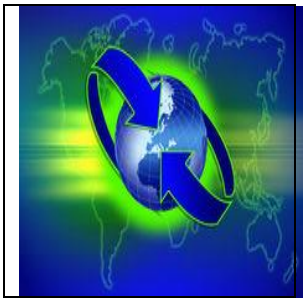

Effects of Multimedia Projectors as Instructional Media on Secondary School Students' Academic Performance in Chemistry

[1] Ojelade, I. A & [2]Aregbesola, B. G
Department of Science & Environmental Education,
Faculty of Education, University of Abuja, Nigeria
[1]E-mail: nikeojelade@yahoo.com *[2]*busayo.aregbesola@gmail.com
Received March,2020, Accepted July, 2020, published September, 2020

Abstract

The study examined the effect of multi-media projectors as instructional media on secondary school students' academic performance in chemistry. A pre-test-post-test control group quasi-experimental design was adopted in the study. 90 SSII Chemistry students were selected using simple non- randomized sampling technique. 45 students' each was selected randomly to form the experimental and control groups. The experimental group was taught using multi-media projector while the control group was taught using conventional method. The instrument for the study was a Chemistry Achievement Test (CAT) multiple choice items. Data gathered for the study were analyzed at 0.05 level of significant using t-Test Statistical method. The finding showed that there was a significant difference between the mean achievement scores of students exposed to Multimedia and those exposed to conventional method, it means that multi-media projector heightens students' understanding in chemistry. Similarly, there was no significant difference in the mean achievement scores of male and female students exposed to Multimedia-based instruction. This showed that multimedia projector is favourable to both male and female but conventional method does not. Therefore, among others it is recommended that the use of multimedia projector should be utilized in teaching and learning of Chemistry among secondary school students.

Keyword: Multimedia projector, instructional media, student's academic performance and teaching aids

Introduction

Chemistry is the science about substances, their composition, structure, properties and interactions. It is traditionally taught in the classroom and in the laboratory. Over time, what happens in the classroom has become conventional and objective, while what happens in the laboratory has become constructivist, problem-based or generative learning (Smith and Ragan, 2012). Although these two approaches have come to be regarded as the best paradigms of teaching and learning chemistry. Mayer, (2001) argues that teaching has always been a "multimedia" enterprise. The whole concept of media technology in education has created a

revolution in teaching-learning experiences. Media teaching and learning can be defined as a process that involves an integration of sound, video, graphic, text and animation to assist the students' learning skills and the teacher teaching processes with modern technology.

The theory of multi-media projection is based on the integration of multiple forms of media. Multimedia combines five basic types of media into the learning environment: text, video, sound, graphics and animation, thus providing a powerful new tool for education. There are theories that support multimedia projectors as instructional resources: Behaviorist learning theory supports multimedia projectors as an instructional resource and this is based on the fact that students learn through stimuli they receive to their actions, answers, statements, work, etc. Stimuli can be verbal or non-verbal responses that are either positive or negative. Positive responses are when something is added and negative responses are when something is removed, (Standridge, 2012). Heyneman & Loxley (2012) found that there were inadequate and poor school facilities in the developing countries. These inadequate and poor school facilities affected the students to perform much below as compared to the student performance of the developed countries. Levine & Donitsa-Schmidt (2016) compared the traditional learning strategies with computer-based activities in Chemistry. They discovered that the students in computer-based activities perform higher than those in traditional learning. Syed- Manzoor; Masroo & Waqar, (2012) indicated that results of students' academic performance taught using lecture method were lower compared to those of students' using the experimental group.

The implication for multimedia instruction is that it provides resources for additional instruction through tutorial programs and additional practice through drill programs. It also supports Behaviorist learning theory by offering immediate positive or negative responses that allow the students to continue with their learning and practice. Social learning theory promotes "students actively engaged in constructing artifacts and conversing with others" (Laureate Education Inc., 2014). Social Learning theory is an instructional strategy in which

students are actively engaged, working together to accomplish a group goal. Note that students learn through social conversation, dialog and interaction. The implication for multimedia instruction is that virtual and audio sample of similar class/ practical class can be projected by the teacher as the students watch and develop their own skills before being exposed to such environment to perform similar task.

Orji, (2010) views science as having substantive implications of teaching man about the universe, its accessibility to man's reason and its functioning that can be described by law. It asks question like how, when and why about nature and man. Our society, therefore, depends on its science and technology education program for sustainable development. Chemistry is one of the subjects that is central to studies in science and technology. Its portance in technological development cannot be over emphasized. Reforming science teaching for today's society is a necessity and paramount for a vital environment and tomorrow leaders, (Orji; Dajal; & Ojelade, 2009). Orji & Ebele, (2006) opined that the extent to which the knowledge of science is imparted in the learners is largely dependent on the \type of teaching methods wisely utilised, coupled with modern instructional resources. It seems from the foregoing that lack of proper utilization of modern facilities and infrastructure (of which multimedia projectors is vital) in the teaching and learning of chemistry in our schools could have contributed largely to the high failure rate recorded in the subject.

Mwamwenda & Mwamwenda, (2010), observed that school facilities including multimedia are factors that contributed to students' achievement in chemistry. Ahmad, (2013) found that scholastic factors including basic facilities in school and academic facilities in schools were subjected to significant correlation with the examination results. Also, Erwin & Rieppi (2013) compared the effectiveness of multimedia and traditional classes using students' performance. Students in the larger multimedia class averaged higher examination scores than those in the traditional classes. With multimedia projector, key elements are identified with some type of

visual accent that may be easier to determine than the inflections in the voice of the speaker who is trying to do the same thing (Lanius, 2014). Mullis, Martin & Foy, (2015) discovered that there was no gender difference in overall mathematics performance if both male and female are exposed to the same learning environment. Also, trends reveal that males and females are becoming more likely to advance through the pipeline of science courses, completing more courses at the top three levels of science course-taking, and less likely to exit science course-taking at the bottom three levels (Amelink, 2012).

Dalton, Ingels, Downing, & Bozick, (2012) showed that both males and females enrolled in the top two most advanced levels of science courses (i.e., Chemistry I and Physics I and Chemistry II Physics II, or Advanced biology) at approximately the same rates (35% of both female and males completing courses). Female participation in Chemistry I or Physics I, increased over time with 37% of females completing either of these courses, compared with 30% of males in 2004. This means that instructional environments that integrate science preparation may help address gender gaps in science performance given the manner in which academic preparation in the field of science is needed for attainment of the students' Brainard & Carlin, (2014).

Several studies have focused on score differences by gender in science achievement. However, it is important to note that recent assessments show that gender differences in science achievement have narrowed over time Amelink, (2009). Lance, Hamilton-Pennell, & Rodney (2011); Lance, (2012); Todd & Kuhlthau, (2014) confirmed there was a significant correlation between the presence and the use of multimedia resources by students and teachers with better student performance. Similarly, there found a simple correlation between the school inputs (instructional resources) and better student achievement (Todd and Kuhlthau, 2015).

This goes in line with the research carried out by Amunga, Amadalo & Musera, (2010) among 40 secondary schools in Kenya to study the disparities among male and female students' in Chemistry and Biology. The results thus indicate the need to enhance the availability of

facilities in the teaching of chemistry in the school categories. While male and female students exposed to conventional method showed mean of the male was slightly higher than that of the female. Amunga, Amadalo, & Musera, (2010) found that there is a difference in the chemistry achievement among male and female in chemistry in their study carried out among secondary schools in Kenya due to lack of instructional resources that can enhance teaching and learning of chemistry. This shows that the use of the conventional teaching method is gender based, that the girls are perceived to have low capacity for learning science while the boys will always play the lead.

Multimedia projectors, one of the instructional resources for learning in classroom play a very important role in the teaching-learning process of chemistry. Today, education has spread wide and oral teaching cannot be the key to successful pedagogy. Therefore, the teacher has to use modern instructional resources to make the teaching-learning process interesting (Nicholls, 2011; Raw, 2013). Due to the advancement of new techniques and technologies, under a strong influence of computer revolution during the last decades, the traditional source of knowledge, the textbook, is slowly being pushed behind. Computers (modern instructional resources) have recently assumed their role in school teaching, thus pushing behind traditional teaching method used thus far. Nowadays, the use of multimedia projectors in school teaching is of crucial importance. On this strength it has become necessary to investigate the effect of multi-media projector on student performance in senior secondary Chemistry.

Recently, findings from our immediate environment have shown that, an average Nigerian child/student can recall movies vividly both local and foreign with adequate description of the settings and actions in the movie. This picture can be foreseen in the classroom situation where concepts to be taught will be inform of audio-visual form for easy capturing, retention and recalling of information among these young generations. Our generation are no longer audio

learners where the teacher teaches abstract concept rather audio-visual which affix the application of multimedia projector into teaching and learning.

According to WAEC, (2014) the performance of students in chemistry in Nigerian secondary schools have not been encouraging over the years. This poor academic performance has been attributed to various factors including the predominant use of such non result-oriented instructional resources even in our secondary schools (Abimbade, 2016). Besides, educational systems in most of the developing countries do take cognizance of the conventional mode of teaching almost in all classes due to lack of instructional facilities (most of which are media-based). These inadequate and poor school facilities have adversely affected students' performance, causing them to perform much below expectation as compared to the students' performance in the developed countries of the world, especially in science subjects like chemistry. In a bid to improve performance, it has become necessary to investigate the effect of multi-media projector on academic performance of secondary school students' in Chemistry.

The main purpose of this examine is to study the effect of multi-media projector as instructional medium on students' performance in Chemistry. The specific objectives are as follows:

i. To investigate the extent to which multi-media projector can affect performance of students in Chemistry.
ii. To establish possible differences between male d female students' performance in Chemistry exposed to multimedia & conventional instructional method.

Research Questions

In this study, an attempt was made to seek answers to the following questions:

i. How does the use of multi-media projectors affect the performance of senior secondary school students in learning of Chemistry?
ii. What is the difference that exists between male and female students' performance in Chemistry using multimedia & conventional instructional methods?

Hypotheses

Ho_1: There is no significant difference between the mean achievement score of students exposed to the use of multimedia projector and their counterparts who were not.

Ho_2: There is no significant sex-related difference in the mean-achievement score of students exposed to multimedia & conventional instructional methods in chemistry.

Research methodology

The study adopted a quasi-experimental research design that made use of pre-test, post-test and control groups considered suitable enough for the study. A total of 90 students were drawn from the population which comprises of (45 students in the experimental and 45 students in the control groups) as the sample size. The units of analysis, who are members of the same class, were assigned to the various groups as follows:

Group I: Multimedia Projector Group (Treatment group)

Group II: Conventional mode Group (Control group)

Diagrammatically, the experimental design can be represented as shown below:

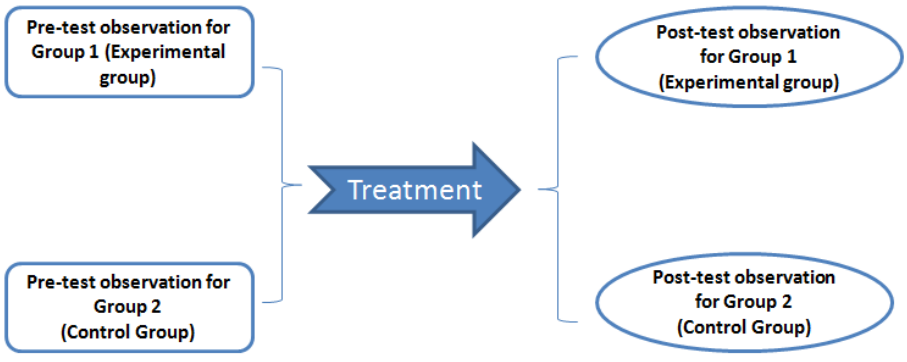

Figure 1: Experimental design

The treatment is the application of multimedia projector for Group 1 and conventional method for Group 2

The selection of the samples for both groups in each class (experiment and control) was not chosen by random. This is to avoid unplanned uneven distribution of students in the two groups,

a situation which may favor one of the groups at the expense of the other. E.g. if a random grouping is done, it is a possibility that the students with the highest IQ may end up in Group 1 and this automatically negates the result of the treatment because of the dissimilarity and imbalance of both groups. To avoid this, the chemistry result for the previous term for each student was collected along with their gender. Gender was included to also eliminate the gender bias in both groups. So the variables that might have affected the results of the outcome of the research were controlled by this sampling method for the groups to increase the validity of the results. This is described diagrammatically in figure 2:

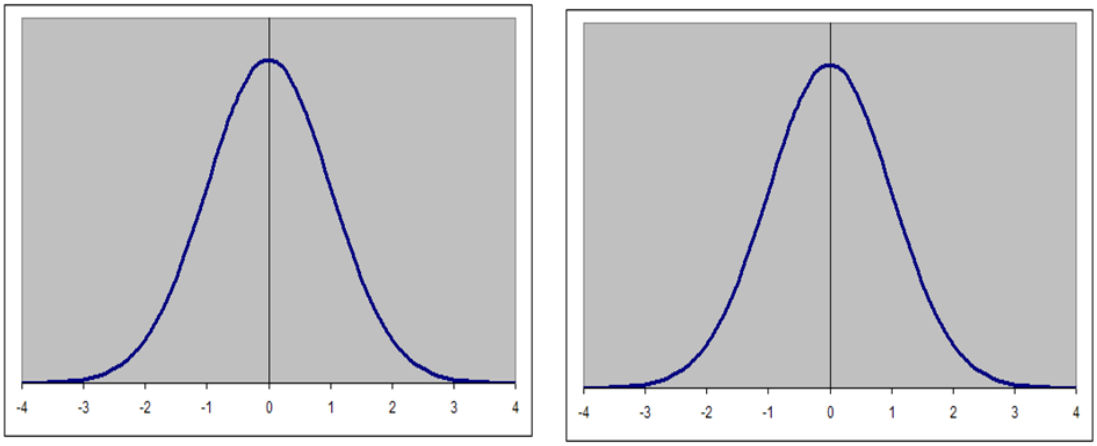

Figure 2: Normal distribution curve for test and control group showing similarities in the sample

The instrument used for data collection was the Chemistry Achievement Test (CAT). The CAT is a 30-item multiple choice objective test, which was used to test students' knowledge of the selected Chemistry concepts that were taught with both conventional method and multimedia method. The items in the test covered all the areas that were taught in the subjects in the two groups. The reliability of the instrument was obtained through a pilot test with the 30-item

multiple choice objective test (CAT) from samples different from that of the study. The data obtained were subjected to Kuder Richardson which gave a reliability index (K-R21) of 0.75. The data obtained were analyzed using means, standard deviations and the t-test statistic from SPSS sub-programmes. All hypotheses were tested at .05 alpha significant level.

Research Question One

How does performance of students taught Chemistry concepts using Multimedia differ from their counterparts in the control group? To answer this research question, frequency count, standard deviations and means were used for the analysis reported in table 1:

Table 1: Descriptive Statistics of Group's Pre-test, Post-test and Mean Gain Scores in Achievement

	Pre-test			Post-test			
Groups	N	X	SD	N	X	SD	Mean Gain
Multimedia (Experimental Group)	45	10.43	3.22	45	23.80	2.75	13.37
Conventional Method (Control Group)	45	11.00	2.64	45	12.20	3.50	1.20

Results on table 1 indicate that the experimental (Multimedia) group had the higher mean score in the post-test than the control group. However in the pretest both experimental and the control groups recorded comparable scores i.e. 10.43 and 11.00 respectively. On the other hand, the conventional method group, which served as the control, recorded the least mean score in the post-test.

Research Question Two

How do performances of male and female students taught Chemistry concepts using Multimedia differ from their counterparts in the control group? To answer this research question, frequency counts, standard deviations and mean were used for the analysis set out on table 2:

Table 2: Performances of Male and Female Students Taught Chemistry Concepts

	Male							**Female**						
	Pre-test			**Post-test**				**Pre-test**			**Post-test**			
Groups	N	X	SD	N	X	SD	Mean Gain	N	X	SD	N	X	SD	Mean Gain
Multimedia (Experimental Gr`oup)	25	9.90	3.00	25	23.2	2.72	13.3	20	10.2	3.07	20	22.5	3.03	12.3
Conventional Method (Control Group)	27	10.1	2.44	27	11.2	2.52	1.1	18	9.98	2.67	18	10.7	2.50	0.72

Results in table 2 indicate that the experimental (Multimedia) group recorded a mean achievement score of 22.5 for the female and 23.2 for the male subjects with a mean gain score of 13.3 and 12.3 respectively in the post test. Within the conventional method group, which served as the control, there were records of mean achievement score of 19.2 for the male and 18.7 for the female with mean gain score of 1.10 and 0.72 for both male and female students respectively. Besides, it could be observed that pre test scores were generally low on the learning outcomes in respect of all the various groups, while the control group recorded a relatively lower mean score than the Multimedia group. With these results from the descriptive analysis, it has become necessary to test each hypothesis.

Testing of Hypotheses

Ho_1: The first hypothesis states that there is no significant difference between the mean achievement scores of groups of students exposed to Multimedia and those in the control group.

In order to test for this hypothesis t-test was used to analyze the mean scores. The summary of this analysis is shown on table 3:

Table 3: t-test Value on Achievement Scores of Students Exposed to Multimedia and the Control group

Groups	Number (N)	Mean - (X)	Standard deviation (SD)	Df	t-Value	Std Error	Sig. (Two-tailed	Decision
Multimedia	45	23.80	2.75	88	11.05	1.0423	0.0000	Rejected
Control	45	12.20	3.50					

- Significant at P<.05

Table 3 shows that there was a significant difference between the mean achievement scores of students exposed to Multimedia and those exposed to conventional method (t=11.05, df=88, P<05). This hypothesis was therefore rejected. It then means that students' achievement in Chemistry differed significantly as a result of treatment with Multimedia.

Null Hypothesis Two

H_{O2}: The second hypothesis states that there is no significant difference between the mean achievement scores of male and female students exposed to Multimedia. To test for this hypothesis, t-test statistic was also used to analyze the mean scores. The summary of this analysis is shown on table 4:

The table indicates that there was no significant difference in the mean achievement scores of male and female students exposed to Multimedia-based instruction. Hence, this hypothesis was accepted in the light of the above result. It then means that achievement of boys and girls exposed to Multimedia were not significantly different from each other.

Table 4: t-test Value on Mean Achievement Scores of Male and Female Students Exposed to Multimedia

Gender	Number (N)	Mean - (X)	Standard deviation (SD)	Df	T- Value	Std Error	Sig. (Two-tailed	Decision
Male	25	23.2	2.72					
Female	20	22.5	3.03	43	1.23	1.1142	0.4346	Accepted

Discussion of Findings

The major aim of this study was to investigate the effect of multi-media projectors as instructional media of secondary school students' performance in chemistry. Two hypotheses were upraised and t-test statistical method was used to analyze the relevant data and the result in table 3 showed that there was a significant difference between the mean achievement scores of students exposed to Multimedia and those exposed to conventional method. The reason for this finding could be linked with the fact that Multimedia is student-centered method. It gives room for the students' to be at the center of their learning while the teacher facilitates the learning and more throw light on those difficulty areas. Heyneman & Loxley (2012) found that there were inadequate and poor school facilities in the developing countries. These inadequate and poor school facilities affected the students to perform much below as compared to the student performance of the developed countries. Levine & Donitsa-Schmidt (2016) discovered that the students in computer-based activities perform higher than those in traditional learning. Syed-Manzoor; Masroo & Waqar, (2012) indicated that results of students taught using lecture method were lower compared to that of those students' using the experimental group. The result of this finding is in agreement with the work of Mwamwenda & Mwamwenda, (2010) described that

school facilities including multimedia are factors that contributed to student achievement in Chemistry.

Table 4 indicates that there was no significant difference in the mean achievement scores of male and female students exposed to Multimedia-based instruction. Hence, this hypothesis was accepted in the light of the above result. It then means that achievement of boys and girls exposed to Multimedia were not significantly different from each other. This result is in agreement with Dalton, Ingels, Downing, & Bozick, (2012) whose study showed that both males and females performed brilliantly with the use of multimedia projector. This also goes in line with the research carried out by Amunga, Amadalo & Musera, (2010) in Kenya, results of their study showed for male and female students exposed to conventional method, revealed that mean of the male was slightly higher than that of the female. This can be said that multimedia projector enhances both male and female students' academic performance in Chemistry equally.

Conclusion and Recommendations

Based on the findings, it was concluded that students that were exposed to multimedia-projector performed better than those who were not. Also the use of multimedia-projectors does not base on gender influence that is, both male and female perform at equal level when expose to multimedia-projector. Therefore, it can be concluded that the use of multimedia-projector will further help the students perform better in chemistry thus, the appropriateness of educational technology to develop a learning environment that fosters increased student performance and attitude to be introduced into all our public secondary schools. It was recommended that,

Teaching should be seen as a dynamic profession, as a result, teachers should be sent for seminars, workshops, conferences and other related programmes that can keep them abreast in their chosen fields with the use of technology. Thus, students should be given opportunities to discover concepts while the teachers facilitate the teaching and the use of multimedia-projector

will adequately help both the teacher and the students to achieve this, by learning from other colleagues via multimedia usage

Reference

Abimbade, T. (2016). Association for Educational Communication and Technology. *The Definition of Educational Technology.* Washington DC: Author.

Ahmad, M. (2013). *Identification & Analysis of Educational & Socio-Economic Factors Affecting the Standards of Education.* A Research Study of Secondary Schools in Karachi West & Control Districts. Unpublished, Ph.D Dissertation, Institute of Education & Research (IER), University of Karachi, Pakistan.

Amelink, C. (2009). SWE-AWE-CASEE ARP Resources – Gender Differences in Science Performance.SWE-AWE CASEE Overviews.Retrieved11/11/13from http://www.AWEonline.org.

Amunga, J.; Amadalo, K. & M. Musera, M. (2010). Disparities in Chemistry and Biology Achievement in Secondary Schools: Implications for Vision 2030. *International Journal of Humanities and Social Science vol. 1 no. 18 www.ijhssnet.com* 226. University of Science and Technology Kenya.

Brainard, L. Carlin H. (2014). Teachers and machines: The classroom use of technology since 1920. New York: Teachers College Press.

Dalton, B., Ingels, S. J., Downing, J., & Bozick, R. (2012). *Advanced Mathematics and Science Course-Taking in the Spring High School Senior Classes of 1982, 1992, and 2004* (NCES 2007-312). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Erwin, T. D., & Rieppi, R. (2013). Comparing Multimedia and Traditional Approaches in Undergraduate Psychology Classes. Teaching of Psychology, 26(1), 58–61.

Hamilton-Pennell, R. E. & Rodney, R. B. (2011). The instructive animation: Helping students build connections between words and pictures in *multimedia* learning. *Journal of Educational Psychology, 84: 444-452.*

Heyneman, S.P., & Loxley, W.A., (2012). *The Evaluation of Human Capital in Malawi. World Bank Staff,* Working Paper No. 420, SWP 420, The World Bank, Washington, USA.

Kuhlthau, L. (2015). Role of interest in learning from scientific text and illustrations: On the distinction between emotional interest and *cognitive* interest. *Journal of Educational Psychology, 89, 92-102.*

Lanius, C. (2014). PowerPoint TM, not Your Grandmother's Presentations, but Is It Evil? Cell Biological Education, 3, 158–160.

Lance, T.O. (2012). Educational technology. In F. Durso (Ed.), Handbook of applied cognition. Chichester, England: Wiley.

Laureate Education Inc., (2009).Technology & Science Education. Starting Points, Research Programs & Trends. *International Journal of Science Education,* 25(6): 727-758.

Levine, T. and Donitsa-Schmidt, S. (2016). Classroom Environment in Computer-Integrated Science Classes: Effects of Gender and Computer Ownership, *Research in Science and Technological Education*, 14: 163-78.

Masroo & Waqar, (2012). *Teaching with Technology: Creating Student-Centered Classrooms*. New York Teacher College Press ERIC Document Reproduction Service No. ED 402923.

Mayer, R.E. (2001). *Multimedia Learning.* New York. Cambridge University Press.

Mullis, Martin & Foy, (2015). The no Significant Difference Phenomenon as Reported in 355 Research Reports, Summaries and Papers: A Comparative Research Annotated Bibliography on Technology for Distance Education, North Carolina State University, Raleigh.

Mwamwenda, T.S. and Mwamwenda, B.B. (2011). *School Fertilities and Pupils Academic Achievement, Comparative*.23 (2): 225-235.

Nicolas, G. (2013). *Learning to Teach*. PP.356-360, Bell & Bain Ltd. Glasgow.

Orji, A.B.C. (2010). Critical Appraisal of Science Education Programme for the Gifted in Nigeria. Paper Presented at *Educations State Leader's Forum. Held* at Federal University of Technology Minna, Niger State.

Orji, A.B. C, Dajal, R. G and Ojelade, I. A. (2009).(Reforming Science Education Curriculum for Good Governance in Nigeria). National Association for Science, Humanities and Education Research. Journal, 7(3): 136-139.

Orji, A.B.C. & Ebele, F.U. (2006). Effect of Thematic Instructional Strategy on the Performance of Male and Female Students' in Nigerian Secondary Schools. International Journal of Education, Science, Mathematics and Environmental Studies (IJESMES). Vol3. No.1 pp 10.

Raw, V.K. (2003). *Quality Teaching.* APH Publishing Corporation, 5 Ansan Road New Dehli. Pp 36-39.

Smith, P.L. & Ragan, T.J. (2009). *Instructional Design.* Hobokan, N.J. Wiley.

Standridge, (2012). *Teaching with Technology: Creating Student-Centered Classrooms*. New York: Teachers College.

Todd, R. & Kuhlthau, C., (2014). Student Learning through Ohio School Libraries, Part 1: How Effective School Libraries Help Students. *School Libraries Worldwide, 11*(1): 89-110.

WAEC, (2014). Chief Examiner's Report May/June Examination. Yaba-Lagos, Nigeria.