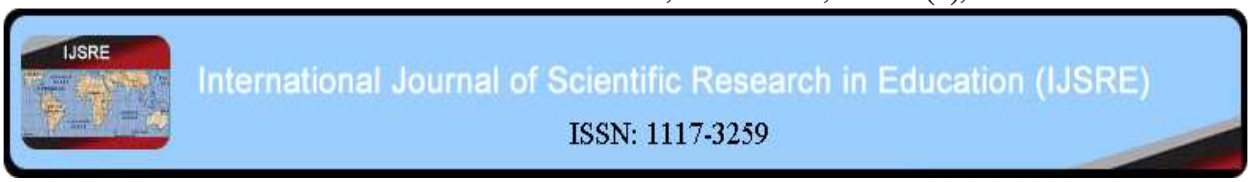
International Journal of Scientific Research in Education, March 2017, Vol. 10(1), 69-78.



Effects of Ethno-Science Instructional Approach on Students' Achievement and Interest in Upper Basic Science and Technology in Benue State, Nigeria

Okwara Kalu Okwara[i]
Department of Science Education, Federal University of Agriculture
Makurdi, Benue State, Nigeria.
okwarakalu@gmail.com

Francis Terseer Upu[ii]
Department of Science Education, Federal University of Agriculture
Makurdi, Benue State, Nigeria.
francisupu@yahoo.com

Abstract

This study determines effects of ethno-science instructional approach (ESIA) on students' achievement and interest in Basic Science and Technology in Benue State, Nigeria. A quasi-experimental control group design was adopted. Two validated instruments were administered to a sample of 485 out of 14,925 Upper Basic II students. Research questions were answered using mean and standard deviation, while analysis of covariance was used to test null hypotheses. The findings revealed a significant difference in the mean achievement and interest scores of students taught using ESIA and their counterparts taught using demonstration teaching method (DTM). Based on the findings, the conclusion was that ESIA enhances students' achievement and interest. Recommendations were made that seminars, conferences and workshops should be organized by government and relevant professional bodies to sensitize science teachers on the proper use of ESIA in teaching of science; curriculum should be restructured to reflect Nigerian culture (indigenous science).

Keywords: Ethno-Science Instructional Model, Achievement, Interest, Upper Basic.

Reference to this paper should be made as follows:

Okwara, O. K., & Upu, F. T. (2017). Effects of Ethno-Science Instructional Approach on Students' Achievement and Interest in Upper Basic Science and Technology in Benue State, Nigeria. *International Journal of Scientific Research in Education, 10*(1), 69-78. Retrieved [DATE] from http://www.ijsre.com.

INTRODUCTION

Basic science and technology as fulcrum for sustainable national development can simply be seen as the bedrock for man's systematic way of acquiring scientific knowledge and skills for understanding and explaining of natural phenomena such as albinism, rainbow, diffusion, eclipse, mirage, surface tension, capillarity, adhesion and cohesion forces among others as well as application of the acquired scientific knowledge and skills to meet the needs of the contemporary societies (Ezeudu, 2011; Ityokaa, 2013). Basic Science and Technology as a subject come in existence as a result of curriculum reform movement in Nigeria to make science education (teaching about science) more functional for sustainable national development.

The curriculum of Basic Science and Technology is a product of the restructuring and integration of four primary and junior secondary school science curricula namely; Basic Science, Basic Technology, Physical and Health Education and Computer Studies/Information Communication Technology (FRN, 2012). Nigerian Educational Research and Development Council (NERDC) (2012) posit that the need for integration of these science curricula became necessary for the following reasons:

The recommendation of the presidential summit on education (2010) to reduce the number of subjects offered in primary and junior secondary schools; feedback from the implementation of the curricula in schools that identified repetition and duplication of concepts as the major cause of curriculum loaded; need to encourage innovative teaching and learning approaches and techniques that promotes creativity and critical thinking in learners; need to promote the holistic view of science at the Basic Education level for better understanding of contemporary and changing world and need to infuse emergent issues that are of national and global concern such as gender sensitivity, globalization and entrepreneurship.

The main objectives of teaching and learning of Basic Science and Technology in Nigeria schools as stipulated by NERDC (2012) is that learners are expected to; develop interest in science and technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills to meet contemporary societal needs; take advantage of the numerous career opportunities provided by science and technology; become prepared for further studies in science and technology; avoid drug abuse and related vices; and to be safety and security conscious.

In order to achieve the objectives of Basic Science Technology, the thematic approach to content organization was adopted by NERDC for the holistic presentation of scientific and technological concepts, knowledge and skills to learners. While selecting the contents by NERDC (2012), major issues shaping contemporary growth and development of the nations and influencing knowledge driven societies were identified and infused into the curriculum content at various levels of Basic Education system, from basic 1-9 with a progression in infusion of concepts as class advances. These include; environmental education; climate change; drug abuse education; food and drugs safety education; disaster risk reduction education; consumer education; safety and security as well as entrepreneurship.

The topics in each theme are spirally sequenced, from simple to complex across 9 years of schooling in order to sustain the interest of students in science and promote meaningful learning and skills development. The content, context and methodology of Basic Science and Technology curriculum places emphasis on guided inquiry, field studies, guided discovery, laboratory techniques and activity-based teaching and learning using locally made sourced materials (FGN, 2013). This means that teaching and learning of Basic Science and Technology is expected to be culturally and environmentally oriented to provide students with adequate foundations, which are capable of solving their problems and of the

contemporary society. Obiekwe (2008) reported that all is not well with science instruction, which Basic Science and Technology is a foundation. The author maintains that teaching of science today lays extreme emphasis on content and the use of conventional methods by the science teachers neglecting the cultural based approach which enhances teaching and learning. The negligence attitude of science teachers from cultural oriented approach of teaching led to poor achievement and lack of students' interest in science (Ugwuanyi, 2015). In line with this, Atran (2007), earlier suggested that the development of culturally relevant activities as part of science curriculum would help the students make sense out of what they learn both in their culture and science classes which will improve their achievement and interest in pure science (Biology, Physics and Chemistry).

Achievement in opinion of Ogundukun and Adeyemo (2010), is the exhibition of knowledge attained or skills developed by students in a subject as determined by test scores of students, assigned by teachers. Achievement according Abakpa (2011) is the measure of accomplishment in a specific field of study. The authors argue that achievement of students is the demonstration of their abilities to attain certain levels of instructional objectives outcome of their classroom instructions and experiences. The achievement of students in Basic Science and Technology cannot be compromised, because it is essential for the productive economic sector of our nation, for the production of labour force that is scientifically and technologically literate to bring about the desired changes for sustainable national development (Adejoh, 2008).

Atadoga and Lakpini (2013) report that the persistent poor achievement of students and their lack of interest in science subjects are attribute to their poor foundation and instructional methods used by the science teachers. Adesoji (2008) agrees that instructional method used by science teachers has a significant influence on achievement and interest of students. That is why NERDC (2012) recommended child-centered and culturally oriented instructional approaches for the teaching and learning of Basic Science and Technology. According to James (2006) the study of cultural values and perception of students on science and technology, the appropriate alternative approaches to science education and technology practice can have a positive effect on students' achievement and interest. One of the approaches for teaching and learning of Basic Science and Technology that relates to the cultural heritage of students environment and their culture is ethno-science. In this study, the researchers investigate the effects of ethno-science instructional model on Upper Basic II (UBII) students' achievement and interest in Basic Science and Technology, as one of the cultural oriented approaches using demonstration teaching method as a control variable to determine its effectiveness.

The ethno-science refers to the materials, ideas, beliefs and technology in a given society or environment, that derived from the past and present cultural practice and traditions of students. These evolved from myth, supernatural, and mystical realities as well as ongoing acculturation in the environment (Ugwuanyi, 2015). Sanga (2004) posits that ethno-science is the knowledge that is of indigenous to particular groups of people, their language, beliefs, technologies and cultures. In other words ethno-science is the study of humans' interaction with the natural environment and the construction of realities that link culture with advance scientific knowledge. Speaking on the rationale of ethno-science Aderson (2009), explains that western science is like a smoke screen, while its force is direct at the resolution of Nigerian most urgent problems, it makes those problems more numerous because it covers up the root of the technical problem. In the rhetoric of harmony it enshrouds the reality of imperialism and in so doing it traps our traditional scientific growth. Anderson further revealed that dominance of the capitalists' technology and constant relegation of our ethno-scientific process deforms most attempts of our society and indigenous science to create in our cultural ways. This means that Basic Science and Technology as a fulcrum for

sustainable national development, if taught using ethno-science instructional approach will improve students creativity, critical thinking, achievement and interest in science for sustainable national development.

Demonstration teaching method deals with demonstrating and doing for the students to watch, observe and learn. Cyril (2013) asserts that demonstration involves arranging materials, tools and equipment by the teacher to show students how an operation is performed or a practical is being carried out. The method is effective in introducing lesson and new skills to students; however it has numbers of limitations when there is a need for making lesson activity-based that students should actively participate in the teaching-learning process. This necessitated the researchers to determine the effectiveness of ethno-science instructional model on UBII students' achievement and interest in Basic Science and technology.

Interest can be defined as persistent tendency to pay attention and enjoy some activities or contents (Nworgu 2006). Interest in Basic Science and Technology refers to students' reactions, feeling and impression about Basic Science and Technology contents and concepts as well as related tasks. Abakpa (2011) asserted that interest is an energized power of learning, without which meaningful learning cannot take place. Achinugu in Ugwuanyi (2015) pointed out that the type of interest a student brings into the classroom is a very important factor for his/her achievement or otherwise in science. This implies that, if students have positive interest towards Basic Science and Technology they will not only enjoy studying it but would also derive satisfaction from the knowledge and skills acquire from it. Students' achievement and interest in science have direct link with instructional methods. This means that methods of instruction are functions of students' achievement and interest in science.

Statement of the Problem

The objectives of teaching Basic Science and Technology is for students to develop interest in science and technology, acquire basic knowledge and skills in science and technology and apply scientific and technological knowledge and skills acquired to solve contemporary societal problems. These objectives have hardly been achieved over the years. This has been attributed to methods of instruction used by the science teachers which do not take care of the cultural background and the needs of the students. As a result, students have been viewing science taught to them in schools as foreign, abstract, unreal and meaningless. As a result, students merely memorize the contents and concepts taught, to pass their examinations with little or no interest which results in persistent poor achievement.

Various studies revealed that the effective utilization of ethno-science instructional approach influences students' achievement and interest in science. Most of these research works focused in other areas of Biology, Chemistry and Physics. Much is yet to be done on Basic Science and Technology which is considered as foundation for students' acquisition of scientific and technological knowledge and skills for sustainable national development. The foregoing in mind necessitated the researchers to investigate effects of ethno-science instructional approach on students' achievement and interest of Upper Basic II students in Basic Science and Technology.

Purpose of the Study

The main purpose of this study is to determine the effects of ethno-science instructional approach on students' achievement and interest in Basic Science and Technology in Benue State, Nigeria. The specific objectives of this study are to find out the differences in:

- The mean achievement scores of students taught, Basic Science and Technology using ethno-science instructional approach and those taught, using demonstration teaching method.
- The mean interest scores of students taught Basic Science and technology, using ethno-science instructional approach and those taught using demonstration teaching method.

Research Questions

The following research questions were raised to guide the study:

- What is the difference between the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method?
- What is the difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method?

Hypotheses

The following null hypotheses were formulated and tested at 0.05 alpha levels of significance:

- HO_1: There is no significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.
- HO_2: There is no significant difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.

Methodology

A quasi-experimental of non-randomized, pre-test, post-test control group design was adopted in this study. The population of the study was 14,925 Upper Basic II students of Benue state. A sample of 485 drawn from six secondary schools in education zone A of Benue State was used for the study. Education zone A was randomly chosen out of three education zones of Benue State by simple random sampling technique of balloting. The simple random sampling technique was used in selecting sampled schools. Only six schools were randomly chosen because of the experimental nature of the study. Three schools each were assigned to experimental and control group.

The instruments for data collection were Basic Science and Technology Achievement Test (BSTAT) and Basic Science and Technology Interest Scale (BSTIS) they were developed by the researchers. The BSTAT consists of 20 multiple choice items, drawn from Basic Science and Technology of Upper Basic II curriculum based on the following topics; diseases, pollution, drug abuse and habitats. BSTIS consists of 20 items and it scored on a four point scale of strongly agree (SA) = 4 points, agree (A) =3 points, disagree (D) =2 points and strongly agree (SD) =1 point, for the positive items and in the revised order for the negative items. The validation of BSTAT and BSTIS were done by three experts in the Department of Science Education; University of Agriculture Makurdi. The reliability of the BSAT and BSTIS were determined using Kuder-Richardson 20 formula ($K\text{-}R_{20}$) and Cronbach Alpha Coefficient which gave the values of 0.76 and 0.78 respectively. These

values showed positive relationship within the test items which means the instruments are both internally consistence and reliable.

The regular Basic Science teachers were used for the study in both experimental and control groups. One week training programme was organized for the research assistant by the researchers. They were properly trained on how to teach using ethno-science instructional approach and administration of BSTAT and BSTIS. The training lasted for one week, the teachers practiced by demonstrating on how to teach, using the researchers' prepared lesson plans that contained the necessary steps of ethno-science instructional approach in form of micro teaching.

BSTAT and BSTIS were administered to students as pre-test to establish their initial level of achievement and interest in Basic Science and Technology before the commencement of the experiment. Immediately after the pre-test the teachers taught the experimental group, adhering to 12 ethno-science instructional approach lesson plans; procedures prepared by the researchers. The control group was also taught the same contents using 12 demonstration teaching method lesson plans. The treatment lasted for six weeks. Each teacher in experimental and control group completed the content as stipulated in the researchers' guideline. Immediately the conclusion of the teaching, the BSTAT and BSTIS were given as post-test and scores were recorded. The mean and standard deviation were used for answering of research questions. Analysis of Covariance (ANCOVA) was used to test null hypotheses at 0.05 alpha level of significance. The choice of ANCOVA is to check the group initial difference that might exist due to the random assigning of schools.

RESULTS

Research Questions 1

What is the difference in the mean achievement scores of the students taught Basic Science and Technology, using ethno-science instructional approach and those taught, using demonstration teaching method? To answer research question one, the analyzed Basic Science and Technology achievement scores of students is presented in Table 1.

Table 1: Mean and Standard Deviation on Students' achievement in Basic Science and Technology

Group	N	Pre-BSTAT		Post-BSTAT		Mean Gain
		Mean	SD	Mean	SD	
Experimental	288	32.43	3.16	56.75	2.04	24.32
Control	237	32.55	3.28	43.67	3.19	11.12
Total	485					
Mean difference		**-0.12**		**13.08**		**13.20**

Table 1, shows that students taught using ethno-science instructional approach had pre-BSTAT and post-BSTAT scores of 32.43 and 56.75 with standard deviations of 3.16 and 2.04 respectively. Students taught using DTM had pre-BSTAT and post-BSTAT of 32.55 and 43.67 with standard deviation of 3.28 and 3.19 respectively. The mean gain for the experimental group was 24.32, while the mean gain in the control group was 11.12 with the mean difference of 13.20, which showed the difference in mean achievement scores between experimental and control groups. This result is further investigated by testing of hypothesis one in the table 2.

Hypothesis 1

There is no significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach (ESIA) and those taught using demonstration teaching method (DTM).

Table 2: Analysis of Covariance on Students' Achievement in Treatment Groups

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1372.124[a]	2	686.062	1304.376	.023
Intercept	4804.802	1	4804.802	352.017	.213
Pretest	502.411	1	502.411	21.932	.003
Group*	432.678	1	432.678	156.402	.000
Error	250.640	482	.520		
Total	36405.000	485			
Corrected Total	**78065.129**	**484**			

a. R Squared = .992 (Adjusted R Squared = .991)

Table 2 results reveal that the experimental group have F-value of 156.402 and significant value of 0.000, this significant value is less than p-value of 0.05 (i.e. p = 0.05 > 0.00). With this result, the null hypothesis one which stated that there is no significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method is rejected. This implied that there is a significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science and those taught using demonstrating teaching method. This confirms that the earlier observed difference in the mean achievement scores of the two groups was due to the treatment in favour of ethno-science instructional approach.

Research Question 2

What is the difference in the mean interest scores of students taught Basic Science, using ethno-science instructional approach and those taught using demonstration teaching method? The data answering this research question are presented in table 3.

Table 3: Mean and Standard Deviation of Students' Interest Scores in BSTIS

Teaching Method	N	Pre-interest		Post-interest		Mean Gain
		Mean	SD	Mean	SD	
ESIA	288	2.43	1.09	3.87	0.05	1.44
DTM	237	2.48	1.08	2.96	0.25	0.48
Total	485					
Mean difference		**-0.05**		**0.91**		**0.96**

Table 3 shows that students taught Basic Science and Technology with ESIA had Pre-interest and Post-interest mean scores of 2.43 and 3.87 with the standard deviation of 1.09 and 0.05 respectively, while that of students' in DTM had pre-interest and post-interest mean scores of 2.48 and 2.96 with standard deviation of 1.08 and 0.25 respectively. The mean gain in experimental group was 1.44, while mean gain in the control group was 0.48, with mean difference of 0.96. This indicates that mean interest scores of students taught Basic Science and Technology using ESIA was higher than those taught using DTM. This answers the

question of differences in the mean interest scores of students taught Basic Science and Technology using ESIA and those taught using the DTM. Hypothesis two was tested for level of significance to confirm this result.

Hypothesis 2

There is no significant difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.

Table 4: Analysis of Covariance on Students' Interest in Basic Science and Technology

Source	Sum of squares	df	Mean Square	F	Sig.
Corrected Model	69264.630[a]	2	34632.315	2516.235	.000
Intercept	424.875	1	424.875	212.409	.001
Pretest	465.736	1	465.736	12.159	.032
Interest*	12.466	1	12.466	9.836	.000
Error	1565.054	482	3.247		
Total	**238127.000**	**485**			
Corrected Total	41661.318	484			

a. R Squared = .918 (Adjusted R Squared = .901)

Table 4 indicates that F-value is 9.836 at the significant value of 0.000, which is less than the p-value of 0.05. Hence, hypothesis two which state that there is no significant difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.is rejected. This means that there is a significant difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration method. This confirms the observed difference in the mean interest scores of students in Basic Science and Technology interest scale.

The following are summary of major findings:

- There is a significant difference in the mean achievement scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.
- There is a significant difference in the mean interest scores of students taught Basic Science and Technology using ethno-science instructional approach and those taught using demonstration teaching method.

DISCUSSION

The main purpose of this study is to find out whether the use of ethno-science instructional approach is effective in improving the achievement and interest of students in Basic Science and Technology. Before treatment commenced, pre-test was given to determine the equivalent knowledge and interest of students in Basic Science and Technology. Therefore the observed differences in the results are owing to the treatment. The results of the analysis of data on research questions and null hypotheses are hereby discussed based on the objectives of the study.

The result of the analysis revealed that the students taught Basic Science and Technology using ESIA achieved higher than those taught using DTM. This result was

further supported by the testing of hypothesis one which showed a significant difference in the mean achievement scores of students in the experimental and control groups. This finding is in agreement with that of Atran (2007), Obiekwe (2008) and Ugwuanyi (2015) whose results indicated that students taught using ethno-science instructional approach scored higher in their post-test mean achievement scores than students taught using conventional teaching method. This implies that if ethno-science instructional approach is implemented in Nigerian schools, it will enhance students' achievement in science in general and Basic Science and Technology in particular.

The result of this study indicated that mean interest scores of students taught Basic Science and Technology using ESIA was higher than their counterparts taught using DTM. This was further confirmed by hypothesis two, which showed a significant different in the mean interest scores of the students taught Basic Science and Technology using ESIA and those taught using DTM. This finding is in consonant with the findings of Aderson (2009) and Ugwuanyi (2015) who in their different studies at different times reported there is a significant difference in the mean interest scores of student taught with ethno-science approach and those taught with conventional methods. In the other hand this study disagrees with James (2006) who found out that cultural oriented instructional approach do not have a significant influence on students' interest in science. However this study shows that ethno-science instructional approach is effective in teaching science because it arose and sustained students' interest in Basic Science and Technology.

CONCLUSION

Based on the findings of this study, the researchers concluded that ethno-science instructional approach enhances students' achievement and interest in Basic Science and Technology. Therefore, it is an effective approach of teaching science, especial Basic Science and Technology subject.

Recommendations

Based on the results of this study, the following recommendations were made that:

Seminars, conferences and workshops should be organized by government and relevant professional bodies such as Nigerian Educational Research and Development Council and Science Teachers' Association of Nigeria to educate and sensitize science teachers on the proper use of ethno-science instructional approach in teaching of science.

Curricula of universities and colleges of education should be review to incorporate ethno-science instructional approach to their training programmes so that the prospective science teachers will be taught how to teach, reflecting Nigerian culture and environment when they enter the teaching profession.

REFERENCES

Abakpa, B. O. (2011). *Effects of mastery learning approach on senior secondary school students' achievement and interest in geometry.* Unpublished PhD thesis; University of Agriculture, Makurdi, Nigeria.

Adejoh, M. J. (2008). Improving the quality of integrated science and technology curricula in secondary schools. *Nigerian Journal of Teacher Education, 4*(1), 43-52.

Adesoji, F. A. (2008). Students' ability levels and effectiveness of problem-solving instructional strategy. *Journal of Social Science, 17*(1) 5-8.

Anderson, A. (2009). *Learning strategies the missing things in physical education and coaching. A practical guide to the development of strategies learning*. Toronto: Sport Books publishers.

Atadoga, M. M., & Lakpini, M. A. (2013). *A comparison of numeracy achievement of primary school pupils taught using whole class and varied classroom organization instructions.* Proceedings of Multicultural African Conference, Held at Faculty of Education, Ahmadu Bello University, Zaria, 11th – 15th June, 2013.

Atran, S. (2007). Cultural mosaic and mental model of nature. *Proceedings of the National Academic of Science, 104*(35) 13868-13874.

Cyril, M. U. (2013). Effects of individualized, demonstration and discovery methods of teaching mechanical craft practice in technical colleges in Adamawa state. *Nigerian Vocational Association Journal, 18*(2), 79-86.

Ezeudu, F. O. (2011). *Fundamentals of science education for colleges and universities*. Enugu: City and Company.

Federal Government of Nigeria (2013*). National policy on education.* Lagos: NERDC Press,

Ityokyaa, F. M. (2013*). Evaluation of the implementation of biology programme in secondary schools in benue state*. Unpublished Master Thesis: University of Agriculture Makurdi, Benue State.

James, K. (2006). Identify cultural values and American Idians' perceptions of science and technology. *American Indian Culture and Research Journal, 30*(3) 53-58.

Nigerian Educational Research and Development Council, (2012). *9-year basic education curriculum: Basic Science for Upper Basic Education 7-9*: NERDC PLC.

Nworgu, B. G. (2006). *Educational research; basic issues and methodology*. Enugu: University Trust Publishers.

Obiekwe, C. L. (2008). *Effects of constructivist instructional approach on students' achievement and interest in basic-ecologgical concepts in biology*. Unpublished master thesis: University of Nigeria Nsukka.

Ogundokun M. O., & Adeyemo D. A. (2010). Emotional intelligence and academic achievement: the moderating influence of age, intrinsic and extrinsic motivation. *The African symposium, 10*(2), 127-141.

Sanga, G. (2004). *Natural knowledge: Ethno-science, cognition and utility*. New York: Berghalin Books publisher.

Ugwuanyi, E. C. (2015). *Effects of an ethno-science based instructional model on students' academic achievement and interest in the senior secondary school biology.* Unpublished master thesis: University of Nigeria Nsukka.

---

[i] Dr. Okwara Kalu Okwara is a lecturer is the Department of Science Education, Federal University of Agriculture, Makurdi, Benue State, Nigeria. he can be reached via email at okwarakalu@gmail.com.

[ii] Francis Terseer Upu is of the Department of Science Education, Federal University of Agriculture, Makurdi, Benue State, Nigeria. He can be reached via email at francisupu@yahoo.com.