

EFFECT OF ACTIVITY-BASED TEACHING STRATEGY ON STUDENTS' ACHIEVEMENT IN GEOMETRY AMONG JUNIOR SECONDARY SCHOOL TWO (2) IN PANKSHIN L.G.A OF PLATEAU STATE

Augustine, M.Y., Toma, I.A. & Gakbish, J.G.

07032469630 | yillengaugustine @ gmail.com
08069693049 | tomapate2021@gmail.com
08069693049

Department of Mathematics, Federal College of Education Pankshin, Plateau State Nigeria.

Abstract

The purpose of the study is to investigate the “effect of activity-based teaching strategy on students’ achievement in geometry among junior secondary school two (2) students in Pankshin Local Government Area.” Two research questions and two hypotheses were asked formulated respectively. Quasi-experimental research design was adopted for the study and four junior secondary schools were used for the study as sample size. A sample of 124 students out of the population of the junior secondary schools in Pankshin L.G.A was selected who were further divided into experimental and control group, consisting 57 and 67 students respectively. The data collected was analyzed using SPSS and the hypotheses were tested using independent sample t-test. The instrument for data collection was Geometry Achievement Test (GAT). The result of the study indicated that Teaching Geometry using activity-based teaching strategy and the conventional method has a statistically significant difference on mean achievement scores for experimental group ($X=48.96$, $S=18.79$) and for the control group ($X=45.69$, $S=14.88$) with an effect in favor of using activity-based teaching strategy. Gender has no statistically significant effect on students’ achievement in geometry using activity-based teaching strategy. Based on the findings, recommendations were made such as activity-based teaching strategy should be adopted by mathematics teachers, to teach geometrical concepts in mathematics. Workshops and seminars should be organized by stakeholders in mathematics education for in-service mathematics teachers on the need for the use of activity-based teaching as instructional strategy in the teaching and learning of mathematics.

Introduction

Mathematics as a key subject of study can be described as the essential science, it is that branch of science that utilizes numbers and signs, numbers and signs are organized utilizing orderly numerical principles. It can be comprehensively defined as the science of space, time, capacity, amounts, shapes, numbers and their association with each other, it is also considered that mathematics is hard to learn whereas it has unique ideas and is called the study of logical thinking. It assists a person to provide precise clarification to his thoughts and decisions.

In appreciation of the importance of Mathematics and its relevance to national development, Kiplagat, Role and Makewa (2012) confirm that mathematics study is recognized worldwide as the most important subject in most fields of human endeavors. A lot of value were attached to mathematics such as mathematics education is a national priority; the foundation upon which subsequent higher level of education depends on, as the mirror of civilization and a science of immutable truths (Betiku, 2001; Obioma, 2005; Maduabum and Odili, 2006, National Mathematical Advisory Panel, 2008). Others include the need for basic knowledge and application of mathematics in science and technology for purposeful and meaningful economic development. The National Policy on Education of Nigeria also reflected that the teaching of problem solving in the classroom is very essential in order to prepare the students for problem-solving challenges outside the four walls of the classroom (Fajemidagba, Salman and Ayinla, 2012). There is evidence that students lack interest in the subject and perform poorly in mathematics education (Agwagah, 2001; Betiku, 2001; Obioma, 2005; Maduabum and Odili, 2006). Studies have also reaffirmed that students at the secondary education level lack skills in answering almost all the questions asked in general mathematics especially in Geometry of circles and 3-dimensional problems (The West African Examination Council (WAEC), 2005; 2006). What then is geometry?

According to Ahmad, (2013), Geometry can be described as the science of space and it is important in a person's cultural development.”, geometry can also be described as a branch of mathematics that study properties of given elements that remain invariant under specified transformations. Geometrical content, according to Henderson (2016), can be classified into four areas i.e. Plane geometry; the geometry that deals with figures in 2- dimensional planes,

Solid geometry which deals with figures in 3- dimensional space, Spherical geometry dealing with figures on the surface of the sphere, Euclidean geometry which deals with plane and solid based on Euclid's postulates and Analytical geometry that deals with the relationship between algebra and geometry, using graphs and equations of lines, curves and surfaces to develop and prove relationships (Henderson, 2016). In order to provide the students with the correct information, the teachers are the focal figure and have to set standards accordingly for their students. They are required to be competent enough and must possess the required knowledge of the subject matter. This knowledge must be passed on to the students in the most neutral and creative ways to enable the students to develop a clear insight of stimulating critical thinking skills. Ericksen (2015) believes that "Effective learning in the classroom depends on the teacher's ability to maintain the interest that brings students into the course in the first place."

The emphasis of effective learning in a classroom has vital importance in student retention. The teachers are required to be adaptive to the changing classroom and student needs' such that the students enjoy the course and establish goals. One of such method is Activity Based Teaching (ABT), which is defined as a learning process in which students are constantly engaged (Panko et al., 2007). Activity Based teaching is defined as a setup where students actively participate in the learning experience rather than sit as passive listeners. These writers emphasize that active learning method is different from the traditional method of teaching by: (a) the active role and involvement of students in the classrooms and (b) collaboration amongst the students in a learning environment.

These two items are the key to ABT and aim to establish a positive learning environment in the classroom. Churchill (2003) propagates that activity-based teaching aids students and learners to construct mental models that allow for higher-order achievement such as applied problem solving and transfer of information and skills.

Activity-based teaching is the baseline for creative and critical thinking skills enhancement. However, this method will not function properly if students are not motivated enough to achieve their actual potential. The most useful and effective method to teach concepts that are complex in nature is by involving students in interactive activities, which is also the backbone of ABT. By utilizing different activities in the classroom, critical thinking skills and creative skills of the students are also enhanced. Hake (2014) emphasizes the

importance of various activities and their relevance in everyday activity-based teaching methodologies. The researchers suggested that an essential teaching strategy used by mathematics teachers at junior secondary school level is an approach that aims mutually to reinforce practical or activity based approaches in order to develop students thinking skills, particularly in teaching Geometric shapes. They should be given the opportunity to learn about these shapes.

Evidences from research findings revealed that many young learners performed very poorly in the subject due to one factor or the other thereby limiting their career prospect in areas that demands little or no mathematics (Ado, 2014 & Gana, 2016). The reasons behind these low achievements may be due to several factors such as poor teaching methods, psychological factors, poor learning environment, inadequate evaluation process, bad attitudes of students and teachers, lack of interest and motivation during the teaching learning processes, teachers' qualifications, and Governmental policies. What is achievement?

Achievement or academic achievement is seen as the extent to which a student or institution has achieved either short- or long-term educational goal. An American philosopher, psychologist, and education reformist, John Dewey, stated in the early 1900s, "If we teach today as we taught yesterday, we rob our children of tomorrow" (Tolbert, 2015). Studies have indicated that an up-to-date method of teaching, Activity-Based Teaching can be a valuable supplementary aid used to improve student achievement.

In line with this, Narad and Abdullah (2016), defined achievement as the knowledge gained which is assessed by marks by a teacher or educational goals set by students and teachers to be achieved over a specific period of time. Academic achievement is commonly measure through examination and continuous assessment. However there is no general agreement on how it is best evaluated or which aspect is most important. Several factors such as attitude of students and teachers, study habit, teachers' qualification, teaching methods, school environment, government policy, school location, gender, and family types have been identified in several studies as factors influencing students' academic achievement (Akomolufe & Olorumfemi-Olabisi, 2011).

Gender is an important variable in the school system. Gender refers to the condition of being male or female. According to Kanno, (2016), gender is an analytic concept that describes sociological roles, cultural responsibilities and expectations of men and women in a given society or cultural setting. Therefore, gender is a psychological term and a cultural construct developed by the society to differentiate between the roles, behavior, mental and emotional attributes of males and females (Eugene & Ezech, 2016). Hence Okeke (2017) described the male attributes as bold, aggressive, tactful, economical use of words while the females are fearful, timid, gentle, submissive and talkative. This may be the reason why Umoh, (2015) asserted that more difficult works are usually reserved for males while the females are considered feminine in a natural setting. Furthermore, Ezeudu and Obi (2013) stated that teachers also encourage gender stereotype by giving different treatment to males and females in class. Teachers go further to give different career guidance to males and females. The males are also assigned leadership positions and the females are to assist or follow. However, it is expected that the learning experiences offered to students in schools should not discriminate against the males and females. There is the need to see that both male and female students are given equal access to education especially in mathematics.

Therefore, the search for a good instructional delivery strategy that will stimulate the interest of students in geometry and facilitate their overall achievement in Mathematics is necessary. Thus, there is need to investigate the effect of Activity-Based Teaching strategy on students' achievement in geometry.

Students see certain aspects of geometry as very difficult and as a result students' achievement in geometry remains low. despite effort of mathematics teachers to enhance learning of geometry as a result many students avoid geometrical problem in external examination like BECE. Majority of the candidate found it difficult in attempting questions on geometry and majority of those who did, performed poorly as they were unable to calculate the areas and volumes of plane and solid shapes, angle of elevation and depression, angles at a point add up to 360, parallel lines cut by a transversal, types of triangles and angles and inability to calculate areas and volumes of irregular shapes (WAEC, 2019). According Ngwu, (2014) ineffective and uninspiring teaching methods and lack of students' involvement are responsible

for the observed poor achievement in secondary school students in mathematics particularly in geometry.

A good understanding of geometry is fundamental in students' progress in the study of mathematics. Various conventional methods (lectures, discussion, guided discovery and expository) has been used in teaching and learning of geometry but has contributed very low in students' achievement in geometry (Ngwu 2015). This is because the conventional method of teaching geometry limits effective communication of geometrical concept to students (Lasisi, 2007, Adeyegbe, 2008). Available research on Activity-Based Teaching indicates that its use in the classroom instruction can promote acquisition of facts and skills, enhance understanding of concepts, make learning more varied, practical and interesting and provide individualized instruction as well as effective interaction and immediate feedback to the learner (Tolbert, 2015). For this reason, the study seek to investigate the effect of Activity- Based teaching strategy on students' achievement in geometry among Jss II students in pankshin local Government Area of plateau state.

The purpose of the study was to investigate the effect of Activity-Based Teaching on students' achievement in Geometry among junior secondary II students in Pankshin, L G A. The following are the objectives of the study :

- i. To determine the effects of Activity-Based Teaching on students' mean achievement scores in geometry.
- ii. To determine the effects of Activity-Based Teaching on male and female students' mean achievement in geometry.

In view of the above, the following research questions were raised and answered.

- i. What is the difference in the mean achievement scores of students' taught geometry with Activity-Based Teaching and those taught with conventional teaching method?
- ii. What is the difference in the mean achievement scores of male and female students taught geometry using Activity-Based Teaching?

The following Null hypotheses were formulated and tested at 0.05 level of significance.

Ho₁: There is no significant difference in the mean achievement scores of JSS II students' taught geometry using the Activity-Based Teaching and those taught using conventional method.

Ho₂: There is no significant difference in the mean achievement scores of male and female students taught geometry using Activity-Based Teaching method.

This study will be of significance to professional bodies, mathematics teachers, students, Ministries, Curriculum Planners, and government.

Professional bodies such as MAN and STAN will see the need to organize seminars, conferences, and workshops for mathematics teachers on the need and the use of activity-based teaching strategy for effective teaching and learning of geometry in both secondary and primary schools.

The study will enable mathematics teachers identify the appropriate strategies (activity based) towards teaching geometry. It will provide them with alternative approach towards the steps in constructing shapes and calculating the area and volumes of the 2-dimensional and 3-dimensional shapes.

To students, the result of the study will help them use geometrical ideas effectively even in the learning of other subjects and an alternative to understanding the role of geometry in human life. It will inculcate in them the habit of individualization and think- share approach towards learning.

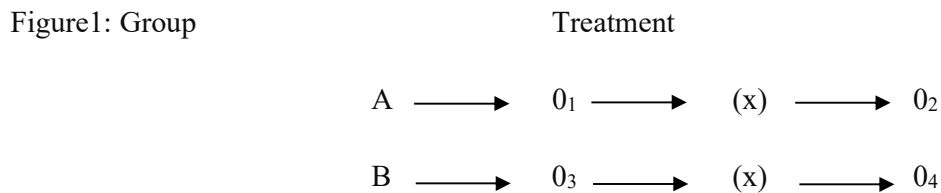
The study will be of significance to the Ministry of Education, as well as Ministry of Science and Technology, as they are the principal determinants in the pedagogic aspect of curriculum in secondary school education in Nigeria. The findings of the study will enable them to understand the situation and position of activity-based teaching strategy towards quality of education as it will offer students various degrees of control over their own learning, enable instruction to be tailored according to individual student's needs, and enable the ministry to get feedback on student achievement and store it for further reference.

The study will be of significance to the Curriculum Planner as it will afford them the opportunity of streamlining many educational tasks. It will provide them with the vision to plan for a wide range of fields, including all the main disciplines in elementary, secondary, and tertiary institutions. More so, the findings will help the curriculum planner to integrate and enhance the skills of search and development of in-class activity into the curriculum content.

This research delimited to the effect of Activity-Based Teaching Strategy on students' academic achievement in some selected junior secondary schools in Pankshin LGA Plateau State, Nigeria. The content covered in geometry are areas and volumes of some 2 and 3-dimensional shapes.

METHODS

This study employed the use of quasi-experimental design. Quasi-experimental design according to Oluwaseyi (2015), is a research design used to estimate the causal impact of an intervention on its target population. This was to avoid the disruption of the school programmes. Consequently, the research design is illustrated in figure 1:



Where

A = Experimental group

B = Control group

0_1 and 0_3 = Pre-test observation.

0_2 and 0_4 = Post-test observation.

(x) = Treatment applied.

(-) = No treatment applied.

The population of this study was all the 24 public and 38 private schools in Pankshin L.G.A which has a total population of 11,689 (eleven thousand, six hundred and eighty-nine) students. The total population will comprise of 4,944 females and 6,745 males in both public and private secondary schools in Pankshin L.G.A of Plateau state (Source: Quality Assurance Office Pankshin LGA of Plateau state).

Four schools were sampled from the entire population of secondary schools in Pankshin LGA. The entire population of the JSS II Students of the four Junior Secondary Schools was used as the sample. Total number of one hundred and twenty-four (124) students was used. This comprise of 71 males and 53 females. The nature of the study, however, required that the research sample were randomly selected with each school given equal chance of being selected.

To get the experimental and control group, YES and NO were written and dropped in a container shake properly then a student from each school was asked to pick a piece of paper from the container. Those that pick YES were assigned to the Experimental group while those that picked NO were assigned to the Control group.

The instrument that was used for the data collection is Geometry Achievement Test (GAT) consisting of a total of twenty-five (25) items that contain fifteen objectives question and ten (10) fill in the blank questions which were used to measure the learners' achievement in geometry. Geometry Achievement Tests (GAT) were used for both the pre-test and post-test. The pre-test achievement test was used to measure the students' achievement in Geometry before the exposure of the treatment. The post-test was used to measure the students' achievement in Geometry for both experimental and control groups after the treatment. Both pre-test and post-test Geometry Achievement Tests contain structured questions with equal scores in each question carrying 4 marks each and total score of 100 mark.

The data collection begins by administering a pre-test to the two group (experimental and control group). The scripts were collected and scored. The treatment period was two weeks in each school which the mathematics teachers of the schools were used as research assistants. At the end of the two weeks teaching, the post-test was administered to the students. The scripts were also collected and scored.

The research questions were answered using the students' mean achievement scores while the research hypotheses were tested using the independent sample t-test at $\alpha \leq 0.05$ level of significance, with the aid of the SPSS (Statistical Package for Social Sciences) software.

RESULTS

Answering of research questions

Research Question One

What is the difference in the mean achievement scores of students' taught geometry with Activity-Based method and those taught with conventional method?

Table 4.1: Mean and Standard Deviation Achievement Test of pre-test and post-test of the experimental and control group

Group	N	Pre-test mean	SD	Post-test mean	SD	Mean Gain
Exp. group	57	48.96	18.79	71.88	14.51	22.92
Control group	67	45.69	14.88	61.81	13.68	16.12

Table 4.1 above shows the mean and standard deviation Achievement Test of students taught geometry using ABT and Conventional method. From the table, the mean and standard deviation of the pre-test are 48.96 and 18.79 and that of post-test score of the ABT are 71.88 and 14.51 respectively. Similarly, the mean and standard deviation of Pre-test and post-test scores of the Conventional group are 45.69 and 14.88 while the post-test has a mean and standard deviation of 61.81 and 13.68 respectively.

The mean gain of students taught Geometry using ABT was 22.92 while that of conventional was 16.12. Therefore, the mean Achievement Test of students taught geometry using ABT is higher than those taught using conventional method. This implies that the students taught Geometry using ABT showed higher achievement in learning Geometry than that of students taught using conventional method.

Research Question Two

What is the difference in the mean achievement scores of male and female students taught geometry using Activity-Based method?

Table 2: Mean and Standard deviation achievement scores of pre-tests and post-test of the Male and Female students in then experimental group.

Group	N	Pre-test mean	SD	Post-test mean	SD	Mean Gain
Male	36	48.37	18.28	71.94	15.44	23.57
Female	21	45.67	14.68	71.96	13.13	26.26

Table 2 above shows the mean and standard deviation achievement score of male and female students taught Geometry using ABT. From the result, the mean and standard deviation of the pre-test and post-test score of male students taught geometry using ABT are 48.37 and 18.28 and 71.94 and 15.44 respectively. Similarly, the mean and standard deviation of Pre-test and post-test scores of female students taught geometry using ABT are 45.67 ± 14.68 and 71.96 ± 13.13 respectively.

The mean gain of male students taught geometry using Activity-Based method was 23.57 and that of the females was 26.29. Therefore, the mean achievement score of female students taught geometry using ABT is higher than their male counterpart.

Hypotheses testing

Ho1: There is no significant difference in the mean achievement scores of students taught geometry using Activity-Based method of teaching and conventional method.

Table 4.3: Independent sample t-test achievement score of students taught Geometry using ABT and the conventional method.

Group	N	Mean (X)	SD	DF	T	P-value	Mean Difference
Experimental	57	71.88	14.51	122	3.97	0.00	10.07
Control	67	61.81	13.68				

An independent sample t-test was conducted to compare the achievement score of students taught Geometry using ABT and the Conventional method. There was a significance difference in mean achievement scores of students taught statistics using ABT and those taught using conventional method with t- value of $t(122) = 3.97, (p=0.00, \text{two tailed})$.

Therefore, the null hypothesis (Ho2) of no significance in the mean achievement score of students taught geometry using ABT and those taught with Conventional method is rejected at 0.05 level of confidence.

Ho2. There is no significant difference in the mean achievement scores of male and female students taught geometry using Activity-Based Teaching.

Table 4: Independent sample t-test achievement score of male and female students taught Geometry using ABT.

Group	N	Mean (X)	SD	DF	T	P-value	Mean Difference
Male	36	71.94	15.44	55	0.045	0.96	0.18
Female	21	71.96	13.13				

An independent sample t-test was conducted to compare the achievement scores of male and female students taught statistics using ABT. There was no significance difference in mean achievement score of female students and male students taught Geometry using ABT with a t-value of $t(55) = 0.045$, ($p=0.96$, two tailed). Therefore, the null hypothesis (H_02) of no significance in the mean achievement score of male and female students taught geometry using ABT is retained at 0.05 level of confidence.

Discussion

The result obtained in testing of hypotheses one revealed that the mean achievement scores of the students in the experimental and control group were statistically different after the treatment. By implication, there is significance difference in the mean achievement scores of students taught geometry using ABT and the conventional method. The results of this study are supported by the findings as noted by Hussain, Anwar and Majoka (2011). Activity-based learning integrated with peer instruction creates an ideal situation for teaching science subjects.

Finally, the result of hypotheses two showed no significant gender difference in the mean achievement scores of male and female students taught geometry using ABT. This result agrees with Elisha, (2013), who carried out a research and discovered no significance difference in the mean achievement scores of male and female students taught using ABT.

Summary of the Findings

The forthcoming is the summary of the findings.

Teaching geometry using activity-based teaching and the conventional method has a statistically significance difference on students means achievement scores with a large effect in favor of using activity-based teaching.

Gender has no statistically significant effect on student's achievement scores in geometry using Activity-Based Teaching.

Conclusion

There was no significant difference in the mean achievement score of male and female students taught geometry using activity-based teaching.

Recommendations

Based on the finding of this study the following recommendations are made:

Activity-based teaching strategy should be incorporated in the teaching and learning of mathematical concepts by mathematics teachers. Workshops and seminars should be organized by stakeholders in mathematics education for mathematics teachers on the need for the use of activity-based teaching as instructional strategy in the teaching and learning of mathematics.

Suggestion for Further Study

From the findings of this study, the following suggestions were made.

More studies, using a larger sample size, on effect of activity-based teaching on achievement in geometry. Similar studies should be carried out on the effect of ABT strategy on students' achievement in other content area in mathematics. Comparable studies should be carried out in primary and nursery schools.

References

- Abdullahi, A. (2015). Assessing performance and changing attitude towards mathematics among adolescents. *Journal of Mathematics Education* 2(3), 14– 32.
- Ado, I. (2014) & Gana, E. (2016). Analysis of students' achievement in mathematics of senior school certificate examination (SSCE) in Niger state unpublished B.Tech (Ed) thesis FUT Minna
- Agwagah, U. N. V. (2001). The teaching of number bases in Junior Secondary school mathematics: The use of Base board. *ABACUS: Journal of Mathematics Association of Nigeria. (Mathematics Education Series)* 26(1) 1-7.
- Ahlfeldt, S., Mehta, S., & Sellnow, T. (2005). Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. *Higher Education Research and Development*, 24(1) 5-20.
- Ahmed, E. (2013). Identification of the problems of the low achievers in the subject of the mathematics at secondary level. (Unpublished thesis) IER, Lahore: University of the Punjab.
- Aiyebusi, D. A. (2015). Motivating Student Interest in Science, Mathematics and Technology by linking their concept to seal life; *International Journal of Research in Education* 2(1&2), 123-126.
- Anderson, C. J., Shim, S. S. & Ryan, A. (2008). Achievement goals and achievement during early adolescence: Examining time-varying predictor and outcomes variables in growth-curve analysis. *Journal of Educational psychology*, 100, 655-671.
- Anwar, F. (2019). The effect of activity-based teaching techniques on student motivation and academic achievement. *Journal of Education and Educational Development*, 6(1), 154-170
- Aprebo, F. C. (2009). "The secondary school mathematics curriculum content and its implementation; the teaching problems and solutions for a sustainable technological advancement in the African continent". *Science, Technology and Mathematics Education for sustainable development in Africa*. Ibadan; STAN
- Betiku, O. F. (2001). Causes of Mass Failures in Mathematics Examinations among students. A Publication of the Mathematics Panel of the Science Teachers Association Nigeria, *Journal of issues in Mathematic*) 8 (1), 1-8.
- Campbell, J. R., Hombo, C. M., & Mazzeo, J. (2000). *NAEP Trends in Academic Progress. Three Decades of Student Performance*. Washington DC. US Department of Education. Office of Educational Research and Improvement National Center for Education Statistics. Cangelosi, (2003). Quoted by National Science Foundation, *Vol. 1, No. 1* (2006) pp. 62–82, *Applications and Applied Mathematics (AAM): An International Journal*

- Çelik, H. C. (2018). The Effects of activity based learning on sixth grade students' achievement and attitudes towards mathematics activities. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(5), 1963-1977.
- Churchill, D. (2003). Effective design principles for activity-based learning: the crucial role of 'learning objects' in Science and engineering education. Retrieved from Commissioned paper presented At Government Secondary School, Karu, Abuja Science
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.
- Dewey, J., (1902). The child and the curriculum. Retrieved from <http://books.google.10m/books>.
- Duit, R. & Treagust, D. F. (2003). Conceptual Change. A Powerful Framework for proving science. *International Journal of Science Education Education*, 25(6), 671- 688.
- Ericksen, S. C. (2015). *The Lecture. Memo to the Faculty*, 60. Ann Arbor: Center for Research on Teaching and Learning, University of Michigan.
- Ezeudu, F. O. & Obi, T. N. (2013). Effects of and Location on students' Achievement in chemistry in secondary schools in Nsukka LGA of Enugu State, Nigeria. *Research on Humanities and social sciences* 3(15), 50-55.
- Fajemidagba, M., Salman, M. & Ayinla, O. (2012). Effect of Teachers' Instructional Strategy.
- Festus, A. B. (2013). *Activity-based learning strategies in the Mathematics classroom*. *Journal of Education and Practice*, 8-14. 4(13).
- Gray, A. (1997). Constructivist Teaching and Learning. Retrieved 16, August, 2016 from www.saskschoolboards.ca/instruction.
- Hake, R. R. (2014). Interactive-engagement versus traditional methods: A six- thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64-74.
- Harbor-Peters, V. F. A. (2011). Unmasking some aversive aspect of school mathematics and strategies for averting them. Inaugural lecture: 5th July
- Hussain, S., Anwar, S., & Majoka, M. I. (2011). *Effect of peer group activity-based learning on students' academic achievement in physics at secondary level*. *International Journal of Academic Research*, 3, 940-944.
- Iji, C. O & Harbor -Peter V. F. A. (2015). Effect of logo and basic programs on the achievement in geometry of junior secondary school students Abacus in Ondo, Nigeria. *Journal of Education and Practice*, 3 (7), 159-169
- Ingels, S. J., & Dalton, B. W. (2018). Trends among High School Seniors, 1972- 2004 (NCES 2008-320). Washington, DC: National Center for Education Statistics, Institute for Education Sciences, U.S. Department of Education.

- Johnson, D. W., Johnson R., & Smith K., (2013). *Active Learning: Co-operation in the college classroom*. Edina, MB: Interaction Book Co.
- Kanno, T. N. (2016). Gender Neutral Nature of modern careers. Paper presented at a workshop organized by Federal Ministry of Education for women and Girls, at Owerri from 26th-28th August 2016.
- Kiplagat, P. Role, E. and Makewa, L. N. (2012). Teacher commitment and mathematics performance in primary schools: A meeting point! *International Journal of Development and Sustainability*. Retrieved on 8 July 2015 from [http://www.isdsnet.com/ijds 1\(2\), 286-304DS Article ID: IJDS12090301](http://www.isdsnet.com/ijds 1(2), 286-304DS Article ID: IJDS12090301)
- Lasisi, P.N. (2007). *The teaching of mathematics for Nigerian secondary schools*. Jos: Fab Anieh Nigeria limited.
- Maduabum, M. A. and Odili G. A. (2006). Analysis of students' performance in General Mathematics at SSCE level in Nigeria 1991-2002. *Journal of Research in Curriculum*
- Mistretta (2011). Enhancing geometry reasoning. *Adolescence*, 35:365-379. Pattern on Senior Secondary School Students' Performance in Mathematics Word Problems Teaching, 1(1), 64-68.
- National Mathematical Advisory Panel (2005). *Foundation for success. The final report of the National Mathematical Advisory Panel*. Washington, D.C: U.S. Department of Education
- Ngwu, P.N. (2014). Mathematics as a tool for re-branding Nigeria: Implications for secondary mathematics education. *Journal of Mathematical Association of Nigeria*, 38 (1), 1-11.
- Noreen, R., Munir, A. & Rana, M. K. (2019). Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level. *Bulletin of Education and Research, Vol. 41, No. 2 pp. 145-159*
- Obioma, G. O. (2005). Emerging issues in mathematics education in Nigeria with emphasis on the strategies for effective teaching and learning of word problems and algebraic expression.
- Odili, G.A. (2006). *Mathematics in Nigeria secondary schools: A teaching perspective*. Port Harcourt: Anachuna Educational Books.
- Odugu, H. N. (2010). The mathematics teacher factor in achievement of the goal of Universal Basic Education (UBE). A presented at MAN workshop in 2010
- Okeke, E. A. (2017). Clarification and Analysis of concepts. Focus on Research, Reproductive Health Education, and Gender sensitive classroom. *Science Teachers Association of Nigeria. Gender and STM Education series 2, 5- 8.*
- .Oluwaseyi E. (2015). *Effect of Computer Assisted Instruction on Students' Performance in Economics in Senior Secondary Schools in Ekiti State*. Thesis in Curriculum of Studies Ahmadu Bello University Zaria, Nigeria.

- Panko, M., Kenley, R., Davies, K., Piggot-Irvine, E., Allen, B., Hede, J. & Harfield, T. (2007). Learning styles of those in the building and construction sector. Report for Building Research, New Zealand.
- Penick, J. E. (2016). Rationale for teaching seminar paper on train-the teacher on science and mathematics held in Minna 6th – 11th February
- Rao, D. (2011). *Science education in developing countries*. New Delhi; Discovery Publishing House (124-126)
- Shah, I., & Rahat, T. (2014). Effect of activity-based teaching methods in science. *International Journal of Humanities and Management Sciences (IJHMS)*, 2(1), 34-41
- Tolbert, Ernest Jr (2015). *The Impact of Computer-Aided Instruction on Student Achievement*. Education Dissertations and Projects. 127.
- Umoh, C. G. (2013). A Theoretical analysis of the effect of Gender and family Education on Human Resource Development. *Journal of curriculum Organization of Nigeria*. 10(1), 1-4.
- Weber E. (2016). *Brain based business*. Retrieved from <http://brainbasedbusiness.com>. On December 23, 2007.