EFFECTS OF COMPUTER SIMULATION INSTRUCTION AND JIGSAW 1 METHOD ON ACHIEVEMENT IN PHYSICS AMONG SECONDARY SCHOOL STUDENTS IN KATCHA LOCAL GOVERNMENT, NIGER STATE

ZUBAIRU, D. M., GIMBA, R. W. (PhD)., NDAKO, U. Z., & MOHAMMED, N. J.
Department of Science Education,
Federal University of Technology, Minna, Niger State, Nigeria
E-mail: zmdanlami@gmail.com
Phone No: +234-803-647-7733, +234-803-285-3603

Abstract
The study investigated the Effects of Computer Simulation Instruction and Jigsaw 1 Method on Achievement in Physics among Secondary School Students' in Katcha Local Government Niger State. The design of the study was Quasi Experimental design with pretest posttest non-equivalent control group. There were two experimental groups and one control group. Experimental group 1 was taught with Computer Simulation Package (CSP), Experiment group 2 was taught with Jigsaw 1 method (JM) while control group was taught using Conventional lecture method (CLM). A sample of 171 Students was purposively selected from 3 senior secondary schools in Katcha Local Government area of Niger State, Nigeria. Physics Achievement Test (PAT) was used to collect data on the students' achievement. Test retest method was used to determine the reliability coefficient of the instrument and a score of 0.78 was obtained using Pearson's product moment correlation coefficient (PPMC). The data collected were analyzed using Mean, Standard deviation and ANCOVA in answering the research question and for testing the null hypotheses respectively. Findings of the study showed that Computer Simulation Package increases students' achievement in Physics more than Jigsaw 1 Method and Conventional Lecture Method. There was also no significant difference in the achievement of Male and Female students on the Physics concept. Based on the results it was recommended that Computer Simulation Package should be used in teaching and Learning of Physics in schools.

Keywords: Achievement, Computer, Jigsaw, Optics, Physics, Package, Simulation

Introduction

The results of the research in the field of Physics have led to many useful inventions as well as the production of many technological gadgets like radar controls in large airports, computer in banks, other large companies and industries. The television, radio, and high power in our homes. Microscope for use in laboratories, long range missiles and the space travels to mention but a few. Thus, the development of any nation depends very much, on quality of Physics instruction in secondary schools and higher institutions of learning. It is perhaps for this reasons that Physics is popularly regarded as the soul of science as it is basic and crucial for the development of all types of technology. The national policy on education (FRN, 2004) stipulated that Physics subject taught in the senior secondary school curriculum is aimed at enabling students to provide basic literacy in Physics for functional leaving in the society, Acquire basic concepts and principles of Physics as a preparation for further studies, Acquire essential scientific skills and attitudes as a preparation for technological application of Physics, to Stimulate and enhance creativity.

These aims can only be realized if students in Physics achieve better result in the subject. Achievement represents performance outcomes that indicates the extent to which students has accomplished specific goals that were the focus of activities in instructional environment specifically in schools (Maden, 2011). Poor academic achievement of students in Physics had been much pronounced in recent times, this is supported by the National Examination Council (NECO) result of students in Physics for 2006 -2018. The analysis of the result

revealed the fluctuation in the number of passes in NECO Examination between these periods. Arong and Ogbadu (2010) outlined some factors contributing to the decline in quality of education. These are lack of instructional materials, library facilities and students attitude towards learning. Adesoji and Ogini (2012) linked up the poor achievement in Physics to the poor academic background of students in Basic science taught at the Junior Secondary Schools classes (JSS 1-3) level.

The main aim of teaching is to transfer knowledge, understanding, critical thinking abilities, practical skills, interest and attitudes relating to the subject to the learner. For effective teaching and learning to take place, the teacher needs to use different methods and techniques in teaching, (Ezeudu & Ezewanne, 2013). Unfortunately, poor Physics achievement has been attributed to poor teaching methods used by teachers (Maden, 2011). The present Nigeria Physics classroom does not provide the fun, hands-on, challenging interactive and collaborative environment needed by new generation of students who have been exposed to internet, computer usage, handset and other sophisticated gargets (Ezeudu & Ezewanne, 2013). Therefore, there is the need for the use of Computer as medium of instruction in classroom at our Secondary School level.

The use of computer as a medium of instruction in schools is regarded as Computer Managed Instruction (CMI), Computer Assisted Learning (CAL), Computer Based Education (CBE), Computer Assisted Instruction (CAI), Computer Aided Instruction (CAI), Computer Based Instruction (CBI) and Computer Enriched Instruction (CEI). Computer Assisted Instruction (CAI) is a method of instruction in which the computer is used as a medium of instruction to the students and where the computer contains the instruction which is design to teach, guide and test the students until a desired level of proficiency is attained, (Goldsim, 2011). The computer assisted instruction (CAI) includes Drill and Practice, Tutorial, Games and Simulation, among others.

Simulations are tools that facilitate learning through representation and practice in a repeatable focused environment (Gusen, 2012). According to Goldsim (2011) simulation helps to identify and understand factors which control the system and to predict the future behaviour of the system. Simulation programme can be applied to Physics by providing real life settings for the application of optical concepts. Simulation includes role plays, games, computer programme that encourage students to become active participant in Physics classroom, simulation can be interior substitute, imitating an original or a display of real behavior.

Simulation package in teaching and learning Physics helps in understanding of the abstract and difficult concept by allowing the students to develop their own understanding of Physics concept. From an instructional design perspective, educational simulation package support predetermined learning outcomes by providing participants with opportunities to deal with the consequences of their actions and to respond to feedback. Simulation package is also valuable in presenting many types of representational formats, including diagram, graphics and animations, sound and video that can facilitate understanding. Computer simulation package also contain a manipulatable model of a real or theoretical system. The simulation package accepts commands from the user, alters the state of the model and when appropriate displays the new state, the simulation package provide a potential means of providing students with experiences that facilitate conceptual development. According to Akpomedeye (2014), computer simulation should be designed with the purpose of immersing students into real-life science encounters that require hand-on activities, higher-order thinking, and collaborative problem solving. Another teaching method that also

encourages student's activeness, higher-order thinking and collaborative problem solving in sciences is the Jigsaw 1 method (Maden, 2011).

The Jigsaw 1 method was developed by psychologists Eliiot Aronson and associate. The Jigsaw is a method of organizing class activity that makes students depend on each other to succeed (Lestick & Pious, 2012). In this method, the students are divided into small group of five or six each (called the jigsaw groups) and the concept to learn optics is broken into segments or sub-topics each student in the Jigsaw group is assigned a segment to specialize on as all students with same topics form expert groups. After the session, they reconvene in their Jigsaw group where each expert explains his or her topics to other members after which they take up quiz individually without help from group members. The score of individual members are summed up to form the group score which is used to reward the best group. In this method, each piece of information and each student's part either male or female is essential for completion and full understanding of the material (Emmanuel, Musa & Zipporah, 2013).

Gender is the range of characteristics pertaining to, and differentiating between masculinity and femininity (Tauna, 2013). Gender is any physical and behavioral differences between males and females which are socio culturally based (Okeke, 2008 & Ezeh, 2013). This means that women and girls grapple with a lot of discriminations and difficulties (Ezeh, 2013). Some studies revealed that male students experienced better change in learning and attitudes (Chen & Howard, 2010). Some studies could not even find out any form of influencing being exerted on gender on academic achievement (Tauna,2013). Thus, the issue of gender and students academics achievement is still far from being conclusive. These issues essentially set forth the problems that were investigated in this study.

The poor academic achievement of students in Physics had been much pronounced in recent times, this is supported by the National Examination Council (NECO), Performance of students in Physics for 2006 -2018 examination results. The analysis of the result revealed fluctuation in the number of passes in NECO Examination between these periods. The National Examination Council, (NECO, 2018) Chief Examiners Report, observe areas where students performance were below average. These areas includes projectile, waves, optics, electricity, photoelectric emission, Half-life, Threshold frequency, Inductance, Atomic and nuclear Physics. The field of optics (light waves) is a difficult area for students and many studies have reported students' difficulties in learning optics. The National Examination Council, (NECO, 2018) Chief Examiner's Report observed that students performance in Physics is below average and that this could be due to lack of understanding of the concept. Cheer, (2010) also observed that Physics poses more difficult and challenging task to learners and expressed worry that the decline in Physics achievement. Gusen (2012), had found conventional teaching method not working so well in secondary schools and that increasing visual content and student's co-operative learning makes instruction lasting and effective. In view of the above, it becomes imperative to provide an alternative instructional strategy such as simulation package and Jigsaw 1 method for teaching Physics (optics) for improvement of achievement in senior secondary school Physics.
The objectives of this Study includes:

To determine the effects of computer simulation package, Jigsaw 1 method on senior secondary school students' achievement in Physics and those taught Physics using the conventional method, determine the effects of gender on the achievement of students taught Physics using computer simulation package and determine the effects of gender on the achievement of students taught Physics using Jigsaw 1 method.

Research Questions

The following research questions guided the study.

(i) What is the difference in the mean achievement scores of students taught Physics using computer simulation package, Jigsaw 1 method and those taught using conventional method?

(ii) Would there be any difference in the mean achievement scores of male and female students taught Physics using computer simulation package?

(iii) What is the difference in the mean achievement scores of male and female students taught Physics using Jigsaw 1 method?

Research Hypotheses

The following null hypotheses were formulated for the study and tested at 0.05 level of significance:

HO_1: There is no significant difference in the mean achievement scores of students taught Physics using computer simulation package, Jigsaw 1 method and those taught using the conventional method.

HO_2: There is no significant difference in the mean achievement scores of male and female students taught Physics using the computer simulation package.

HO_3: There is no significant difference in the mean achievement scores of male and female students taught Physics using Jigsaw 1 method.

Methodology

The Quasi-experimental design with pretest posttest non-equivalent control group was adopted for the study with intact classes for both experimental and control groups. The experimental groups were taught with Computer Simulation Package (CSP) and the Jigsaw 1 Method (JM). The control group was taught using the normal conventional method. The design layout is shown in Table 1.

Table 1: Research Design Layout

Groups	Pretest	Treatment	Post test
Experimental group 1	O_{11}	X_1	O_{12}
Experimental group 2	O_{21}	X_2	O_{22}
Control group	O_{31}	-	O_{32}

Schematic representation of Research layout

Where:
X_1, X_2 = Experimental Treatments (CSP & JM)
$O_{11}O_{21}O_{31}$ = Pretest Scores
$O_{12}O_{22}O_{32}$ = Post-test scores
- Control Treatment (CT)

The population for the study comprises of twelve (12) Senior Secondary Schools in Katcha Local Government area of Niger State, with a total population of 2441 students. The sample comprises of three (3) selected coeducational Senior Secondary School (SS II) in Katcha Local Government of Niger State drawn through purposive sampling procedure. The reason for purposively selecting the sample schools is that they have computer laboratories and these schools are believed to share in common environmental condition, class size, population, curriculum and routine. The choice of S S II classes is based on the fact that the

concept of the study Rectilinear Propagation of Light and Reflection of light in optics fell under their syllabus and scheme of work. Two (2) schools were assigned to experimental group one and experimental group two respectively while the third group was assigned to control group. Simple random sampling was used in assigning each intact class to experimental group one and two and the control group.

The research instruments that were used to gather data for the study were divided into two: (i) Treatment instrument (Computer Simulation Package) and (ii) Test instrument.
The treatment instrument (Computer Simulation Package) was developed and produced by the researcher with the help of computer expert. The computer simulation package consists of two topics which are sub-divided into four lessons. The computer simulation package was developed using macromedia fireworks 8.0 the interface for the simulation package was designed. Macromedia action scripts 2.0 which is a programming language in macromedia flash was used to add interactivity to the interface. The designed user face was created using macromedia fire work for text, button and graph, while macromedia flash was used for the simulation. The main menu of the package consists of introduction, lists of lesson, topics, sub-topics, the home, previous, next, mute and exit. The voice over was done using audacity and finally compiled after inserting the audio in the package.

The Computer Simulation Package was validated by two Education Technologist experts in the department of Science Education and one computer expert in Computer Science department of Federal University of Technology, Minna. They determined the appropriateness of the package in terms of clarity and simplicity, colour used, spellings, text, audio voicing as well as the font size used. Suggestions made by the validators were taking into consideration and used to improve on the instrument.

The Test Instrument (Physics Achievement Test) was used for data collection and it comprises of 30 objective questions with four options A to D as possible answers to each question raised. The score of one mark was awarded for the correct answer and zero for any wrong answer and the overall scores were converted into percentage by the researcher. The test instrument was based on SS II Physics curriculum on the concept of optics which was administered to intact classes selected from different schools offering Physics in SS II. This instrument was administered to the experimental and control groups as pretest and post-test respectively. The Physics Achievement Test (PAT) was subjected to face and content validity by two Physics teachers from secondary school, two lecturers in Science Education Department as well as a lecturer from Physics Department, Federal University of Technology Minna for adequate coverage of the subject matter and content. The corrections and suggestions made by the experts helped the researcher to modify the test instrument. Test- retest method was used at the interval of two weeks and a reliability coefficient of 0.78 was obtained using Pearson's Product Moment Correlation Coefficient (PPMC).

Descriptive statistics such as the mean (x) and standard deviation were used to answer the research question. The null hypotheses were tested at $P \leq 0.05$ level of significance using analysis of covariance (ANCOVA). The pretest scores were used as covariate to the post-test scores, where significant difference was observed a comparative analysis of the effects of the three modes of instruction on achievement, multiple comparisons analysis was conducted (Scheffe). The data was analyzed using Statistical package for Social Sciences (SPSS) 20.00 version.

Results

Research Question One

What is the difference in the mean achievement scores of students taught Physics using computer simulation package, Jigsaw 1 method and those taught Physics using conventional method?

To answer this research question mean and standard deviation was used and the result is presented on table 2.

Table 2: Mean and Standard Deviation of CSP, JTM and CLM

		Pretest		Post test		
Group	N	Mean (x)	Std. Deviation	Mean (x)	Std. Deviation	Mean Gain
CSP	51	41.69	13.38	74.02	7.868	32.33
JM	56	37.62	12.58	67.45	7.296	29.83
CLM	64	40.94	12.74	51.66	7.751	10.72

Table 2 shows the mean and standard deviation of Computer Simulation Package, the Jigsaw 1 group and conventional lecture method group, as follows: Computer Simulation Package group ($\bar{x}$ = 74.02, SD = 7.868); Jigsaw ($\bar{x}$ = 67.45, SD = 7.296); and Conventional Lecture Method group ($\bar{x}$ = 51.66, SD = 7.751) respectively.

Research Question Two

Would there be any difference in the mean achievement scores of male and female students taught Physics using computer simulation package?

To answer this research question mean and standard deviation was used and the result is presented on table 3.

Table 3: Mean and Standard Deviation of male and female computer simulation package

		Pretest		Post test		
Gender	N	Mean (x)	Std. Deviation	Mean (x)	Std. Deviation	Mean Gain
Male	39	40.61	4.76	73.28	7.810	32.67
Female	12	41.50	8.54	76.42	7.902	34.92

Table 3 shows the mean and standard deviation of male and female group as follows: male group ($\bar{x}$ = 73.28, SD = 7.810); and female group ($\bar{x}$ = 76.42, SD = 7.902) respectively. Mean difference is 2.25 in favour of female students.

Research Question Three

What is the difference in the mean achievement scores of male and female students taught Physics using Jigsaw 1 method?

To answer this question, mean and standard deviation were used to answer the research question three on table 4.

Table 4: Mean and Standard Deviation of male and female jigsaw 1 method Group

		Pretest		Post test		
Gender	N	Mean (x)	Std. Deviation	Mean (x)	Std. Deviation	Mean Gain
Male	37	39.40	10.74	67.62	7.119	28.22
Female	19	42.96	14.61	67.11	7.817	24.15

Table 4 shows the mean and standard deviation of male and female group as follows: male group ($\bar{x}$ = 67.62, SD = 7.119); and female group ($\bar{x}$ = 67.11, SD = 7.817) respectively. Mean difference is 4.07 in favour of Male students.

Pre-test Analysis

Table 5: Summary of ANOVA comparison of the pre-test mean achievement scores of experimental and control groups

	Sum of Squares	df	Mean Square	F-value	p-value
Between Groups	994.100	2	497.050		
Within Groups	11780.754	168	70.124	7.088*	.001
Total	12774.854	170			

* = significant at 0.05 (P<0.05)

The Table 5 present the result of the pretest scores of experimental and control group. The results yield an F-value of 7.088 and a P-value of 0.001 (F_{-cal} of 7.088, df 149 and $p < 0.05$). This indicated that there is significant difference between the mean score of the experimental and control groups in the pretest. Hence, the three groups were not equivalent in the prior knowledge of physics before the application of the treatment, hence ANCOVA was used to analyze the hypotheses

Hypothesis One: There is no significant difference in the mean achievement scores of students taught Physics using computer simulation package, Jigsaw 1 method and those taught Physics using the conventional method.

Table 6a: Summary of ANCOVA Comparison of the Posttest Mean Achievement Scores of Physics students taught using CSP, JM and CLM,

Source of variable	Sum of Squares	df	Mean Square	F-value	P-value
Corrected Model	15506.848[a]	3	5168.949	88.138	.000
Intercept	92445.103	1	92445.103	1576.321	.000
Covariate (Pretest)	13.356	1	13.356	.228	.634
Main Effect (Group)	14047.979	2	7023.989	119.769*	.000
Error	9793.901	167	58.646		
Total	714752.000	171			
Corrected Total	25300.749	170			

*= Significant at 0.05 level

The results yielded an $F(2, 167) = 119.769$, $p < 0.05$. The result was significant at $p < 0.05$ and hypothesis one (HO_1) was rejected. Therefore, the computer simulation package (CSP) and Jigsaw 1 method (JM) produced a significant effect on the Posttest achievement scores of students when covariate effect (pretest) was controlled. This implies that a statistically significant difference exist among the three groups computer simulation package (CSP), Jigsaw 1 method (JM) and the conventional lecture method (CLM). Since it was established that there was a significant difference between the groups, the Scheffes' post hoc multiple comparison analysis was conducted to establish the direction of the difference among the groups. The result is presented in the Table 6b.

Table 6b: Summary of Scheffe's post hoc test for CSP, JM and CLM

	CSP	JTM	CLM
CSP	-	6.57*	22.36*
JTM	-6.57*	-	15.79*
CLM	-22.36*	-15.79*	-

From the Scheffes' post hoc analysis on the CSP, JM and CLM on mean achievement scores in the three groups. From the table it could be deduced that a significant difference was established between CSP and CLM: (mean diff = 22.36, p <0.05). The table shows that a significant difference was established between JTM and CLM: (mean diff = 15.79, p <0.05) also from the table it could be deduced that a significant difference was established between CLM and JM: (mean diff = -15.79, p <0.05).

Hypothesis Two: There is no significant difference in the mean achievement scores of male and female students taught Physics using the computer simulation package.

Table 7: Summary of ANCOVA comparison of the posttest mean achievement scores of physics students taught using CSP of male and female students

Source of variables	Sum of Squares	df	Mean Square	F-value	P-value
Corrected Model	242.866[a]	2	121.433	2.044	.141
Intercept	29520.377	1	29520.377	496.817	.000
Covariate (Pretest)	152.700	1	152.700	2.570	.115
Main Effect (Gender)	25.056	1	25.056	.422[ns]	.519
Error	2852.115	48	59.419		
Total	282519.000	51			
Corrected Total	3094.980	50			

ns= Significant at 0.05 level

The results yielded an F (1, 50) = 0.422, p > 0.05. The result was not significant at p > 0.05 and hypothesis two (HO_2) was retained. Therefore, the CSP package produced no significant effect on the Posttest achievement scores of male and female students when covariate effect (pretest) was controlled. This implies that there is no statistically significant difference among the two groups Male and Female.

Hypothesis Three: There is no significant difference in the mean achievement scores of male and female students taught Physics using Jigsaw 1 method.

To test this hypothesis, ANCOVA comparison was carried out as shown in Table 8.

Table 8: Summary of ANCOVA comparison of the posttest mean achievement scores of male and female physics students taught using Jigsaw

Source of variables	Sum of Squares	df	Mean Square	F-value	P-value
Corrected Model	57.921[a]	2	28.961	.535	.589
Intercept	40699.122	1	40699.122	751.608	.000
Covariate (Pretest)	54.574	1	54.574	1.008	.320
Main Effect (Gender)	6.692	1	6.692	.124[ns]	.727
Error	2869.918	53	54.149		
Total	257673.000	56			
Corrected Total	2927.839	55			

ns= Significant at 0.05 level

The results yielded an f 0.727 ($F(1, 55) = 0.124$, $p > 0.05$. The result was not significant at $p > 0.05$ and hypothesis three (HO_3) was retained. Therefore, the Jigsaw had no significant effect on the Posttest achievement scores of male and female students when covariate effect (pretest) was controlled. This implies that there is no statistically significant difference existing among the two groups (male and female students).

Findings of the Study

The summary of the findings of this study are:

(i) The Computer Simulation Package group performed better than the Jigsaw 1 method group and the Conventional Lecture Method group with higher mean achievement scores.

(ii) The female group performed better than the male group with higher mean achievement scores when taught using computer simulation package.

(iii) The result shows that the male group performed better than the female group with little mean achievement scores when taught using Jigsaw 1.

Discussion

The finding of the study reviewed that the Computer Simulation Package group perform better than the Jigsaw 1 method and conventional lecture group with a higher mean achievement score. This is in line with finding of Ezeudu and Ezewane (2013). That student's achievement using Computer Simulation was higher than the achievement of students taught using the lecture method. Also, there is no significant difference between the achievement of male and female group taught optics using Computer Simulation Package and conventional lecture method in the selected secondary schools.

Conclusion

Based on the finding of this study it was concluded that students taught using Computer simulation package and jigsaw 1 method in the learning of Physics in secondary schools have exhibit high level of achievement in optics concept than the lecture method. The female students taught optics concept with computer simulation package and Jigsaw 1 method achieve significantly than students exposed to lecture method.

Recommendations

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

(i) Computer should be proved in secondary school for teaching and learning of Physics.

(ii) Physics teachers should be train on the use of Physics software such as Computer Simulation Package for teaching and learning of different concepts in Physics.

References

Adesoji, F. A., & Ogini, A. M. (2012). Student's aptitude indices as predicators of learning outcomes in chemistry. *British Journal of Art and Social* Science, *8*(11), 174-182.

Akpomedaye, R. (2014). *Effect of computer simulation on academic achievement and retention in Biology among senior secondary school student in Niger State, Nigeria*. Unpublished M.Tech Thesis Federal University of Technology Minna, Nigeria.

Anyakoha, M. W. (2010). *New school Physics for senior secondary school*. Third Edition, Africana First Publishers Plc.

Aronson, E. (1978). *The Jigsaw classroom*. Beverly Hills: Sage publication.

Chen, C., & Howard, B. (2010). Effect of live simulation on middle school students attitudes and learning toward science. *Journal of Education Technology and Society. 13*(1), 133-134.

Emmanuel, E. A., Musa, H., & Zipporah, P. D. (2013). Do all comparative learning strategies have the potential to eliminate gender difference in student's achievement in biology? A field report on STAD and Jigsaw strategies*. Journal of Science Technology, Mathematics and Education (JOSTMED), 10*(1), 140-141.

Ezeh, D. N. (2013). *Writing research proposal and report without tears*: *Prior Knowledge, exploration discussion dissatisfaction.* Nigeria: Ephrata Publishers.

Ezeudu, F. O., & Ezewanne, O. P. (2013). Effect of simulation on students' achievement in senior secondary school chemistry in Enugu State, Nigeria. *Journal of Education and Practice, 19*(4), 273-278.

Federal Ministry of Education (2009). National curriculum for senior secondary, Lagos: *Nigeria Educational Research and Development Council (NERDC) Publisher.*

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

Goldsim, A. K. (2011). Information to what is simulation. (Online) available athttp://www.goldsin.com/web/introductionsimulation

Gusen, l. (2012). Learning with technology: Theoretical foundations underpinning simulations in higher education. *Journal of Apply Science, 4*(1), 103-108.

Lestik, M., & Pious, S. (2012). *Jigsaw classroom.* Retrieved on February, 20, 2015 from Jigsaw org. http://en.m.wikipedia.org/wiki/jigsaw (teaching techniques).

Maden, S. (2011). Effect of Jigsaw 1 techniques on achievement in writing expression skills. *Journal of Educational Science, Theory and Practice, 11*(2), 915-917.

National Examination Council of Nigeria (NECO) Result of 2006 – 2018 Academic Sessions. Statistical Results.

NECO (2018). Chief Examiners Report May/June 2018

Okeke, E. A. C. (2008). *Making science education accessible to all.* 23rd Inaugural Lecture of the University of Nigeria Nsukka. University of Nigeria, Press.

Simeon, M. I., & Simeon, O. M. (2013). Effect of computer assisted instruction on achievement in geometric optics in the senior secondary school Physics. *Journal of Science Technology, Mathematics and Education (JOSTMED), 9*(3), 227 -229.

Tauna, F. G. (2013). Correlative word of the femine and neuter gender. Paper presentation at University of Vaginia.