.05) No significant difference was found between males ($\bar{X}$ =17.86) and females' ($\bar{X}$=17.70)achievement in the experimental group ($t_{cal}$ =.230, df = 58, p > 0.05). It was concluded that improvised models are important tools for effective teaching and learning of Biology concepts. It was recommended among others that biology teachers should improvise and utilize models in teaching and learning of biology contents.*

**Keywords:** Liver model, Improvisation, Academic Achievement, Poor Performance

## Introduction

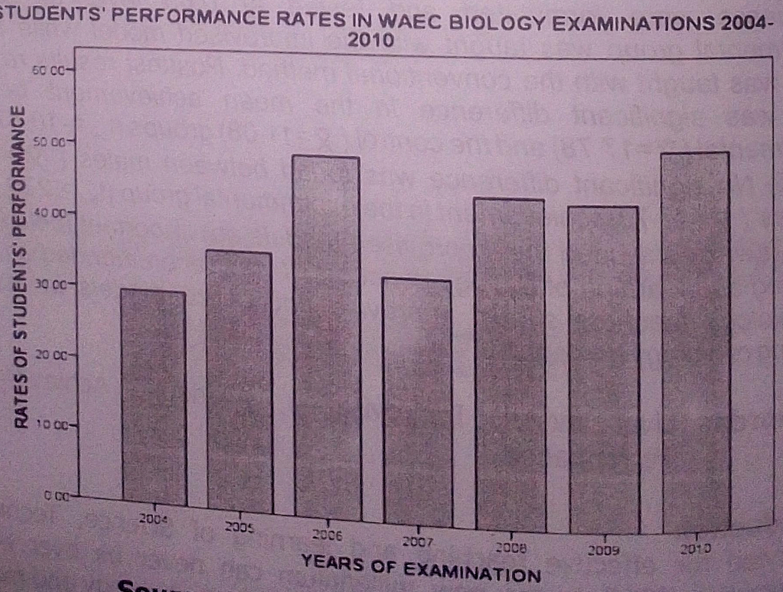
The need for effective teaching and learning of Science, Technology and Mathematics (STM) in the new millennium can never be over emphasized. Through effective teaching and learning of science technology and mathematics,

the dynamic global challenges among which include global warming (Michael & Stephen, 2009), food (UMS,2012) and human security (fellowships,2012.) could be addressed.

The development of science and technology over the years are associated with the teaching and learning of the basic science subjects in secondary schools such as Physics, Chemistry, Biology, Agricultural Science and Geography. At tertiary level, they are made to constitute disciplines like Medicine, Engineering, Architecture, etc.

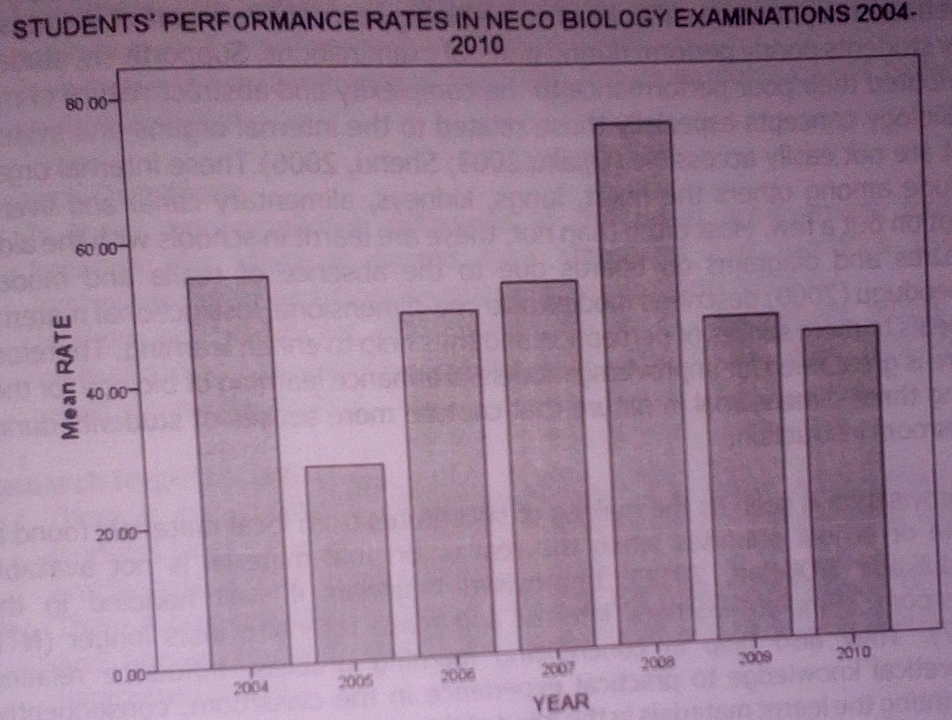
Biology being one of the major components of sciences, is a basic science subject that studies living things (Ramalingam,2007).It is an indispensable subject as medicine, pharmacy, Biotechnology, embryology, botany, zoology, microbiology, ecology and other related disciplines are concerned (Larku,2011). Several researchers have reported about poor performance of students in this subject, particularly at the Senior Secondary School Certificate Examination (S.S.C.E.) levels in Nigeria (Ajayi, 1998; Ahmed, 2008 in Yusuf & Afolabi, 2010; Ndagi, 2012). Chief Examiner's reports in both WAEC and NECO right from the year 2004 to 2010 have shown students' poor performance in biology in Senior School Certificate Examinations.

**Figure 1:**




**Source: WAEC Office, Minna (2010)**

**Figure 2:**




**Source: NECO Headquarters, Minna (2012)**

Figures 1 and 2 report shows students' performances in biology in WAEC and NECO examinations over a period of seven years. In WAEC, over these years students have been experiencing dramatic poor performance ranging from 29.68 percent to 50.70 percent. More devastating is the situation in NECO where there were fluctuations in the performance rates ranging from 55.14 to 45.26 showing remarkable significant failure. It was only in 2008 that students' performance rate reached 75.72 percent and since that year, the students' performance in biology has not been encouraging, in other words, it has been poorer consistently. By implication, this revealed that there has been consistent massive failure in both WAEC and NECO biology examinations over the years which is a great obstacle to the educational development in Nigeria.

It is revealed that lack of adequate instructional materials and science equipments is what is responsible for the endemic poor performance in Biology in both National Examinations Council (NECO) and West African Examinations [illegible] years (Yusuf, 2004 in Yaki, 2011). Kareem (2003)

evealed that low level of performance in biology is in part due to the type of nstructional materials used and the method of teaching. Ojiaku (2003) reported hat misconception and difficulty of some Biology concepts are part of the reasons why students poorly perform during general examinations. Supportively, students attributed their poor performance to the complexity and abstract nature of most of Biology concepts especially those related to the internal organs and systems that are not easily accessible (Ojiaku,2003; Shehu, 2006).These internal organs include among others the heart, lungs, kidneys, alimentary canal and liver to mention but a few. Most often than not, these are learnt in schools with the aid of pictures and diagrams on boards due to the absence of realia and models. Omeodugu (2000) described models as three-dimensional instructional materials appeals to more senses of perception and thus help to enrich learning. Therefore, there is great need for improvising models to enhance learning of biology for their being three-dimensional in nature that capture more senses of students during classroom instruction.

Improvisation is seen as the making of substitutes from local materials found at home or school premises when the real or original material is not available (Abdulkadir &Olaitan, 2011). Improvised materials if well handled in the classroom, stimulate learners' interest and make retention lasts longer (NTI, 2007). They also help in concretizing learning process, influence relating theoretical knowledge to practical experience in the classroom, consequently, imprinting the learnt materials in the mind of the learners (NTI, 2008).

Models can be used to clarify abstract ideas, arouse interest and stimulate enthusiasm and aesthetic value of biology and its pervasiveness (Cundy &Rollet, 2006). Improvised models have been yielding positive results as students' academic achievement is concerned. Orisabiyi (2002) reported an improved performance of students in Biology who were taught using an improvised human skin and no gender difference was identified in their performance..In another investigation by Nsofor (2010), students treated with models of excretory and circulatory systems performed better than the control group and the models proved to be gender friendly. Although some findings proved that males perform better in science than the females (Lahey, 2003; Iwendi, 2009). Contrarily, Anagbogu and Ezeliora (2007) are of the opinion that females perform better than their male counterparts in science and Mathematics. This indicates that gender difference in academic achievement is still controversial phenomenon due to the inconsistency in research findings. None the less, for any treatment to be regarded as an effective treatment, it has to be gender friendly in all circumstances.

## Research Objectives

The study was designed to:-

(i) Investigate the effects of the improvised liver model on academic achievement of senior secondary school students.

(ii) Investigate the achievement of male and female students taught biology using liver model.

## Research Questions

(i) Is there any significant difference in the mean achievement scores between the students taught liver structures and functions using improvised model and those taught using conventional method?

(ii) Is there any significant difference in the mean achievement scores of male and female students taught liver structures and functions using improvised model?

## Research Hypotheses

$Ho_1$: There is no significant difference between the mean achievement of students taught liver structures and functions using the improvised model and those taught with conventional method.

$Ho_2$: There is no significant difference between the mean achievement of male and female students taught liver structures and functions using the improvised model.

## Methodology

The design for this study is the pre-test, posttest, experimental and control group design which is a type of true experimental design research. The population of this study comprises of all SSIII students in 14 senior secondary schools in Kontagora Local Government of Niger State with a number of 2,392 students. The content to be learnt is scheduled to be offered by S.S.III students as provided in the senior secondary school biology syllabus.

Three public co-educational secondary schools were purposefully selected from 14 senior secondary schools for the study for their having adequate number of male and female students. They were Government Secondary School Kontagora (G.S.S. (B)), Muazu Ibrahim Commercial Secondary School (M.I.C.S.S.(A)) and Government Day Secondary Schools Kontagora (G.D.S.S. (A)). From each school,40 students ( 20 males and 20 females) were randomly selected giving a total number of 120 students. They were randomly assigned in to experimental and control groups (30 males and 30 females) in each group through simple

The medium of instruction was improvised liver model which was face validated by two educational technologists in science education department, Federal University of Technology, Minna, and biology teacher in G.S.S. Kontagora. The instrument used for data collection was Liver Structures and Functions Test (LSFTEST) developed by the researcher. The instrument contains 30 questions covering structures of human liver, functions of liver which include carbohydrate, lipid, and protein metabolism, storage of vitamins and minerals, detoxification, inactivation of hormones, heat production and formation and breakdown of red blood cells. After the general observations and corrections, a 25 items test was developed where a researcher correct response marking scheme was used for the scoring.

The face and content validity were assessed by a lecturer from science education department, Federal University of Technology Minna, and a Biology teacher from G.S.S. Kontagora. Reliability was ascertained using test-retest method with different subjects from those used for the study. Eventually, 0.86 reliability coefficient was obtained using Pearson Product Moment Correlation formula.

Prior to the teaching activities, samples were randomly assigned to the experimental group (30 males & 30 females) and the same proportion to the control group. A pre-test was administered to assess learners' entry behaviour before teaching commenced.The experimental group were taught with the human liver model, while the control group were taught using the traditional method. The content covered were structures of human liver, functions of liver which include carbohydrate, lipid, and protein metabolism, storage of vitamins and minerals, detoxification, inactivation of hormones, heat production and formation and breakdown of red blood cells. It took two weeks with four periods to round off the teaching and learning activities. Eventually, a post-test was administered, scored and analyzed using Statistical Package for Social Sciences (SPSS) version 16.

## Results and Discussion

**Table 1: Independent t-test comparison of the mean scores of experimental and control groups on the pre-test**

| Group | N | df | Mean | SD | t-cal | sig.(2- tailed) |
|---|---|---|---|---|---|---|
| Experimental | 60 | 118 | 12.08 | 4.19 | $-.111^{ns}$ | 0.912 |
| Control | 60 | | 12.17 | 4.05 | | |

ns = Not Significant at 0.05 level

Table 1 presents the pre-test t- test results which revealed that there is no significant difference between the performance of the control and experimental groups $t_{cal} = -.111$, df = 118, $p > 0.05$). Hence this indicates that the two groups are of the same level of entry behaviour.

**Hypothesis One:** There is no significant difference in the mean achievement scores of students taught structures and functions of human liver with the improvised human liver model and those taught with traditional method.

**Table 2: Independent t-test comparison of the post test mean scores of the experimental and control groups**

| Group | N | df | Mean | SD | t-cal | Sig (2- tailed) |
|---|---|---|---|---|---|---|
| Experimental | 60 | 118 | 17.78 | 2.78 | -10.47* | 0.000 |
| Control | 60 | | 11.08 | 4.11 | | |

*= Significant at 0.05 level

From Table 2, the results reveals that the experimental group have higher mean achievement score of 17.78, with standard deviation of 4.11 than the control group whose mean achievement score was 11.08 and standard deviation of 4.11. The t-calculated was -10.466 which was statistically significant at 0.05 level of significance ($t_{cal}$ -10.466, df = 118, $p<0.05$). It is evident that there is significant difference between the control and the experimental groups in favour of experimental group. Hence the null hypothesis is not accepted.

**Hypothesis Two:** There is no significant difference between the mean achievement scores of male and female students taught liver structures and functions with the improvised human liver model.

**Table 3: Independent t-test comparison of the posttest mean scores of the males and females of the experimental group**

| Group | N | df | Mean | SD | t-cal | Sig (2- tailed) |
|---|---|---|---|---|---|---|
| Experimental | 30 | 58 | 17.87 | 2.65 | $0.230^{ns}$ | 0.819 |
| Control | 30 | | 17.00 | 2.95 | | |

ns= Not significant at 0.05 level

From Table 3, the mean achievement scores of male students was 17.87 and standard deviation 2.65, while that of the female students was 17.70 with standard deviation of 2.95 which shows very slight difference. The t-calculated was 0.230 that appeared to be not significant at 0.05 alpha level. Table 3 reveals that no significant difference exists between the performance of male and female students in the experimental group ($t_{cal}$ 0.230, df = 58, $p > 0.05$). The result of the study reported gender differences in the achievement of the experimental group in which no significant difference was found. Hence the null hypothesis is not rejected.

**Discussion of Findings**

The results of the study clearly indicated that there was significant difference in the academic achievement between the students taught liver structures and functions using the improvised liver model and those who were taught using the conventional method. This finding agree with previous studies of Nsofor (2010) and Orisabiyi (2002) that reported positive results emanated from the utilization of improvised models in teaching different concepts of biology.

Results from hypothesis two revealed that there is no significant difference in the academic performance of male and female students taught liver structures and functions with the improvised human liver model. This finding corroborates with those of Orisabiyi, (2002), and Nsofor (2010) who also discovered gender friendliness of the improvised models of human organs and systems used in teaching and learning of Biology concepts. This finding, however, is contrary to the discoveries which propounded that males usually perform better in science and mathematics than their female counterparts (Lahey,2003; Iwendi, 2009). Similarly, it deviates from the finding of Ezeliora (2007) who reported that female students performed better than male students in science and mathematics. Most significantly, from the results obtained, the model proved to be effective for the fact that it facilitated positive improvement in students' academic achievement. Hence it strengthens the position of National Teacher Institute (NTI) (2007) and Cundy and Rollet (2006) who established that improvised models stimulate

enthusiasm, arose learners interest and make retention last longer. Similarly, it is also in support of NTI (2008) who maintained that improvised materials imprint learnt materials in the minds of the learners.

## Conclusion

From the reviewed literature and the findings of this study, it is evident that use of improvised models in teaching Biology enhanced learning of abstract concepts thereby improving the performance of students. It can also be evident that improvised biology organ and system models are usually gender friendly when used in teaching and learning activities in schools.

## Recommendations

Based on the findings of this study, the following recommendations are given:

(i) Teachers and students should be encouraged to always use improvised models during teaching and learning of biology contents.

(ii) Students should be given ample opportunity to manipulate improvised models during biology instruction as to have better understanding of its concepts.

(iii) Schools should embark on the production of marketable improvised biology instructional models in order to ensure their availability and adequacy among schools as to enhance teaching and learning of biology contents.

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