American Research Journal of Humanities Social Science (ARJHSS)
E-ISSN: 2378-702X
Volume-02, Issue-01, pp-27-35
January-2019
www.arjhss.com

Research Paper Open Access

Effects of Computer Assisted Instruction on Male and Female Students' Achievement in Basic Science in Jos Metropolis, Plateau State, Nigeria

Gongden, Ephraim Joel[1], Gongden, Esther Ephraim[2]
[1]*Department of Science and Technology Education, University of Jos, Nigeria*
[2]*Department of Crop Sciences, University of Jos, Nigeria.*

ABSTRACT: *This study investigated the effects of computer-assisted instruction (CAI) on male and female students' achievement in basic science in Jos metropolis, Nigeria. The study adopted pretest and posttest quasi experimental control group design with a sample of 153 Junior Secondary School two basic science students from two schools. These were randomly assigned into control and experimental groups. A Basic Kinetic Achievement Test, BKAT (r = 0.74) consisting of 30 multiple choice questions was used to collect pretest and posttest data. A CAI package on kinetic theory of matter was used as treatment instrument for experimental group while lecture method was used for the control group. Descriptive statistics and t- test for independent samples were used to analyze the data. The results showed statistically significant difference in the performances of students in the experimental and those in the control groups. However, there was no statistically significant difference in the achievements of male and female students taught using CAI. The study recommended that instructional materials such as computers and its accessories be provided by government and school administrators to facilitate quality teaching and learning. Teachers should be trained during pre-service and in-service programs to acquire skills in the use of CAI strategy.*

Key words: *computer-assisted instruction, basic science, achievement, BKAT*

I. INTRODUCTION

The importance of science and technology cannot be over emphasized. The development of new technology has been vital for human survival and progress throughout history as technology is seen as the primary vehicle through which humanity progresses [1]. It serves to eliminate hunger, poverty and lack of access to education in the future. This accounts for the current developments in science and technology which have so greatly affected the lives of humans. It is commonly acknowledged that the gateway to the survival of a nation can only be achieved through science and technology education. This accounts for the current developments in science and technology which have so greatly affected the lives of humans. The emphasis by the Nigerian government on science and technology as a necessary ingredient for national development as spelt out in the Nigeria National Policy on Education and vividly portrayed in the increasing number of new Science and Technical Colleges, Polytechnics and Universities of Technology is commendable. At the secondary school, students begin serious encounter with the sciences when they offer basic science at the Junior Secondary School (JSS) level. The subject introduces them to the main science subjects: chemistry, physics and biology.

Generally, the state of science teaching and learning in Nigerian secondary schools has been a source of concern to teachers, parents and stakeholders in Nigeria in view of the emphasis the National Policy lays on teaching science to every Nigerian child and scientific literacy [2]. Research works and reports have revealed the poor performance of students in basic science and the sciences in general. Analysis of past results of students in the Basic Education Certificate Examination (BECE) in Plateau state and the Local Government of study revealed that there was a dismal underachievement in basic science.

Table 1: Performance of Students in BECE (JSCE) in Plateau State

Year	%Credit Pass
2011	51.13
2012	71.61
2013	46.41
2014	15.63
2015	51.13
2016	46.48
2017	53.64

Source: Education Resource Centre, Jos

Table 2: Performance of Students in BECE (JSCE) In Jos North LGA

Year	%Credit Pass
2011	15.69
2012	64.78
2013	33.82
2014	08.89
2015	40.68
2016	30.78
2017	40.00

Source: Education Resource Centre, Jos

Analyses presented in Table 1 shows that the highest percentage pass obtained for the past five consecutive years was in 2012 when 71.61% of the students that sat for the BECE in Plateau state got at least, a credit pass in basic science. The achievement of students was worse in 2014. The average percentage pass for integrated science for the period 2011-2017 was 48%. This means that only 48% of the students that sat for basic science within the period got credit and above in the BECE. Table 2 gives the achievement of students in basic science within the same period in BECE but in Jos metropolis – the area where this study is carried. The average percentage pass for the period 2011-2017 was 33.52%. A look at the tables and the results shows that the performance of students in the BECE (JSCE) over the years has been not only been fluctuating, but not encouraging. There is no definite direction or consistency.

Many factors have been attributed to the underachievement in science subjects by secondary school students in Nigeria and one that is most common is poor teaching methods [3], [4], [5]. [6] had earlier observed that the main reason why students are unable to perform well in science education lies with the method of instruction. Teaching methods can best be described as the types of principles and methods used for instruction [7]. There are many types of teaching methods depending on the skill or information the teacher wants to convey to his students. [8] observed that the conventional lecture strategy is usually the dominant approach adopted by most science teachers in Nigeria. Teachers do not present the concepts in a variety of contexts for students to understand but in verbal and formal ways using the lecture teaching strategy. Other factors are type of school, lack of academic and professional qualifications, class size, attitude of teachers and students and inadequate motivation of teachers. A teacher who is not properly motivated would be less dedicated to his work and less productive.

At a time when scientific and technological competence is vital to the nation's future, the weak performance of students in science examinations at the secondary schools reflects the uneven quality of current science education at the secondary (upper basic) level of education. Many experts have called for a new approach to science education based on ongoing research on teaching and learning. Several studies have been undertaken on the teaching and learning of science subjects with a view to addressing nature and processes of science, instructional strategies and gender. These efforts were aimed at improving science teaching and learning.

The conventional lecture method is still the most frequently used teaching strategy - usually the dominant approach adopted by most science teachers in Nigeria [8]. The teacher sometimes writes on the chalkboard by way of solving examples or using instructional material while the students listen and take notes. Sometimes they ask the teacher questions for clarification. The method however, does not allow for students' participation as they are not engaged with the topic. They also do not seem to listen for very long thereby leading to minimal retention of concepts. The teacher talks most of the times, leading to, fleeting coverage of numerous topics but without understanding. [9] observed that when the conventional lecture strategy is adopted by teachers, students are not

actively involved in developing knowledge; they generally remain passive throughout the lesson. Hence, the strategy is mainly a teacher-centered approach to learning.

In view of the lapses inherent in the conventional lecture strategy of teaching basic and other sciences, many experts have called for a new approach to science education based on ongoing research on teaching and learning. Various instructional strategies have emerged through researches and have proved effective for learning science especially at the basic school level. Among these approaches are co-operative learning, computer-assisted instruction, concept mapping, multimedia instruction, analogies, simulations and games, advanced organizers, task approach and hybrid active learning strategies. Researches carried out in the past support the fact that each of these strategies had positive impact on the academic achievement of students, thus indicating advancement in knowledge and improvement of teaching and learning [10], [11]. These strategies constitute active learning strategies, which suggest that the techniques employed in the teaching and learning of basic and other sciences should be learner-centered.

The advent and introduction of computers in the field of education introduced a new dimension in the area of teaching and learning. According to [12], the use of computers in the learning process bring a major shift in the education paradigm that promises advantages over lecture learning system where, computers in education is slowly taking over those lecture, teaching aids such as overhead projectors, photographic slides, charts Research works have established the usefulness of CAI instructional media in the field of science education. The use of CAI in sciences especially basic science encourage exposure and capacity building in understanding, skills, knowledge and access to information in the technology world.

Computer Assisted Instruction (CAI) is an interactive technique whereby a computer is used to present the material and also to monitor the learning that takes place [13]. CAI has been found to be successful and beneficial as instructional approach for boosting interest, uplifting mentality, building up students' retention capacity and performance [14], [15], [16], [17]. CAI programs motivate the students and arouse their interest in teaching and learning process even in abstract concepts [13], [18]. In this study, the researcher used computer (laptops), projector screen and software on kinetic theory to teach junior secondary two the concept of kinetic theory of matter.

One of the variables that have been found to affect students' achievement in basic science is gender. Gender issues are of global contemporary concern and gender disparities have been found in students' achievement in basic science examinations. While some researchers are of the view that male students achieve better than the females [19], [20], others opined that female students achieve better [21], [10]. Yet still, some researchers [22] observed that both male and female students achieve equally. This is an indication that the existing accounts fail to resolve the contradiction between male and female achievement. Therefore, the situation calls for further investigation; more so that it has been opined that instructional method used in the classroom may influence gender and students' academic achievement in science.

The consequence of allowing the aforementioned problems to persist means allowing the gradual decline and fluctuation in the achievement of students in basic science examinations. This will have serious consequences on chemistry, physics and other science subjects which in turn will affect science and technological development of the nation and the socio-economic life of the nation. Therefore, there is an urgent need to improve on the teaching and learning of basic science by exploring the use of more innovative learner-centered teaching methods such as the computer assisted instruction (CAI). The computer assisted instruction (CAI) has been used in the teaching and learning of various courses and subject areas with promising results. However, while basic science teaching may benefit from the inclusion of this strategy, there seems to be scanty empirical research on the use of CAI approach to the teaching of basic science in junior secondary schools in Jos metropolis. This study therefore investigated the effect of the introduction of computer assisted instruction (CAI) on junior secondary two students' achievement in basic science among male and female students in Jos, Nigeria.

II. AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to investigate the effects of computer assisted instructional strategy on junior secondary two male and female students' achievement in basic science in Jos North Local Government of Plateau state. Specifically, the study sought to find out if the pretest mean achievement score of Junior Secondary two (JSII) students taught basic science using CAI instructional strategy differs from the pretest mean score of JSII students taught basic science with the conventional lecture strategy. It also sought to find out if the posttest mean achievement score of the JSSII students taught using CAI differs from the posttest mean score of the students in the control class. The influence of gender on JSII students' achievement in basic science when taught with CAI was also considered.

III. RESEARCH DESIGN

The research design used in this study was the quasi-experimental design. Specifically, it was the pre-test - post-test non-equivalent control group design. This design was chosen because intact classes were used as experimental and control groups as randomization of students was not possible.

The population of the study comprised of all the co-educational Junior Secondary two students schools in Jos metropolis for the 2017/2018 session. The students were the next to sit for the Basic Education Certificate Examination (BECE or JSCE). The aspect of basic science taught them the study, which is kinetic theory of matter, is part of JS2 curriculum. The sample consisted of seventy one hundred and fifty three (153) students made up of eighty four (84) and sixty nine (69) females from four schools. Simple random sampling was used to select the four schools, the intact class to be used in each school and to assign the classes into experimental and control groups. There were two experimental and two control groups.

Table 3: Student sample from the schools

S/No	Classl	Male	Female	Total	Group
1	A	25	21	46	Lecture
2	B	23	18	41	Expt
3	C	19	15	34	Expt
4	D	17	15	32	Lecture
Total		84	69	153	

3.1 MATERIALS AND METHODS

The research instrument used for data collection was the Basic Kinetic Theory Achievement Test (BKAT). The test in addition to seeking the name and gender of the students, consisted of thirty (30) multiple choice items were derived from the concept of kinetic theory of matter. Each item (question) was followed by a four-option response of A, B, C, and D. Only one of the options among the four bore the correct response to the question. Each correct option given by the respondents attracted one mark while incorrect option had a score of zero (0). The scores were converted to percentages.

The content validity of the BKAT was established by three experts from Technology Education and Test and Measurement Unit of the Faculty of Education, University of Jos, and a basic science teacher from a secondary school. The reliability was determined using the Split-Half method with the Spearman Brown formula used to estimate and correct the reliability value. The reliability of the BKAT was found to be 0.74.

3.2 Procedure for Data Collection

The researcher personally administered a pre-test using the BKAT to the students in the experimental and control groups with the assistance of the basic science of he schools. Their scores were recorded and kept for future use. In order to avoid bias, the researcher taught both the experimental and control groups the topic: kinetic theory of matter, using appropriate lesson plans. The topics covered included kinetic theory of matter, solids, liquids, gases, kinetic theory of gases, boiling and evaporation. The experimental class was taught using CAI (consisting of computers, projector, screen, specially designed programs on kinetic theory of matter, etc) while the control class was taught using the conventional lecture method. The teaching lasted two weeks in all. A posttest was administered after the two weeks of instruction with the items on the BKAT reshuffled and serial numbers changed. The posttest scores were recorded for analyses.

3.3 Method of Data Analysis

The data obtained was analyzed using SPSS Statistics version 22 the most recent version. Descriptive statistics (mean and standard deviation) were used to answer the research questions 1-3 which simply sought to find out the differences in mean scores. Hypotheses 1-3 were tested using t-test for independent samples and at 0.05 level of significance.

IV. RESULTS AND FINDINGS

The pretest and posttest raw data (scores) obtained were analyzed and used to answer the research questions and test the research hypotheses appropriately. The results are presented in the following tables:

Table 4a: Mean pretest achievement scores of JSII students taught basic science using CAI and lecture strategy.

Achievement	N	Mean	Standard deviation	Mean Difference
Lecture	78	26.051	9.86	0.19
CAI	75	25.853	10.46	
Total	153			

Table 4b: T-test for independent samples for pretest scores of JSII from public and private schools taught basic science using CAI instructional media and those taught using lecture method

Achievement	N	Mean	tcal	DF	Sig.(2-tailed)	Decision
CAI	75	25.853	0.12	151	0.904	Not significant
Lecture	78	26.051				
Total	153					

P>0.05

Analyses from Analyses from Table 4a show that the mean pre-test achievement scores of JSII students taught basic science using lecture strategy is 26.051 with standard deviation 9.86and the mean pre-test achievement scores of those taught using CAI instructional media is 25.853 with standard deviation of 10.46. The mean difference of 0.19 is very small. This indicates that the pre-test mean scores of students taught using CAI instructional media and the pre-test mean scores of students taught using lecture method are almost the same. The difference is very negligible.

T-test of independent samples (Table 4b) conducted indicates that there is no statistically significant difference in pre-test achievement scores of JSII students taught basic science using CAI instructional media and those taught using lecture strategy ($t_{151} = 0.12$, $p > 0.05$). Thus the null hypothesis is accepted with adequate evidence since the p-value of 0.904 is greater than the level of significant 0.05

Table 5a: Mean posttest achievement scores of JSII students taught basic science using CAI and those taught using lecture strategy

Achievement	N	Mean	Standard deviation	Mean Difference
CAI	75	60.85	9.77	8.02
Lecture	78	52.83	9.83	
Total	153			

Table 5b: T-test for independent samples of posttest mean scores of JSII students taught basic science using CAI and those taught using lecture strategy

Achievement	N	Mean	t-cal	DF	Sig.(2-tailed)	Decision
CAI	75	60.85	5.062	151	0.000	Significant
Lecture	78	52.83				
Total	153					

P>0.05

The output in Table 5a above revealed that the mean post-test achievement scores of JSII students taught basic science using CAI is 60.85 with standard deviation 9.77and the mean post-test achievement scores of those taught using lecture strategy is 52.83 with standard deviation of 9.83. The mean difference of 8.02 is huge which indicates that the mean post-test achievement scores of students taught basic science using CAI instructional media

is quite different from that of students taught basic science using lecture. The mean achievement scores of students taught basic science using CAI instructional media is higher than those taught using lecture by 8.02

The t-test of independent samples conducted and presented in Table 5b indicates that there is highly statistically significant difference in post-test achievement scores of JSII students taught basic science using CAI and those taught using lecture strategy ($t_{151} = 5.062$, $p < 0.05$). Thus the null hypothesis is rejected with adequate evidence since the p-value of 0.000 is less than the level of significant 0.05. Therefore there is a significant difference between the post-test mean achievement scores of JSII students taught basic science using CAI instructional media and the JSII students taught using the lecture strategy

Table 6a: Mean posttest achievement scores of JSII male and female students taught basic science using CAI instructional media.

Achievement	N	Mean	Standard deviation	Mean Difference
Male	42	61.83	10.10	2.22
Female	33	59.61	9.26	
Total	75			

Table 6b: T-test for independent samples for mean posttest achievement scores of male and female students taught basic science using CAI

Achievement	N	Mean	t-cal	DF	Sig.(2-tailed)	Decision
Male	42	61.83	0.98	73	0.33	Not significant
Female	33	59.61				
Total	75					

P<0.05

The results in Table 6a reveal that the mean post-test achievement scores of JSII male students taught basic science using CAI is 61.83 with standard deviation 10.10 and the mean post-test achievement scores of JSII female students that were taught basic science using CAI instructional media is 59.61 with standard deviation of 9.26. The mean difference of 2.2 is small. Therefore there is no difference between the mean achievement scores of male and female students taught basic science using CAI instructional media.

The t-test of independent samples in Table 6b for the male and female students taught using CAI indicates that there is no statistically significant difference in post-test achievement scores of JSII male and female students achievement. This implies that their mean achievement scores is similar ($t_{73} = 0.98$, $p > 0.05$). Thus the null hypothesis is accepted with sufficient evidence since the p-value of 0.33 is greater than the level of significant 0.05. Therefore there is no significant difference between the posttest mean achievement scores of JSII male and female students taught basic science using CAI

V. DISCUSSION OF THE FINDINGS

The study found out that there was a significant difference between the post-test mean achievement scores of JSII students taught basic science using CAI and those taught using the lecture strategy with the students taught with CAI outperformed those taught with lecture strategy. This result clearly indicated that the treatment was statistically significant on the students' achievement in basic science. The use of computer assisted instructional strategy improved students' academic achievement in basic science. This finding agrees with that of [23] who found out that computer assisted instruction enhanced higher students' achievement in basic science than the conventional method. The finding also supports previous assertion by [13] that students taught through computer assisted instruction as supplementary strategy performed significantly better in science. This implies that the use of computer must have facilitated and improved instruction thus improving understanding of the content, hence students' academic achievement. The conventional lecture method employed by researcher and most teachers for instructional delivery seem ineffective for equipping students for better academic achievement in basic science. This significant difference between the post-test mean achievement scores of JSII students taught basic science using CAI and those taught using the lecture strategy could be due to the supporting roles that tools play in learning. Tools like computers support the learner to construct his or her own knowledge in a way that leads to more efficient learning, provides

motivation and facilitates innovation. Vygotsky's social constructivism also supports the use of tools, which through scaffolding and providing directed pointers can "enrich and broaden both the scope of activity and the scope of thinking of the learner.

However, the result disagreed with the findings of [24] who found out in a study that investigated the comparative efficiency of computer-assisted instruction (CAI) and conventional teaching method in biology on senior high school students that the performance of students instructed by the conventional approach performed better on the posttest examination. The finding is also at variance with that of [25] who, in a comparison of a computer-based and a lecture-based computer literacy course, found no significant difference between computer-based instruction group students' and lecture-based instruction group students. [26] carried a comparative study to assess the effectiveness of lecture method of learning versus computer assisted learning. Their study revealed that there was an improvement in the knowledge gained in both groups however difference between the two groups were statistically insignificant. The present study however disagreed with this result as it established the effectiveness of computer assisted instruction over the traditional lecture method.

The study also found out that the introduction of computer-assisted instructional media into junior secondary two basic science improved both male and female students' academic achievement in basic science almost equally. There was no statistically significant difference between the posttest achievement mean scores of male and female students taught basic science using CAI. This finding supports earlier finding by [13] who found out that computer-assisted instruction was equally effective for both male and female students. It also agreed with those of [27], [28] and [29] who in their various studies on the effects of CAI established that the strategy equally and significantly increased the achievement of both male and female students than the use of conventional lecture method.

The non-significant effect of gender on students' academic achievement in basic science is not consistent with that of [30] who, in a study on the effectiveness of CAI in developmental mathematics found a significant difference between male and female students with the JSII female students outperforming the male students. The finding here also disagreed with that of [31] who found that female students performed better than their male counterpart in a study involving the use of digital video for instruction. [32] also found a significant difference in the performance of male and female students who were treated with digital video Instruction in chemistry. The male outperformed their female counterpart. The non-significant effect of gender on students' academic achievement may be that the computer assisted instruction impacted and produced the same learning effect on both male and female students in basic science hence the non difference in their achievement. It does not discriminate in the performance of males and females. The implication of this finding could be that what matters in teaching and learning is the effectiveness of the instructional strategy and not gender of the learners. Hence, computer assisted instructional strategy is not gender-sensitive as it increased the achievement of both gender significantly

VI. CONCLUSION AND RECOMMENDATIONS

The results of the study clearly indicated that the use of CAI led to a statistically significant difference on JSII students' achievement in basic science. The introduction of computer-assisted instructional strategy into junior secondary schools proved that it can be used to improve students' academic achievement in basic science. The study also showed that computer-assisted instructional strategy equally influenced both male and female students equally. This study has proved the position of computers for education and instruction in developed countries. The study recommended that seminars, workshops and conferences be organized by the state ministry of education to train teachers and curriculum planners on the application and usage of CAI for effective teaching and learning of basic science and other secondary school subjects. Instructional materials such as computers and its accessories should be provided by government and proprietors of schools in order to facilitate quality teaching and learning.

REFERENCES

[1] Malik, A., *Technology and developing countries, 2010, r*etrieved July 18, 2014 from http://amalik17.blogspot.com/2010/09/importamce-of -science-and-technology.html

[2] Sowunmi, V. O., & Aladejana, F. O., Effect of simulation games and computer assisted instruction on performance in primary science in Lagos state Nigeria, West Africa. *Journal of Social Sciences*, *2 (2)*, 2013, 117-122

[3] Omosewo, E. O., Physics teachers' education and national education reforms, in Lawal, A. R. (Ed.), *Education reforms in Nigeria – past, present and future*, (Stirling-Harden Publishers Ltd, Lagos, 2008), 247-250.

[4] Adegoke, B. A., Integrating animations, narrations and textual materials for improving students' learning outcomes in senior secondary school physics. *Electronic Journal of Research in Educational Psychology, 8(2)*, 2010, 725-748.

[5] Nsungo, N. N., & Arikpo, U. U., Teaching Physics for Retention. *International Journal of Modern Management Sciences, 2(1)*, 2013, 18-25.

[6] Gabel, D., *Problem solving in chemistry*: *Research matters to the science teacher*, 2003, retrieved June, 12 2013 from www.narst.org/publications/research/problem.cfm

[7] Gatto, J. T., *A different kind of teacher* (New York: Berkeley Hills Books, 2010).

[8] Atadoga, M. M., Mari, J. S., & Danjuma, A. B., Effects of computer-assisted instructions on academic achievement of NCE physics students in Niger state, Nigeria. *Reports and Opinion*. *8(1)*, 2016, 39-46.

[9] Adegoke, B. A., Effect of multimedia instruction on senior secondary school students' achievement in physics, *European Journal of Educational Studies, 3(3)*, 2011, 537-541.

[10] Adeniran, S. A., Task approach as an innovation for facilitating meaningful learning, *International Journal for Science, Technology and Mathematics Education, 2(2)*, 2014, 99-106.

[11] Uche, C. O., & Mankilik, M., Development and validation of a hybrid active learning strategy for direct current electricity concepts for secondary schools in Nigeria, *International Journal for Innovation Education and Research, 3(8)*, 2015, 56-66.

[12] Bharathy J. B., Importance of computer assisted teaching and learning methods for chemistry, *Science Journal of Education, 3(4)*, 2015, l1-16.

[13] Tabassum, R., *Effects of computer assisted instruction (CAI) on the secondary school students' achievement in science*, doctoral dissertation, University of Arid Agriculture, Rawalpindi, 2004

[14] Iqbal, K., Computer-assisted instruction. *School Improvement Research Series*, 2009. http://www.nwrel.org/scpd/sirs/5/cu10.html

[15] Osemwinyen, A. C., (2009). *Effects of e-learning on retention and achievement in secondary school mathematics in Abuja, Nigeria*, doctoral dissertation, University of Nigeria, Nsukka, 2009

[16] Yusuf, M. O., Ofolabi, A. O., & Alyande, E., Effects of computer assisted instruction on secondary school students' performance in biology, *The Turkish on line Journal of educational technology (TOJET), 9 (1)*, 2010, 62-69.

[17] Gambari, A. I., Emmanuel, K., & Ikusanu, T., Efficacy of computer-based simulation on students' achievement in physics education, *Indo-African Journal of Educational Research, 2 (1)*, 2014, 15-20.

[18] Iwuanyanwu, G. O., Obeka, S.S., & Lakpini, M. A., Effects of simulation games strategy on academic performance in biology among secondary school students in Zaria, Nigeria, *Journal of Research in National Development, 14(1)*, 2016, 1-6.

[19] Azar, A. & Sengulec, O. A., Computer-assisted and laboratory-assisted teaching methods in physics teaching: The effect on student physics achievement and attitude towards physics, *Eurasian Journal of Physics and Chemistry Education*, Jan (Special Issue), 2011, 43-50.

[20] Bot, T. D., & Emefo, C. N., Effects of cooperative learning strategy on achievement of male and female SS2 students in algebra in Bichi LGA of Kano state, *International Journal of Research in Science, Technology and Mathematics Education. 2(2)*, 2014, 86-98.

[21] Nsofor, C. C., & Ahmed, N. A., Effects of computer aided package on students' academic achievement in biology concepts in Bauchi state. *International Journal of Research in Science, Technology and Mathematics Education, 2(2)*, 2014, 244-255.

[22] Kathy, D. S., *The effect of computer-assisted instruction in developmental mathematics*, doctoral dissertation, Liberty University, Rynchburg – USA, 2009

[23] Nwafor, C. E., & Oka, O. O., Effects of computer assisted instruction students' achievement in basic science, *International Journal of Scientific & Engineering Research, 7 (10)*, 2016, 1940-1957.

[24] Owusu, K. A., Monney, K. A., Appiah., J. Y and Wilmot., E. M., Effects of computer assisted instruction on performance of senior high school biology students in Ghana, *Journal of Computer and Education, 55 (2)*, 2010, 904-910

[25] Varank, I., A comparison of a computer-based and a lecture-based computer literacy course: a Turkish case, *Eurasia Journal of Mathematics, Science and Technology Education, 2 (3)*, 2006, retrieved from www.ejmste.com on December 18, 2018

[26] Aruna, S. & Thenmozhi, P., Comparative study to assess the effectiveness of lecture method of learning versus computer assisted learning, *IJAICT*, 1 (1), doi:01.0401/ijaict, published Online 05 (05) 2014, retrieved from www.ijaict.com on December 18, 2018.

[27] Olanrewaju, B. O., Better, E. S., & Ugwuanyi, P. N., Effect of computer assisted instruction (cai) on senior secondary students' achievement in chemical reaction and equilibrium in Egbeda Local Government Area of Oyo State, *International Journal of Secondary Education*, *4 (4)*, 2016, 39-43.

[28] Inci, M., John, H. P., Nilgun, S., & Ozge, O. O., "Introduction to precipitation and solubility within a computer-enriched module for analytical chemistry," *The Chemical Educators*, *11(5)*, 2011. 11-18.

[29] Ugo, P., Effects of Computer Assisted Instruction on Students' Achievement in Agricultural Science in Secondary Schools in Bayelsa State, *International Journal of Educational Benchmark (IJEB), 6 (1), 2017,* 58-73.

[30] Spradlin, K. D., *The effectiveness of computer-assisted instruction in developmental mathematics*, doctoral dissertation, Liberty University, 2009

[31] Anagbogu, M. A. and Ezeliora, B., Sex differences and scientific performance, *Women. Journal of Science and Technology*. *4*, 2007, 10-20.

[32] Sani, I. D., *Effects of computer assister concept mapping and digital video instruction on students achievement in chemistry, doctoral dissertation*, University of Nigeria, Nsukka, 2011