

VOLUME 3, NUMBER 2

JOURNAL OF INFORMATION, EDUCATION, SCIENCE AND TECHNOLOGY (JEST)



DECEMBER, 2016

Journal of Information, Education, Science and Technology

ISSN: 2360-8846

**JOURNAL OF INFORMATION, EDUCATION,
SCIENCE AND TECHNOLOGY
(JEST)**

VOL. 3, NO. 2

ISSN: 2360-8846

DECEMBER, 2016

Journal of Information, Education, Science and Technology

VOLUME 3, NUMBER 2

EDITORIAL BOARD MEMBERS

EDITOR- IN – CHIEF

Prof. Victoria I. Ezenwa

DEPUTY EDITOR – IN – CHIEF

Dr. Philip U. Akor
Associate Professor

MANAGING EDITOR

Dr. Robert O. Okwori
Associate Professor

ASSOCIATE EDITORS

Dr. N. A. Oyedum
Dr. I. Y Umar

Business/Circulating Manager

Mrs. A. G Tafida

Editorial Secretary

Mall. I. I Kuta

EDITORIAL CONSULTANTS

- Prof G. D. Momoh** Dept of Industrial and Technology Education, Federal University of Technology, Minna, Nigeria
- Prof. J. D. Enemali** Vocational and Technology Education programme, ATBU, Bauchi
- Prof. B. A. Ogwo** Dept of Vocational Teacher Education, University of Nigeria, Nsukka
- Prof. S. K. Tswana** Dept of Communication Education, Federal University of Technology, Minna
- Prof. Binyao Zheng** College of Education, Kennesaw state University, Kennesaw, Georgia, USA
- Prof. B. N. Ndomi** Dept of Vocational Education, Modibbo Adama University of Technology, Yola
- Prof. I. Haruna** Dept of Library and Information Science, University of Maiduguri
- Prof. C. O. Okwudishu** Dept of Educational Technology, University of Abuja
- Prof. S. M. Yalams** Dept of Industrial Technology, Faculty of Education and Liberal studies, University of Technology, Jamaica
- Dr. S. O. Adenle** Dept of Science and Technology Education, University of Lagos
- Prof. Nicholas Kyei Baffour** Dept of Agricultural Engineering, Kwame Nkrumah University of Science and Technology, Kumasi Ghana.
- Dr. Paa Kwasi Yalley** Dept of Construction and wood Technology Education, University of Education, Winneba, Ghana
- Prof. Israel Kibirige** Dept of Maths, Science and Technology, University of Limpopo, South Africa

SUBSCRIPTION RATE

Nigeria	Individual	N2,000.00
Other Countries	Institution	N4,000.00

TABLE OF CONTENTS

1.	Instructional Materials Improvisation Technique In Mathematics Education: A Panacea For Lecture Method. Afolabi S. Sunday	1
2.	Entrepreneurial Marketing and Motivational Techniques Needed By Teachers Of Electrical Installation And Maintenance Work Trade In North East Geo-Political Zone, Nigeria. Onuh, J., Kareem, W. B. & Dennis K. B.	6
3.	Impact of Deforestation on Farmers Agricultural Land Output in Abia State, Nigeria. Ekele, Garba Emmanuel, Okorie, Veronica Chioma & Waziri, P. A.	14
4.	Effects of Z-A Approach Teaching Strategy on Academic Achievement of Biology Students in Senior Secondary Schools in Minna Metropolis. Idris, U. S. B.; Babagana, B.; Mohammed, Z. C; Salihu, M. & Abdulrahman, M. A.	23
5.	Enhancing Curriculum Development in Technical and Vocational Education and Training Through Interactive Multimedia and Hypermedia Instruction. Afaor, N.N.; Upwa, F. E.; Tyav, A. D.; Shinshima, A. B & Nule, J. S	31
6.	Perceived Usefulness, Ease of Use, Attitude and Intention Towards Mobile Learning Among Colleges of Education Lecturers in the North-Central of Nigeria. Umar, G. K . Gambari, A. I. Nsofor, C. C. & Ahmadu Hussaini	41
7.	Comparative Study of Problem Solving Strategy and Lecture Method on Mathematics Achievement of Low Cognitive Pupils in Niger State, Nigeria. Sulaiman, F. J., Ezenwa, V. I., Wushishi, D. I. & Isah, A.	48
8.	Parent's Attitude Towards the Introduction of Sex Education in Moro Local Government Secondary Schools Kwara State. Bolu-Steve, F. N; Nurudeen, B. A. & Babadare D. A	56
9.	Effects of Computer Simulation on Nigeria Certificate In Education Students' Psychomotor Achievement and Interest In Electronics Technology. Raymond, E., Maxwell E. U. & Halliru, Shuaibu	66
10.	Practical Activities that Demonstrate the Relationship Between Fraction and Decimal Numbers. Alapa Stephen Ochefu	74
11.	Information Needs and Seeking Behaviour of Rural Dwellers in Nigeria. Philip U. Akor., Yusufu Shehu Amanyi & Aji Kingsley Olawale	81
12.	Availability and Accessibility of Information Resources to Under Graduate Students of Federal University of Technology Minna. Onwukanjo, S. A. & Fatimah Mustapha	90
13.	Influence of School Location and Resources on Secondary School Students' Academic Achievement in Makurdi Education Zone of Benue State, Nigeria. Odeh, R. C., Ivagher Ezekiel Dondo & Agugu Daniel Iliamkondo	102
14.	Perception of Plagiarism and Plagiarism Checks Software (PCS) Amongst Lecturers and Students of Federal University of Technology, Minna, Nigeria. Bello M. R., Morenikeji, O. O. & Wushishi, D. I.	113
15.	Water Quality Investigation	

16. Vocational and Technical Education and the Change Agenda in Nigeria. **Solomon, K. Agishi & Upwa Fanen Emmanuel** 131
17. Impact of Interactive Multi-Media Instruction Materials on Biology Students Academic Performance and Interest in Federal Government Girls College Bakori, Katsina State. **Lawal, T. E. & Ibrahim Sukola Tambaya** 138
18. Effect of Pictures on Students' Achievement in Poetry. **Thomas M. Abah & Idoko George Benson** 144
19. Towards Enhancing the Quality of Technical and Vocational Education Programmes in Nigerian Universities in South-South Nigeria. **Ayonmike Chinyere Shirley** 150

EFFECTS OF Z-A APPROACH TEACHING STRATEGY ON ACADEMIC ACHIEVEMENT OF BIOLOGY STUDENTS IN SENIOR SECONDARY SCHOOLS IN MINNA METROPOLIS

Idris, U. S. B.; Babagana, M.; Mohammed, Z. C., Salihu, M. & Abdulrahman, M. A.

Department of Science Education, School of Science and Technology Education,
Federal University of Technology, Minna, Niger State
Email:haumar2008@gmail.com **Phone:** 08065378781.

Abstract

The effectiveness of Z-A approach teaching strategy on academic achievement of students in Biology was investigated in this study. The researchers adopted quasi experimental research design. The sample for the study consisted of 126 Senior Secondary School II (SSII) students from two intact classes. The classes were randomly assigned to experimental and control groups. The instrument used for the study was Biology Achievement Test (BAT) designed by the researcher. Two hypotheses were formulated and tested at 0.05 alpha level of significance. The data were analyzed using mean, standard deviation and t-test statistics. The results indicated that there was significant difference between the mean achievement scores of control and experimental groups $t(123) = 3.866, p < 0.05$ level of significance, there was no significant difference in the mean academic achievement scores of male and female students taught with Z-A approach teaching strategy $t(54) = 0.601, p > 0.05$. It was therefore concluded that Z-A approach teaching strategy improves students' achievement in Biology than the conventional lecture method that explains theories and concepts before application. It is therefore recommended among others that teachers should be encouraged to employ the use of Z-A approach teaching strategy in teaching of Biology in secondary schools.

Key words: Z-A approach, teaching strategy, academic achievement, Biology.

Introduction

Science and technology have been and also remain sine qua non for any physical, structural and human development. Years in years out, governments, private organizations and individuals have been investing in the teaching of science and numerous scientific researches particularly in Nigeria to promote, hold and sustain the interests, needs and aspirations of children, youths and teachers in science (F.R.N, 2004; Gbore & Daramola, 2013). Science is an essential tool for any nations' progress and development (Akinbobola, 2009; Agboghroma, 2009, Chukwunke, 2006). Students at all levels of education deserve opportunity to discover, invent and participate in the rapid expansion in science and technology.

The need to improve science achievement through more effective instructional strategies and the increasing awareness of teaching and learning situation have directed a lot of attention to discovering and understanding more innovative means of enhancing learning. The efforts in assisting learners to learn led to the discovery of different strategies to enhance meaningful learning (Babkie & Provost, 2002; Thomas & Barksdale-Ladd, 2000). In sciences, Biology is one of the subjects that attracts multidimensional studies as to improve students' achievement and to remedy some of the challenges circumscribing around its teaching and learning across institutions of learning in Nigeria. This is because, it has made great impact in the development of nations and its importance chances the need to expose Biology students to innovative methods like Z-A approach in teaching and learning in secondary schools.

Biology is central to many science-related courses, such as medicine, pharmacy, nursing, agriculture, biochemistry, microbiology and so on at tertiary level of education. It is obvious that no student at senior secondary school intending to study these disciplines can do without Biology. These considerations among others have drawn attention of researchers and curriculum planners towards biology as a subject in the school curriculum (Kareem, 2003).

The strategy of teaching is a matter of much concern to analysts, educators and teachers in the institutions of learning (Abdu-Raheem, 2011). It was noted that traditional method is the most commonly used method in Nigerian schools and the system have been discovered not to be satisfactory as the students are not given

Education, Science and Technology (JEST) Vol. 3 No: 2, December 2016 ■
developed. (Abdu- Raheem, 2011). Instructional methods are utilized as part of presentation of lesson to help the students learn by guaranteeing the smooth conveyance of guideline. It is a system by which an instructional unit, instructional stage or an entire course is conveyed (Nafees, Farook, Tahirkheli & Akhtar, 2012). Teaching method is the technique in which an educator conveys his or her topic to students, taking into account pre-stated goals, to promote learning. Several teaching methods have been surveyed by researchers to replace the commonly known conventional lecture method in order to improve the quality of instruction as well as the academic performance of the learner (Nafees, Farook, Tahirkheli & Akhtar, 2012).

The determination of fitting instructional strategy guarantees the accomplishment of the expressed instructional goal viably. Instructional methods are utilized as a part of the presentation of lesson to help the students learn by guaranteeing the smooth conveyance of guideline. It is a system by which an instructional unit, instructional stage or an entire course is conveyed (Nafees, 2012). The strategy or methodology utilized in instruction is a matter of concern to analysts, educators and teachers (Abdu-Raheem, 2011). It is obvious that traditional teaching method is the most commonly used method in senior secondary schools in Nigeria and the system have been discovered not to be so effective on the grounds that students are not given the chance to communicate with the nature's domain and their scholarly abilities are not maximally developed. (Abdu- Raheem, 2011). Without abandoning the traditional teaching method, it can be paired with contemporary teaching strategies such as JIGSAW, Z-A, Guided Discovery e.t.c. to enhance learning.

However, the effects of teaching strategies on students learning should be of interest to every intellectual. The method used in teaching is very important as the method used may promote or hinder learning. The methodology used in teaching has the capability of sharpening students' mental activities which are the bases of social power or may discourage initiatives and curiosity, thus making self-reliance and survival difficult (Ameh & Dantani, 2012). There are several innovative teaching strategies that are used in Nigerian institutions of learning today. They include Guided Discovery, Cooperative learning, Individualized learning, Case Studies, computer simulations, Z-A approach, JIGSAW strategies; to mention but a few. Z-A is one of the newest innovative strategy that is not yet saturated in teaching.

The Z-A approach attempts to explain the application part of a particular concept initially, that is, the teacher explains the application of a particular concept first and later the effects of such applications. For example, Damodharan and Regarajan (n.d.) explain how this strategy was demonstrated in the application of Galileo's theorem. Two balls with different mass were thrown from the tower of pisa and they all reached the ground at the same time. Here the teacher explains how the two objects reached the ground as they were put from a particular distance from ground level. Traditional way of teaching method will be explaining the theorem first and followed by its application. But this Z-A approach goes opposite in a manner that the proof or application is explained first followed by the theory. As a result, learners would be more curious to knowing the cause of the effect, hence, motivation will be enhanced among them.

Another example is what this study demonstrated. Tomato fruits were provided to the students in the class before teaching commenced. The students in the process developed interest in knowing how the fruit was formed. The teacher usually explains the process in retrogressive manner using the advantage of students' curiosity, interest and motivation. The approach helps make concepts clear, stimulate students' interest in knowing a concept and above all, creates long lasting memory (Damodharan and Regarajan, n.d.). Consequently, considering these properties of Z-A teaching strategy, it has the potentials of improving learners' academic achievement.

Academic Achievement is the result of instruction, that is, the degree to which a student, teacher, or an establishment has accomplished their instructional objectives. It is regularly measured by examinations or continuous valuation (Annie, Howard & Mildred, 1996).

Statement of the Problem

The desire to know the causes of poor performance in biology has been the focus of researchers over decades. It has been observed that poor performance in sciences generally, and biology in particular is attributed to poor quality of science teachers, overcrowded classrooms, lack of suitable and adequate science equipments, large class size, heterogeneous classroom in terms of ability level, ill equipped laboratories, overloaded Biology syllabus and poor teaching methods (Ahmed, 2008; Kareem, 2003;

Onwirhiren, 2005). These factors encourage Biology teachers to resort to only lecture method most of the time. It is a well-known fact that the quality of education depends on the teachers and so the strategy they use in teaching matters a lot.

The analysis of Chief Examiner's report of West African Examination Council (2002-2012) on students' performance in Biology revealed consistent fluctuation of performance rates below 50% for more than five years. Researchers have then been conducting studies to find a lasting solution to the declining student's performance in biology most significantly, by exploring innovative strategies of teaching as to enhance learning of sciences in secondary schools. In view of this, the study is therefore, aimed at examining the effectiveness of using Z-A approach teaching strategy on students' academic achievement in Biology which is limited in the local literature.

Aim of the Study

The aim of the study was to determine the effects of Z-A approach teaching strategy on the academic achievement of biology students in Senior Secondary School in Minna metropolis.

In order to achieve this aim, the following objectives are to be focused on:

1. To determine the effects of Z-A approach teaching strategy on the academic achievement of biology students in Minna metropolis compared to those taught using conventional lecture method.
2. To find out if there is any gender influence on the students' achievement when taught biology using the Z-A approach teaching strategy.

Research Questions

In order to guide the study, the following research questions were formulated:

- i. Is there any difference between the mean achievement of students taught biology using Z-A approach teaching strategy and those taught using conventional lecture method?
- ii. Is there any difference between the mean achievement scores of male and female students taught biology using Z-A approach teaching strategy?

Research Hypotheses

The following research null hypotheses were formulated to guide the research:

HO₁: There is no significant difference in the mean achievement scores of biology students taught using Z-A approach teaching strategy and those taught using conventional lecture method.

Ho₂: There is no significant difference in the mean achievement scores of male and female biology students taught using Z-A approach teaching strategy.

Research Methodology

The research design adopted for this research is quasi- experimental research design in which non-equivalent control group design was used. Thus, intact classes were used for the study. The experimental group was taught using Z-A approach teaching strategy while the control group were taught using conventional lecture method. The population for the study comprised all senior secondary school biology students in the 25 schools in Minna metropolis, Niger state, while the target population were 3,450 SSII students in the schools. Two schools were randomly selected from the 25 schools and were used for the study. Two SSII intact classes were involved in the study which were randomly assigned to experimental and control groups. The sample comprised 38 male and 32 female students in the experimental group, while 29 male and 27 female students were in the control group, given a total of 126 students. The instrument used for data collection was Biology Achievement Test (BAT). The test item used was developed by the researcher using the scheme of work and relevant textbooks such as STAN Biology for senior secondary schools and modern Biology among others which are used in teaching biology. The instrument had 20 multiple choice test items which covered topics like reproductive system in plants and Pollination in plants. It had options (A-D) with only one correct answer. The instrument was confirmed valid by three experts in science education. The reliability of the instrument was ascertained through test-retest method using Pearson Product Moment Correlation Coefficient formula in which correlation coefficient of $r = 0.86$ was obtained. The reliability coefficient shows that the test instrument is consistent and reliable.

Method of Data Collection

After gaining access to the subjects, the researchers administered pretest to the subjects in order to determine their entry behavior. Lesson plans developed by the researchers in line with Z-A strategy for

experimental group and conventional for control group were used in teaching which lasted for a period of four weeks. In the fifth week, posttest was administered.

Method of Data Analysis

The data collected for the study were analyzed with respect to the research questions and hypotheses used for the study. Means Standard deviation, and t-Test Statistics were used to analyze the data generated with the aid of statistical Package for Social Sciences (SPSS) version 20.0.

Results

Table 1:

t-test Analysis of the Pretest Scores of the Experimental And Control Groups

Group	N	Mean	SD	df	t-cal	P
Experimental	56	22.16	3.47	123	1.625	0.107*
Control	69	20.99	4.22			

*Not Significant at 0.05 level

Table 1 shows the t-test comparison of pretest scores of experimental and control groups. The experimental group has a mean score of (22.16) with a standard deviation of (3.47) while the control group has a mean score of (20.99) with a standard deviation of (4.22). An examination of the Table shows that there is no significant difference between the two groups $t(123) = 1.625, p < 0.05$ This implies that the two groups were equivalent before treatment.

HO₁: There is no significant difference in the mean achievement scores of Biology students taught using Z-A approach teaching strategy and those taught using conventional lecture method.

Table 2:

t-test Analysis of the Posttest Scores of Experimental and Control Groups

Group	N	Mean	SD	df	t-cal	P
Experimental	56	30.16	3.47	123	3.866	0.000*
Control	69	23.88	3.11			

*: Significant at 0.05 level

Table 2 shows the t-test comparison of posttest scores of experimental and control groups. The experimental group has a mean score of (30.16) with a standard deviation of (3.47) while the control group has a mean score of (23.88) with a standard deviation of (3.11). An examination of the Table shows that there is significant difference between the two groups ($t(123) = 3.866, p = 0.000$) since the p-value is less than the alpha level of significance. On the basis of this, hypothesis one was rejected. This implies that there is significant difference in the mean achievement scores of biology students taught using Z-A approach teaching strategy and those taught using conventional lecture method in favor of those taught using Z-A approach teaching strategy.

HO₂: There is no significant difference in the mean achievement scores of male and female biology students taught using Z-A approach teaching strategy.

Is there any difference between the mean performance scores of male and female students taught biology using Z-A approach teaching strategy?

Table 3:

t-test analysis of the posttest scores of male and female students in the experimental group

Group	N	Mean	SD	df	t-cal	P
Male	27	15.07	3.71	54	0.601	0.550*
Female	29	15.09	4.34			

*: Not significant at 0.05 level

... has a mean score of (15.07) with a standard deviation of (3.71) while the female students has a mean score of (15.09) with a standard deviation of (4.34). An examination of the Table shows that there is no significant difference between the two groups ($t(54) = 0.601, p = 0.550$) since the p-value is greater than the alpha level of significance. On the basis of this, hypothesis two was accepted. This implies that there is no significant difference in the mean achievement scores of male and female biology students taught using Z-A approach teaching strategy

Discussion of Results

The main objective of this research was to determine the "Effects of Z-A approach teaching strategy on the academic achievement of biology students in Senior Secondary School in Minna metropolis. Pretest results in table 1 showed no difference in the pre-entry behavior of the experimental and control groups. Table 2 showed that the experimental group has higher mean score (30.16) and standard deviation (3.47) than the mean score (23.88) and standard deviation (3.11) of the control group after the treatment. The result of the t-test as shown in table 2 showed that the experimental group performed significantly better than the control group. This could have been that the approach highly stimulated the learners in the experimental group to study well. They were curious to see how comes of a fruit, in other words, how was it formed, what was the origin of such fruit? Consequently, that helped in sustaining their attention, concentration and readiness to learn throughout the teaching period. This by implication suggests that Z-A approach teaching strategy enhances learning of Biology concepts than the conventional lecture method at secondary school level. This result was in line with the findings of Abigail and Ebele (2013) who investigated the effects of differentiated instruction as an innovative strategy on academic achievement of biology students where students taught using differentiated instruction method performed better than those taught with conventional lecture method. It also corroborates the finding of *Akanbi and Kolawole (2014) who examined the effects of guided discovery (GD) and self-learning (SL) strategies as innovative teaching strategies on senior secondary school students' achievement in biology. They was discovered that, self learning and guided discovery strategies improved students' achievement in biology. It is also in line with the result of Ibe (2013) who investigated the effects of guided-inquiry and expository teaching methods on students' performances and interest in Biology. The result revealed that Students taught with guided-inquiry teaching method out-performed students taught with conventional teaching method in Biology. It was strengthened by the discovery of Jacinta (2011) who conducted a research on Inquiry Method and Students' Academic Achievement in Biology. Eventually it enhanced students performance in Biology. All these are discoveries adopting varieties of innovative teaching strategies in Biology, but the use of Z-A approach is lacking in the literature base on the researchers' survey.*

The posttest mean scores of male and female students as shown in table 3, indicated that female students performed better than male students after the treatment. The results of the t-test was insignificant at 0.05. This result strenghtens the findings of Bilesanmi and Awoderu (2012) who all reported that there were no longer distinguishing differences in the cognitive, affective ad psychomotor skills achievement of students in respect to gender differences. But on the other angle, it supported the finding of Uchenna and Philomena (2012) who investigated the comparative effectiveness of the expository and concept mapping instructional strategy of presenting secondary school biology concepts to slow learners. Specifically, female slow learners taught with the concept mapping instructional strategy performed significantly better than their male counterparts taught by the same method. The result of this study further established the fact that Z-A strategy is gender friendly. By implication, the application of this strategy of teaching, both in science and art disciplines is lacking, and this study seemed to be one of the fore-front studies (if they exist) experimenting this approach of teaching. Most especially in Biology as a science subject. The strategy was only reported by Damodharan and Rengarajan (n.d.) in the application of Galileo's theorem in physics by falling two objects of different mass from the same distance. Biology is a subject known to deal with realia in teaching and learning activities in schools. None of this type of experiment was found by the researchers in respect to Biology or Biological concepts.

Conclusions

Based on the research findings as related to the hypotheses formulated and tested, the following conclusions were made:

- Exposing Students to Z-A approach teaching strategy improves the students' performance in biology.

strategy performed equally better, that is to say it is gender friendly

Recommendations

On the basis of the research findings, the following recommendations were made:

- Secondary school principals should encourage and give necessary assistance to teachers for effective use of the Z-A approach teaching strategy particularly in teaching Biology.
- Since the use of Z-A approach teaching strategy enhances students' achievement, teachers should be encouraged to employ the use of the strategy in teaching and learning of biology in schools.
- Curriculum planners should also make sure that the curriculum put in place the appropriate innovative teaching strategies to be employed in teaching appropriate concepts of art and science subjects.
- The government should to also provide and sustain opportunities for retraining, symposia, workshops, conferences and seminars for the secondary school teachers on the appropriate selection and application of innovative teaching strategies (Z-A inclusive) in teaching of sciences, Biology in particular.
- Teachers and researchers should endeavour in testing some of these strategies in schools in order to confirm and establish their effectiveness.

References

- Abdu-Raheem, B. O. (2011). Effects of discussion method on secondary school students' achievement and retention in social studies. *European Journal of Educational Studies*. 3(2): 293-301.
- Abigail, M. O. & Ebele C. O. (2013). Effect of differentiated instruction on the academic achievement of Nigerian secondary school biology students. *Educational Research*. (ISSN2141-5161) Vol. 4(7) pp. 555-560.
- Agboghroma T. E. (2009). Interaction effects of instructional mode and school setting on students' knowledge of integrated science. *International Journal for Scientifically Research and Education*. 2(2): 67-75.
- Ahmed, M. A. (2008). Influence of personality factors on Biology lectures assessment of difficulty levels of genetics concepts in Nigerian Colleges of Education. Unpublished Ph.D. Thesis. University of Ilorin.
- Akanbi, A. A. & Kolawole C. B. (2014). Effects of guided-discovery and self-learning strategies on senior secondary school students' achievement in biology. *Journal of education and leadership development*. 6(1). 19-42.
- Akinbobola A. O. (2009). Facilitating Nigerian Physics students' attitude towards the concept of heat energy. *Sci. Paedagog. Exp.*, XLV(2): 353-366.
- Ameh, P. O. & Dantani Y. S. (2012). Effects of lecture and demonstration methods on the academic achievement of students in chemistry in Nassarawa Local Government Area of Kano State. *International Journal of Modern Social Sciences*. 1(1): 29-37.
- Annie, W., Howard, W., Mildred, M. W., (1996). Academic achievement and ability tests Definition of the domain. *Educational measurement*. University press of America, pp 2-5, ISBN 978-0-7618-0385-0
- Babkie, A.M, & Provost, M. C. (2002) Select, Write and use metacognitive strategies in the classroom. *Intervention in School and Clinic*. 37(3) 173 – 177.
- Bilesanmi-Awoderu, J. B. & Oludipe, D. I. (2012). Effectiveness of Cooperative Learning Strategies on Nigerian Junior Secondary Students' Academic Achievement in Basic Science. *British Journal of Education, Society & Behavioural Science* 2(3): 307-325.

Damodharan V. S. & Regarajan, V. (n.d.). Innovative methods of teaching. Retrieved 5th January, 2016 from www.math.arizona.edu

Federal Republic of Nigeria (2004) National policy on education, Lagos: NERDC Press

Gbore, L. O. & Daramola, C.A. (2013) Relative contributions of selected teachers' variables and students' attitudes toward academic achievement in biology among Senior secondary school students in Ondo State, Nigeria. *Current Issues in Education*. 16(1), 1-9

Ibe, H. I. (2013). Effects of guided-inquiry and expository teaching methods on senior secondary school students' performances in Biology in Imo State. *Journal of Education Research and Behavioral Sciences*. 2(4), 051-057.

Jacinta, A. O. (2011). Inquiry Method and Student Academic Achievement in Biology: Lessons and Policy Implications. *American-Eurasian Journal of Scientific Research*. 6(1): 28-31.

Kareem L. O. (2003). Effects of audio-graphic self-instructional packages on senior secondary school students' performance in biology in Ilorin, Nigeria. *Unpublished PhD thesis*. University of Ilorin.

Nafees, M., Farooq, G., Tahirkheli S. A., & Akhtar M. (2012). Effects of instructional strategies on academic achievement in a high school general science class. *International Journal of Business and Social Science* 3(5): 161-166.

Onwirhiren, E. M. (2005). The effects of class size and gender on academic performance in chemistry at post-secondary levels. *Nigeria Journal of Professional Teachers*. 1(1), 146-150.

Thomas, K. F. & Barksdale – Ladd, M. A. (2000) Metacognitive Processes: teaching Strategies in Literacy Education Courses. *Reading Psychology*. 21, 67-84.

Uchenna, U. & Philomena, N. O. (2012). The Effect of Concept Mapping Instructional Strategy on the Biology Achievement of Senior Secondary School Slow Learners. *Journal of Emerging Trends in Educational Research and Policy Studies*. 3(2): 137-142.

APPENDIX Z-A TEACHING APPROACH

