EFFECT OF GUIDED DISCOVERY METHOD ON ATTITUDE AND ACHIEVEMENT IN SIMULTANEOUS LINEAR EQUATION AMONG SS1 STUDENTS IN MANGU LOCAL GOVERNMENT AREA OF PLATEAU STATE, NIGERIA

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

08069693049

tomapate2021@gmail.com

08069693049

07032469630

Abstract

The study investigated the effect of guided discovery method on attitude and achievement in simultaneous linear equation among SS1 Students in Mangu Local Government Area of Plateau State. The population for the study comprised of all senior secondary school students in Mangu LGA. The sum of four schools with 126 students were randomly selected. Two were assigned as experimental group and the other two as control group. The study adopted quasi-experimental pre-test and post-test design. Simultaneous Linear Equation Achievement Test (SLEAT) and Attitude Inventory Questionnaires (AIQ) were the instruments used for data collection. Arithmetic mean was used to answer the research questions while t-test for two samples was used to test hypotheses at 0.05 level of significant. The study revealed that the use of guided discovery approach in teaching Simultaneous Linear Equation has significant positive impact on students' mean achievement scores and interest scores in Simultaneous Linear Equation compared to the conventional method. The result indicated that before treatment, there was no significant difference between the achievements of students in the experimental and control groups. However, after treatment, the performances of the experimental group significantly outweighed that of the control group. The mean attitude rating of students in the experimental group also significantly outweighed that of their counterparts in the control group; guided discovery approach of teaching therefore, impacts positively on students' achievement in mathematics (Simultaneous Linear Equation). The study recommended among others that curriculum developers such as Nigeria Educational Research and Development Council should incorporate the use of guided discovery approach into future curriculum design. For proper implementation, workshops and seminars should be organised for teachers on the effective use of guided discovery approach of teaching mathematics (Simultaneous Equation) in secondary schools among others.

Keywords: simultaneous linear equation, guided discovery and conventional method of teaching.

Introduction

Education is a systematic training and instruction designed to transmit knowledge and develop skills in individuals. This involves a continuing development of relevant knowledge, skills and habit whose broad understanding and application enable individual to contribute meaningfully towards the growth of their society (Mbah, 2012). Nigeria having realized the importance of education as a powerful instrument for national progress and development, adjusted her educational philosophy and methodology to march the ideals and challenges of changing economic and social structures of modern society (FRN, 2013).

Mathematics can be defined as the communication system for the concepts of shapes, size, quantity, and order used to describe diverse phenomena both in physical and economic situation (Akanmu and Fajemidagba, 2013). Ezeugo and Agwagah (2010), in their study considered Mathematics as a scientific tool used realizing the nation scientific and technological aspirations. Usman (2012) considered Mathematics as a subject that encroaches into all aspects of human endeavor and further described Mathematics as the life wire in the study of various disciplines.

Poor academic performance according to Aremu (2014) is a performance indicator that is adjudged by the examiner and some other significant authorities as falling below an expected standard.

Simultaneous linear equation is an aspect of algebra constitutes part of the mathematics curriculum, and it is one of the aspects students performed poorly in Nigerian external and internal examinations making the overall subject achievement very poor (Tsoho, 2015). Simultaneous equation is mostly taught using conventional (chalk and talk) approach, where the whole lesson is teacher centred (Pickens, 2015). This has led to perceived difficulties, poor achievement in mathematics, and negative attitude of student towards mathematics among students.

The dominant method of teaching (conventional method) is the kind where the teacher does everything and the learners just being passive listeners. A teaching method whereby the student is featured as an active participant, where the teacher assumes the roles of a facilitator, mediator and assessor of learning have been found to be superior in developing students' abilities in applying concepts and personal growth, developing positive attitudes, fostering motivation, and encouraging appropriate group social skills (Welbery, 2009). An approach of instruction through which students interact with their environment by exploring and manipulating objects is regarded

as discovery teaching (Romberg, 2010). Bruner (1967) believes that classroom learning should take place through inductive reasoning, that is, by using specific examples to formulate a general principle.

Attitude refers to a set of emotions, beliefs, and behaviors toward a particular object, person, thing or event. Attitudes are often the result of experience or upbringing, and they can have a powerful influence over behavior. Based on this, the research aims at investigating the effect of guided discovery method on attitude and achievement in simultaneous linear equation among SS1 students in Mangu Local Government Area of Plateau State.

Statement of the Problem

Simultaneous linear equation constitutes part of the mathematics curriculum, and it is one of the aspects students performed poorly in Nigerian external and internal examinations making the overall subject achievement very poor (Tsoho, 2015).

WAEC Chief Examiners' Report (2016) also showed that candidates are weak in algebraic expressions and word problems among others. The West African Examination Council (WAEC) and the National Examination Council (NECO) Chief Examiners' Report for the years 2017 and 2018 reported large number of students' failure in Mathematics. In the year 2017, only 26% of 1,560,338 (405,688) candidates who sat for West African Senior Secondary School Certificate Examination (WASCCE) had five credits including mathematics while in 2018, only 38% of 1,571, 231 (597,067) candidates had credit passes including mathematics. These figures implied that 1,154,650 and 974,164 students failed in the 2017 and 2018 respectively. This failure rate surely affects students' attitude and interest in mathematics. This evidence of poor achievement points to the fact that the conventional method employed in teaching mathematics is not effective. The need to seek for a strategy for teaching mathematics that is aimed at improving understanding, academic achievement, and positive attitude is necessary.

Aims and objectives

The main aim of this research is to find out the effect of guided discovery method on attitude and achievement in simultaneous linear equation among SS I students in Mangu Area Educational Zone in Plateau Nigeria.

Specifically the study seek to determine

1. Determine the effect of guided discovery method on mean attitude rating of SS1 students in simultaneous linear equation.

2. The extent to which guided discovery method influences students attitude towards learning simultaneous linear equation
3. The effect of guided discovery method and gender on students' achievement in simultaneous linear equation.
4. Find out the effect of guided discovery method on mean achievement score of SS1 students.

Research Questions

The following research questions were raised to guide the research work:

1. What is the effect of guided discovery method on mean achievement score of SS1 students?
2. What is the effect of guided discovery method on mean attitude rating of SS1 students in simultaneous linear equation?
3. What are the mean achievement scores of male and female students taught simultaneous linear equation using discovery method?
4. What is the mean attitude rating of male and female students taught simultaneous linear equation using discovery method?

Hypotheses

The following null hypotheses were formulated and tested at 5% level of significance to guide the research work.

H_{01}: There is no significant difference in the mean achievement score of students' taught simultaneous linear equation using guided discovery method and those taught with conventional method.

H_{02}: There is no significant difference between the mean attitude ratings of SS1 students' taught simultaneous linear equation using guided discovery method and those taught with conventional method.

H_{03}: There is no significant difference in the mean achievement scores of male and female students taught simultaneous linear equation by discovery method.

H_{04}: There is no significant difference in the mean attitude rating of male and female students taught simultaneous linear equation using discovery method.

Methodology

In this research, quasi-experimental design of non-equivalent (pre-test and post- test) experimental and control group. Intact classes will be used in order not disorganize the already existing class structures. This design according to Ibe (2016) is illustrated below:

Group	Pretest	Treatment	Post-test
1	0_1	X_0	0_2
2	0_1	X_1	0_2

Where 1= control group, 2=experimental group, 0_1 = Pretest observation, X_0 = no treatment (control), X_1 = treatment (experimental group taught using guided discovery method) and 0_2 =post–test observation. The population of this research comprise of all the 1443 students in the 47 senior secondary schools in Mangu Local Government Area of Plateau State. The population consists of 808 females and 635 male students as determine from (Mangu Area Directorate of Education, 2020). The sample size for the research consists of one 126 male and female students which were drawn from two schools by random sampling. The schools were Government Model Secondary school (GMSS) Mangu and Government Secondary School (GSS) Mangu Hale. The experimental group consists of 68 students, while the control group consists of 58 students. The sample consists 67 female and 59 male students. The various schools were represented with serial numbers written on a piece of paper, put in a container, shook properly and the two (2) schools were selected one after the other without replacement. The selected schools were represented with serial numbers as 1 meaning experimental group and 2 control groups. The pieces of papers were squeezed and put in a container, shook properly until the two schools were selected; Government Model Secondary school (GMSS) formed the experimental group while Government Secondary School (GSS) Mangu Hale formed the control group. Simultaneous Linear Equation Achievement Test (SLEAT) and Attitude Inventory Scale (AIQ) respectively.
Simultaneous Linear Equation Achievement Test (SLEAT) was constructed by the researcher which consists of 10 questions multiple choice (objective) test with four options (A, B, C and D) and three essay questions from a careful planned lesson requiring the students to answer any two questions. The criterion used for the development of the achievement test is to evaluate the students on the topic 'Simultaneous Linear Equations'. Attitude Inventory Scale will be a close ended structured questionnaire containing two sections A and B. Section A sought the bio-data

of respondents while section B contains 10 items on attitude inventory. The questionnaire was built on a four (4) modified point Likert scale; (Strongly Agree {SA}, Agree {A}, Disagree {d} and Strongly Disagree {SD}). In scoring the items on the questionnaire for positively framed items, Strongly Agree (SA), attracted 4 points, Agree (A), attracted 3 points, Disagree (D), attracted 2 points, while Strongly Disagree (SD) attracted 1 point. The attitude inventory questions was adapted from literatures that discussed students' attitude in mathematics. The validation of the SLEAT is subjected to content and face validity. Content validation ensured adherence to the table of specifications. Two lecturers from the departments of Mathematics and Educational Psychology and Counseling, Federal college of education (FCE) Pankshin, validated the SLEAT and the AIQ respectively.

Test-retest reliability was used to establish the reliability co-efficient of SLEAT. It was obtained by administering the questionnaire once in a pilot sample of twenty (20) students in a school in the study area that was not part of the sample and re-administered the same questionnaire to the same students at a later date. The Pearson Moment Product correlation coefficient was used to determine the reliability of instrument using SPSS Software Version 25. The reliability coefficient of SLEAT was 0.82 while AIQ was 0.78 which was considered adequate for the research. Permission was granted by the principals and with the help of a trained research assistant, the researcher administered the achievement test and interest inventory questionnaire on the students. Scripts of the achievement test were marked and recorded by the researcher for further data analysis. Teaching of the experimental and control groups and administering the achievement test were done over a period of two weeks. Government Model Secondary school (GMSS) which is the experimental group was taught using guided discovery method while Government Secondary School (GSS) Mangu Hale which is the control group was taught by the conventional method. The teaching took two lesson periods (80 minutes) for each of the groups. The data collected through the questionnaire were carefully assembled and the results obtained were carefully organized and presented in tables. The mean and standard deviation were used to answer the research questions while t-test was used to test the research hypotheses using SPSS (Statistical Package for Social Science) version 25.

Research questions i and iii was answered using mean scores computed from students' responses to Attitude Inventory Questionnaire. The formula is presented below:

To compute the mean, for Attitude Inventory Questionnaire (AIQ),

Mean = $\frac{(SA\times4)+(A\times3)+(D\times2)+(SD\times1)}{Total\ Sample\ Size}$

Where:

SA = Strongly Agree, with score of 4

A = Agree, with score of 3

D = Disagree, with score of 2

SD = Strongly Disagree, with score of 1

Determining the Decision Rule

Mean Score = $\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$

Decision Rule: 2.5 is the criterion mean rating score. If the mean is equal to or above 2.5, the researcher accepts the items. If the mean is below 2.5, the researcher rejects.

Research questions ii and ii were answered using mean and standard deviation scores obtained from Simultaneous Linear Equation Achievement Test (SLEAT). The formula for the mean is presented below:

$$\text{Mean } (\bar{x}) = \frac{\sum fx}{\sum f}$$

Where: $\bar{x} =$ Arithmetic Mean

$\sum. =$ Summation of -

F = Frequency

X = observation or score

Research hypotheses was tested using t-test

For t-test, the formula and decision rules are shown below:

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}} \qquad \text{Standard Deviation (S)} = \sqrt{\frac{\sum_{i=1}^{n}(x - \dot{x})^2}{n-1}}$$

Where:

t = t –test value

$\bar{x}_2$ = mean of the experimental group

$\bar{x}_1$ = mean of the control group

S_1^2 = Standard deviation of the experimental group

S_2^2 = Standard deviation of control group

N_1 = Sample size of the experimental group

N_2 = Sample size of the control group

N = Total sample size

If the calculated t – value is greater than the critical value, the study retains that there is significant difference, otherwise the researcher rejects.

The degree of freedom (d.f) = N – 1

Results and Discussion

The hypothesis was tested using independent sample t-test at 0.05 level of significance by using a statistical package for social sciences (SPSS), the instruments were used to determine the extent of effectiveness in the variables involved.

Research Question One

What is the effect of guided discovery method on mean achievement score of SS1 students?

Table 1: Mean and Standard deviation achievement score of pre-test and post-test of the experimental and control groups

Group		Pre-Test		Post-Test		Mean Gain
		Mean ($\bar{X}$)	SD (S)	Mean ($\bar{X}$)	SD (S)	
Control	58	45.89	25.89	47.52	19.69	1.63
Experimental	68	68.54	18.02	47.29	20.72	21.25
Total	126					

Table 1 shows the mean and standard deviation achievement scores for experimental and control groups. From the result, the mean and standard deviation pre-test and post-test scores of the control group were 45.89, 25.23 and 47.52, 28.23 respectively. This gives a mean gain of 1.64. Similarly, the mean and standard deviation of pre-test and post-test scores of the experimental group are 47.29, 20.72 and 68.54, 18.02 respectively. This gives a mean gain of 21.25, which is higher than that of the control group with gain of 1.6. This indicated that the experimental group taught Simultaneous Linear Equation using guided discovery approach achieved higher than the control group taught using the conventional method.

Research Question Two

What is the effect of guided discovery method on mean attitude rating of SS1 students in simultaneous linear equation?

Table 2: Mean and Standard deviation attitude rating of pre-test and post-test of the experimental and control groups

Group	N	Pre-Test		Post-Test		Mean Gain
		Mean ($\bar{X}$)	SD (S)	Mean ($\bar{X}$)	SD (S)	
Control	58	2.31	0.19	2.23	0.67	0.08
Experimental	68	2.36	0.14	3.81	0.58	1.45
Total	126					

Table 2 shows the mean and standard deviation attitude scores for experimental and control groups. From the result, the mean and standard deviation of pre-test and post-test attitude scores of the control group were 2.31, 0.19 and 2.23, 0.67 respectively. This gives a mean gain of 0.08. Similarly, the mean and standard deviation of pre-test and post-test attitude scores of the experimental group are 2.36, 0.14 and 3.81, 0.58 respectively. This gives a mean gain of 1.45, which is higher than that of the control group with gain of 0.08. This indicated that the experimental group taught Simultaneous Linear Equation using guided discovery approach had higher attitude scores than the control group taught using the conventional method.

Research Question Three

What is the mean achievement score of male and female students taught simultaneous linear equation by discovery method?

Table 3: Mean and Standard deviation achievement score of male and female students taught Simultaneous Linear Equation by guided discovery method

Group	**N**	**Post-Test**		**Mean Difference**
		Mean ($\bar{X}$)	**SD (S)**	
Male	59	72.06	19.30	
Female	67	50.54	18.02	21.52
Total	126			

Table 3 shows the mean and standard deviation male and female achievement scores for experimental groups. From the result, the mean and standard deviation of post-test scores of male and female students were 72.06, 19.30 and 50.54, 18.02 respectively. This gives a mean difference of 21.52 in favor of the male students.

Research Question Four

What is the mean attitude rating of male and female students taught simultaneous linear equation using discovery method?

Table 4: mean and standard deviation attitude rating of male and female students taught Simultaneous Linear Equation by guided discovery method

Group	N	Post-Test		Mean Difference
		Mean ($\bar{X}$)	SD (S)	
Male	59	3.42	0.92	
Female	67	2.03	0.47	1.39
Total	126			

The table above shows the mean and standard deviation attitude scores of male and female students taught Simultaneous Linear Equation by guided discovery method. From the result, the mean and standard deviation attitude scores of male and female students were 3.42, 0.92 and 2.03, 0.47 respectively. This gives a mean difference of 1.39 in favor of the male students. This implies that male students had higher attitude scores than their female counterparts.

Testing of Research Hypothesis

To answer the research questions of the study, the following null hypotheses were formulated and tested at a 0.05 level of significance.

$H1_0$: There is no significant difference in the mean achievement score of SS1 students taught simultaneous linear equation using guided discovery strategy and those taught by conventional method.

Table 5: Independent sample t-test for mean achievement test score of students taught Simultaneous Linear Equation using guided discovery and conventional method of teaching.

Group	N	Mean	SD	Df	t-cal	t-crit	p-value	Remark
Control	58	42.2	13.50					
Experimental	68	48.04	11.40	124	3.17	1.973	0.05	Significant
Total	126							

The result in table 5 indicates that the calculated t- value is 3.17. This value is greater than the t-critical of 1.973 at alpha = 0.05 with degree of freedom (df) = 124. This means that there is significant difference in the mean achievement score of SS1 students' taught simultaneous linear equation using guided discovery strategy compared to those taught by conventional method. Therefore, the null hypothesis one ($\mathbf{H_{01}}$) is rejected. This implies that the experimental group taught Simultaneous Linear Equation by guided discovery performed better than the control group taught by conventional method.

H_{02}: There is no significant difference between the mean attitude score of SS1 students' taught simultaneous linear equation using guided discovery strategy and those taught with conventional method.

Table 6: Independent sample t-test for mean attitude ratings of students taught Simultaneous Linear Equation by the guided discovery and those taught using conventional method

Group	N	Mean	SD	Df	t- cal	t- crit	P - value	Remark
Control	58	40.2	14.806					
Experimental	68	45.04	10.533	124	4.34	1.711	0.05	Significant
Total	126							

The result in table 6 indicates that the calculated t- value is 4.34. This value is greater than the t-critical of 1.711 at alpha = 0.05 with degree of freedom (df) = 124. This means that there is

significant difference between the mean attitude score of SS1 students' taught simultaneous linear equation using guided discovery strategy compared with those taught with conventional method. Therefore, the null hypothesis one (**H_{02}**) is rejected. This implies that the experimental group taught Simultaneous Linear Equation the guided discovery method had higher attitude rating than the control group taught by the conventional method.

$H0_3$: There is no significant difference in the mean achievement scores of male and female students taught simultaneous linear equation using discovery method.

Table 7: Independent sample t-test for mean achievement test score of male and female students taught Simultaneous Linear Equation by guided discovery and conventional method.

Group	N	Mean	SD	Df	t-cal	t-crit	p-value	Remark
Male	58	72.06	19.30					
Female	68	50.54	18.02	124	5.40	1.973	0.05	Significant
Total	126							

The result in table 7 indicates that the calculated t- value is 5.40. This value is greater than the t-critical of 1.973 at alpha = 0.05 with the degree of freedom (df) = 124. This means that there is significant difference in the mean achievement scores of male and female students taught simultaneous linear equation using discovery method. Therefore, the null hypothesis one (**H_{03}**) is rejected. This implies that male students had higher mean achievement test score than their female counterparts.

Table 8: H_{04} There is no significant difference in the mean attitude rating of male and female students taught simultaneous linear equation using discovery method.

Independent sample t-test for mean attitude ratings of male and female students taught Simultaneous Linear Equation by guided discovery.

Group	N	Mean	SD	Df	t- cal	t-crit	P - value	Remark
Male	58	3.42	0.92					
Female	68	2.03	0.47	124	2.69	1.711	0.05	Significant

Total	126

The result in table 8 indicates that the calculated t- value is 2.69. This value is greater than the t-critical of 1.711 at alpha = 0.05 with degree of freedom (df) = 124. This means that there is significant difference between the mean attitude scores of students taught Simultaneous Linear Equation by guided discovery and those taught by conventional method. Therefore, the null hypothesis four (**H_{04}**) is rejected. This implies that male students had higher positive attitude rating than their female counterparts.

Discussion of Findings

Findings from the research in table 1 revealed that guided discovery approach of teaching has significant effect on student's achievement in mathematics. The statistical test used to make a comparison of student's achievement in mathematics between control group and experimental group taught with conventional and guided discovery approaches respectively was the independent t-test. The reason for the higher mean achievement test score by the experimental group in the post-test is because guided discovery approach of teaching mathematics was adopted. Guided discovery approach gives students a complete mastery of what they have learned. Brethaupt and Dunn (2016) further adds that through guided discovery method of mathematics teaching, students develop better understanding of mathematics concepts and more attitude and positive attitude towards the subject. Guided discovery approach is a hands-on delivery approach that is certainly a psychologically sound method, as it aims at utilising the active, original, creative and constructive tendencies of the learner. The higher achievement of experimental group in this study also shows that guided discovery method is very effective way for teaching simultaneous linear equation. This finding agreed with Rahul, Praveen and Achintya (2014) who investigated the effect of guided discovery approach on learners' achievement in simultaneous equation at secondary level after which the experimental group were found to achieve higher than the control group. Similarly, Praveen and Leong (2013) after investigating the effectiveness of using guided discovery approach on learners' understanding of circles had an achievement result in favor of the experimental group and 93% of learners of the experimental group mentioned that they had learnt a lot using guided discovery approach, while 82% were excited about using it and 75% could think creatively and analytically during discussions. This

corroborated the report of Odugwu (2011) and WAEC (2019) which stated that mathematics approach should be student centred and concepts to be taught should not be taught dogmatically.

The study also determined the effect of guided discovery method on mean attitude rating of SS1 students in simultaneous linear equation. The result in table 2 shows that guided discovery approach of teaching Simultaneous Linear Equation also has positive effects on students' attitude towards concepts in mathematics. The experimental group had a mean attitude rating of 3.81 indicating high positive attitude compared with the control group with a mean attitude rating of 2.23 which is lower than the critical mean score (decision rule) of 2.5. This shows that the control group showed negative attitude towards mathematics.

Furthermore, the study also sought the mean achievement scores of male and female students taught simultaneous linear equation by discovery method (table 3). The analyses of results revealed that male students performed better than their female counterparts with a mean difference of 21.52 in favour of the male students. This finding agrees with that higher cognitive tasks areas like linear equations and algebra in mathematics which tend to favor males. The finding however contradicts that of Abubakar and Dodboo (2011) who found out that at the lower level of education, differences in Mathematics abilities of boys and girls are rarely noticed.

Likewise, the study determined the mean attitude rating of male and female students taught simultaneous linear equation using discovery method (table 4). It revealed that male students had higher attitude rating than their female counterparts. This finding agrees with Mathias (2010) who observed that students' attitude towards mathematics is determined by academic achievement. According to Cetingöz and Özkal (2019) attitude is fundamental to the dynamics of behaviors and they are the determining factor of what the students learn.

Conclusion

Based on the statistical test result for post-test for the control group and the experimental group, there is significant difference between the mean achievement test scores of students in the two groups with the experimental group achieving higher than the control group (at $p = 0.05$, t_{calc}). Therefore, there is enough evidence to conclude that guided discovery approach of teaching Simultaneous Linear Equation has significant positive impact on the achievement and attitude of secondary school students in mathematics (Simultaneous Linear Equation).

Recommendations

Based on the results of the study the following recommendations were made

- Nigerian mathematics textbooks authors should be encouraged by the government to review their books in line with student centred teaching approaches like guided discovery method.
- Mathematics teachers should be given refresher courses on the implementation and use of guided discovery teaching approach in all secondary schools.

References

Abubakar R.B. & Dodboo. O. (2011). Age and Gender as Predictors of Academic Achievement of College Mathematics and Science Students. Proceedings of the 2011 International Conference on Teaching, Learning and Change. *International Association for Teaching and Learning.* 5(3). 45 – 47.

Akanmu , M. A and Fajemidagba M.O (2013) Guided Discovery Learning Strategy and senior school student performance in Mathematics in Ejigbo, *Nigeria Journal of Education and Practice* Department of Science Education, Faculty of Education University of Ilorin

Brethaupt,. T., & Dunn, M., (2016). '*T-he effect of Different Practical Approach on Mathematics Students Achievement*' Master's Thesis, University of Southamptom.

Bruner, J. S. (1967). *The Process of Education*. New Jersey. Beverly Hills Publishing Co. Ltd. ISBN 978-0-674-71001-6.

Cetingöz, D. & Özkal, N.(2019). Learning attitude, interest and students performance. *Turkish Journal of Education.* 31(5), 76 – 79.

Ezeugo N.C. & Agwagah, U.N.V (2010). Effects of Concepts Mapping on Students Achievement in Algebra; Implication for Secondary School Mathematics Education 21st Century. *Abacus Journal of Mathematics Association of Nigeria*, 25 (1) 1-12.

Federal Republic of Nigeria, (FRN, 2013). *National Policy on Education. Lagos.* NERDC Press

Mbah. F. I (2012). Learning and Teaching Methodology. *Journal of Education and Social Research*, 2 (4). 2240 – 0524.

Odugwu, H.N. (2011). The Mathematics Teacher Factor in Achievement of the Goal of Universal Basic Education (UBE). A paper presented at MAN Workshop in 2011.

Pickens. J. (2015). *Attitude and Perception in: Borkowski, N. (ED) Organizational Behavior.* Sadury, M.A: Jones and Berhett Publishers, pp 43-47.

Rahul, A., Praveen, M. S. & Achintya, O. O. (2014). Effect of guided discovery approach on learners' achievement in simultaneous equation. *South African Journal of scientific studies.* 3(7). 123 – 126.

Romberg, T. (2010). Changing the Teaching and Learning of Mathematics. *AMT*, 56 (4),6-9.

Takawira, K & Mathias, S. (2010) Effectiveness of teachers at preparing grade 7 candidate for environmental sciences. *Eurasian Journal of Physics and Chemistry Education.* 2(2), 64-84.

Tsoho, L. T. (2011). Effects Of Problem Solving And Student Centered Teaching Strategies On Students‟ Geometry Performance And Retention In Junior Secondary Schools Kano State, Master's Thesis, ABU Zaria.

Usman, K.O. (2012) The Need to Re-train in Services Mathematics Teacher for the Attainment of the Objectives of University Basic Education. *The Academic Journal of the Mathematical Association of Nigeria* (MAN) 27 (1) 19-29.

West African Examination Council, WAEC (2019). *Chief examiners reports: 2015, 2016, 2017 and 2018.* Accra, Ghana: WAEC Press Publishing.