ACTIVE LEARNING TECHNIQUES (ALT) IN A MATHEMATICS WORKSHOP; NIGERIAN PRIMARY SCHOOL TEACHERS' ASSESSMENT

Medinat F. Salman

ABSTRACT. This study examined Nigerian Primary School teachers' assessment of Active Learning Technique (ALT). A total of 120 male and female primary school teachers were purposively sampled from the North central geo-political zone of Nigeria. The sampled primary school teachers were participants at a Mathematics workshop organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO). Out of the 120 participants expected at the workshop, only 85 participated in all the interactive activities on the ALT. Two researcher- designed questionnaire forms titled" Reflection on Methodology and Difficult Mathematics Topics" and "ALT Assessment Scale" were prepared and administered to the participants before and after the workshop activities. The pre-workshop questionnaire sought information on how participants teach Mathematics in their various schools and the Mathematics topics they found difficult to teach. After the workshop activities have been carried out, a questionnaire on participants'assessment of the ALT was administered. The collected data were analyzed using frequency counts and percentages. Reports of analysis indicated that participants found ALT interactive, interesting, motivating, participatory and highly innovative. Based on the findings, it was recommended that the teaching methodology of Nigerian Primary School teachers should be regularly updated through workshops on ALT and that teaching of Mathematics at primary level should be handled by trained Mathematics teachers.

KEYWORDS. Active Learning Techniques (ALT), Nigerian Primary School Teachers, Assessment.

INTRODUCTION

The Nigerian primary school teachers are generalists by virtue of their different subject specializations. This has strong implication for the knowledge of Mathematics imparted to the pupils, as well as the methodology employed. The primary school education holds a strong position in the educational system of any nation particularly in a developing country like Nigeria, aspiring for scientific and technological advancement. The primary school is the foundation level

of Nigeria educational system. This calls for the need to impart adequate knowledge of Mathematics to the pupils through the use of effective instructional techniques. The perennial low performance of Nigerian pupils in Mathematics has been attributed among other things to inadequate knowledge of the subject matter content by teachers and poor instructional techniques (Salman, 2004). The abstract nature of Mathematics and its focus on problem-solving require exposure of teachers who are of different subject disciplines to instructional techniques that could assist their teaching of Mathematics concepts especially those concepts perceived difficult to teach.

Active Learning Technique (ALT) is an instructional technique with focus on the learner interacting with the subject matter content of a course through active participation generating of ideas, rather than be a passive listener and a receiver of knowledge. It also requires that the teacher acts as a facilitator rather than a. Lessons on ALT must be activity oriented. It should allow pupils' active participation in learning to be meaningful. It should relate content to daily experiences of the pupils, and should provide opportunities for both sexes to take active roles in the lesson. It must also be culturally rooted. That is, the relevance of Mathematics or its usefulness in Nigerian culture must be identified and made known to the pupils. Lastly, the topic/concept for instruction must be consistent with the curriculum contents for a particular level of education.

In recognition of the benefits derivable from ALT, Nigerian primary school teachers were exposed to lessons on ALT to enhance their teaching techniques and disengage them from the use of the traditional teacher-centered method of imparting the knowledge of Mathematics to the pupils.

Study Objectives

The study was to determine the assessment by Nigerian primary school teachers of Active Learning Techniques (ALT) at a Mathematics workshop organized by the Nigerian government in collaboration with the United Nations Educational Scientific and, Cultural organization (UNESCO) in the North-Central geo-political Zone of Nigeria. It also sought for the type of instructional methods commonly used by participants to teach Mathematics topics and the Primary Mathematics topics found difficult to teach their pupils.
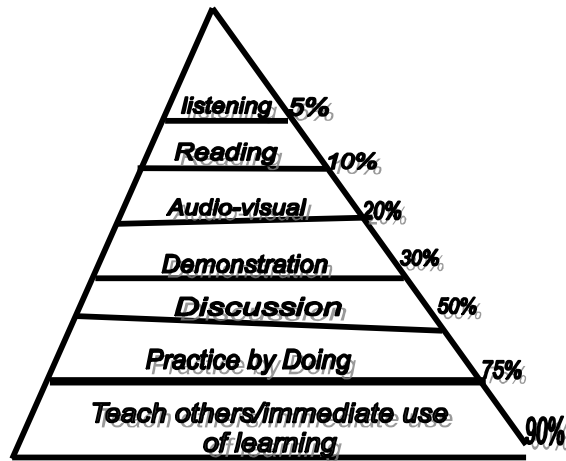
Research Questions

1. What Instructional methods are identified by the participants as commonly used in teaching Mathematics topics?
2. What are the Mathematics topics identified as difficult to teach by the Nigerian primary school teachers that participated in the Mathematics workshop?
3. What is the assessment of ALT by Nigerian Primary School Teachers that participated in the Mathematics workshop?

Literature Review

The general low performance of pupils in Mathematics in Nigerian primary schools could be traced to the crop of teachers who are of different subject specializations and as a result of this, ill-prepared to impart adequate knowledge of Mathematics to their pupils. The poor methods of teaching some topics in Mathematics have made pupils to perceive such topics to be difficult. Salman (2005) confirmed from her research work that pupils dislike certain topics in Mathematics because of the belief that they are difficult, while the teachers also dislike teaching certain topics because of the belief that they are difficult to teach.

Cockcrift (1982), Nuffied (1967) and Oyeneye (1996) have identified the support of teaching and learning of Mathematics with relevant concrete materials and learners' participation through interaction with the concrete materials as being effective in promoting a meaningful understanding of Mathematics contents.

The acquisition of Mathematical language requires understanding the process(es) involved in arriving at solution. The process here refers to the various techniques employed to arrive at the correct solution (s) to a given problem. An example of such Technique is the Active Learning Technique (ALT). In acquisition of Mathematics knowledge, emphasis is more on the process(es) of understanding rather than the products or solutions to the given problems. Petty (2004) presented a learning Pyramid which explains the recall rate of different teaching Techniques as shown in figure1.

Source: Petty, 2004

Figure 1. Learning Pyramid

The pyramid shows that in learning processes the learner's ability to listen, read, demonstrate and discuss are not sufficient evidences to confirm that the learner has acquired adequate knowledge of a concept or topic. It could be inferred from the learning pyramid that effective learning takes place when the learner is able to reflect the acquired knowledge through practice by doing the knowledge to others and apply it to relevant situations.

ALT is a learning process that involves giving the learners the opportunity to take a more interactive relationship with the subject-matter of a course and as well encourage learners to generate ideas, rather than be a passive recipient (Mifflin, 1998). It is a dynamic process that encourages pupils' participation or involvement in creating new knowledge, and application of such knowledge to other professions and academics. It also enhances pupils' activeness, challenges, practical exposure and maximum retention of Mathematics knowledge in classroom situation. Paulo, a Brazilian educator was one of the proponents of ALT. He ascertained through research that the learning process is an exceptionally effective technique that enables the learners to learn more materials, retain the information longer, enjoy the classroom atmosphere and learns with the help of the instructor and other members in the group because the teacher acts as a facilitator by providing proper guidance for the learners to adequate knowledge.

Hattie (2004) defined ALT as a means of involving students in practicing important skills and applying new knowledge. In the same vain, McConnel (2005) conceptualized ALT as a process of involving students in the learning process through reading, writing, discussing, acting, moving, and problem solving. Also, Petty (2004) reported that, in implementing an ALT lesson, the teacher needs to design interactive activities involving problem solving for learners active participation. These activities could involve group work, working in pairs or individually. The

teacher as a facilitator is meant to guide learners on how to accomplish given tasks on their own, through brainstorming. Learners are also encouraged to compare their work with the work of others. The teacher also gives home work/ assignments for certain period of time.

Active Learning is not synonymous with cooperative or collaborative learning. The later involves students working in terms of problems and projects under conditions that assure both positive interdependence and individual accountability, while the former allows individual learner to formulate questions on their own, think or brainstorm about a topic, discuss, explain, and take active part during class lessons (Felder & Brent, 2003). Also, UNESCO (2006) highlighted the characteristics or indicators of a lesson on Active Learning Technique as that which must be meaningful, gender-sensitive, culturally-rooted, consistent and productive.

In order to make the teaching of Mathematics more relevant to the immediate needs of the learners, the societies, and the nation at large, it is imperative to improve the quality of Nigerian primary school teachers through direct involvement in Active Learning Technique as a means of rectifying the differences in their background and subject specializations. The most effective media to accomplish this is through organized workshops and seminars. This study therefore, examined the participation of the Nigerian primary school teachers' in Active Learning Technique and their assessment of the technique at a Mathematics workshop organized by the Nigerian government in collaboration with the United Nations Educational, Scientific and Cultural organization (UNESCO).

METHOD

Design

The study was a descriptive survey type. The survey was considered appropriate because the study sought for individual participants' assessment of ALT, workshop and collected data were analyzed and reported using descriptive statistics.

Participants

A total of 120 Nigerian Primary School Teachers were supposed to participate in the Mathematics workshop on ALT. Purposively, twenty male and female primary school teachers were drawn from each state of the six states in the North-Central geo-political zone of Nigeria. But only eighty five participated in the workshop activities. Therefore, primary school teachers constituted the sample for this study.

Instruments

Two types of researcher- designed questionnaire forms titled "Reflection on methods and difficult topics" and "ALT Assessment" respectively were prepared for the participants. The first one was a pre-workshop questionnaire which sought data on how each respondent teaches mathematics in his/her primary school. It also sought data on Mathematics topics found difficult to teach by teachers to the pupils in their various states. The post-workshop sought data on the assessment of the workshop on ALT by the primary school teachers who were participants. The questionnaire items were validated by two Mathematics lecturers in Kogi State College of Education, the institution where the workshop took place.

Procedures

The Pre-workshop questionnaire forms were first administered by the researcher to the 85 (120 participants were expected to attend the workshop but only 85 turned up. For instance, participant from Plateau state did not turn up for the workshop) participants from Kwara, Kogi, Benue, Plateau, Niger and the Federal Capital Territory of Nigeria to determine whether participants are already familiar with the use of ALT in their lesson presentation, while the request for difficult topics was to give the researcher the opportunity to consider the topics generally found difficult by larger percentage of the participants for activities to enable the researcher who is one of the facilitators for workshop prepare on ALT involving one of the topics identified as difficult to teach. The researcher designed four activities reflecting the characteristics of ALT on the topic, (geometry), identified by majority (76.5%) of the participants as difficult. The first activity involved identification and classification of 2 and 3-dimensional objects within and outside the building where the participants occupied at the workshop. The second activity required participants to draw nets of 3-dimensional geometrical objects (e.g. cubes, cuboids, cylinders and prisms) on cardboard papers, cut them out with scissors or blade and use cello tape to join the edges. The third activity required the participants to list the characteristics of each produced 3-dimensional figures.

The fourth activity sought the cultural relevance of the 3-dimensional figures by asking participants to reflect their minds to their homes, working environments, and their surroundings and identify specific areas where they can be used e.g. cube: sugar, maggi, cuboids: cartoon of biscuits, chalk box, cylinder: tin of milk, pipe hole etc. The individual in each subgroup actively participated in the activities by brainstorming to identify classify, draw and produce net of 2 and

3-dimonsional objects. Each subgroup compared their work with the work of other sub groups. The appointed leader for each subgroup coordinates the activities of the subgroup and later presented the report of their findings. The assessment questionnaire (post- workshop) questionnaire was later administered and collected by the researcher.

RESULTS

Research Question 1: What instructional methods are identified by the participants commonly used in teaching Mathematics topics? This research question is to establish whether Mathematics teachers have been using ALT in teaching their pupils? The methods indicated by participants are in table 1.

Table 1. Identified instructional methods by commonly used respondents

	Methods	Frequency counts and percentage of respondents used.
1	Play way	85 (100%)
2	Role playing	83 (97.65%)
3	Discussion	61 (71.76%)
4	Demonstration	79 (92.94%)
5	Lecture	38 (44.71%)
6	Guided discovery	41 (48.24%)
7	Problem –solving	54 (63.53%)

It is indicated in table 1 that the use of the playway method of instruction is most commonly used among primary school teachers. This is because 100% of the respondents used playway method, at primary schools. The next commonly used methods are role playing (97.65%), demonstration (92.94%) discussion (71.76%), problem-solving (63.53%), guided discovery (48.24%) and lecture method (44.71%). The lecture method had the least percentage of respondents. This could be due to the age and ability levels of children at this level of education who may not be able to cope with the characteristics of the lecture method that is teacher-centred. The lecture method at this level may be used in combination with other instructional methods.

Research question 2: What are the Mathematics topics identified to be difficult to teach the pupils by the Nigerian primary school teachers that participated in the mathematics workshop?

This was analyzed by listing the topics indicated and taking the frequency counts and percentages of respondents that indicated a particular topic as difficult.

Table 2. Primary Mathematics topics identified as difficult and Frequency counts and percentages of respondents**.**

S/No	Identified Difficult Primary Mathematics Topics	Frequency Counts & Percentages Of Respondents	
1	Practical & descriptive geometry (solids or 3-dimensional)	65	(76.5%)
2	Word problems	59	(69.4%)
3	Weight Capacity and volume	46	(54.1%)
4	Graphs	51	(44.7%)
5	Compound Interest	37	(43.5%)
6	Decimal Fraction	35	(41.2%)
7	Everyday Statistics	33	(38.8%)
8	Ratio and Proportion	32	(37.6%)
9	Measurement (Length and Area)	31	(36.5%)
10	Place Value	29	(34.1%)
11	Algebra (Simple equations)	28	(32.9%)
12	Number Line	27	(31.8%)
13	Approximation Estimation.	26	(30.6%)
14	Binary Number	26	(30.6%)
15	Equivalent Fractions	24	(28.2%)

Table 2 shows that 65 (76.5%) of the respondents indicated 3-dimensional geometry   as the most difficult topic. This implies that majority of the Nigerian primary school teachers have difficulty with the teaching of 3-dimensional. Another aspects of difficulty are Mathematical statements (word problems) that need to be transformed into equivalent equations before solving. This could be attributed to the problem of language in general and Mathematical language in particular. It is on this note that the researcher as one of the facilitator prepared the ALT activities on descriptive and practical geometry to determine whether exposure of teachers to ALT using descriptive and practical geometry would reduce the difficulty experience in teaching the topic.

Research Question three: How do Nigerian primary school teachers who participated in ALT workshop assess the technique?
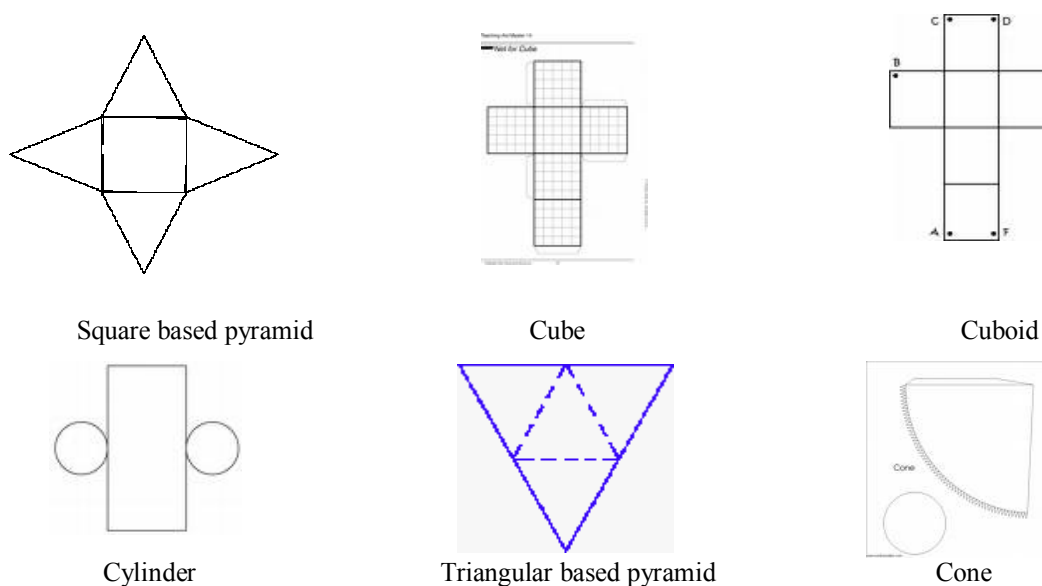
The researcher chose Descriptive and Practical geometry which had the highest frequency counts of respondents that found it difficult to teach and prepare ALT lessons. The lessons reflected the five characteristics of ALT. and activities based to make the participants active. Meaningfulness comes in at the level of the participants requested to identify examples of 1-dimensional, 2-dimensiona and 3-dimensional objects in the environment. Descriptive and practical geometry is a topic in the primary school Mathematics curriculum. Both male and female participants were involved in the lesson activities, such as identifying the dimensions figures, drawing the nets and production of 3-dimensional objects, identifying their properties and the cultural relevance in our societies. The findings from the collaborative or cooperative activities that the participants were involved are reported as follow:

Table 3. Identification and Classification of the dimensions of geometrical shapes by participants.

Type of geometrical dimension	Description	Example
Zero-dimension	A point	Point created by the pointed end of a needle
1-dimensional figure	A line segment	A straight line joining two points
2-dimensional figure	Objects with length and width or breadth or base and height or altitude	Rectangles, square, triangles, circles, rhombus, trapezium, kite etc...
3-dimensional figure	Objects with length, breadth and height or base area and height	**Cube:** sugar and magi cubes. etc **Cuboids:** match box, classroom shape, chalkboard box. Etc. **Cone:** ice cream cone, sharpened pencil edge. etc **Sphere:** Ball, orange, egg. etc. **Cylinder:** Peak milk tin, water pipe, hollow tube. etc **Pyramid:** sand dons, grand nut based pyramid, etc. **Prism:** triangular or quadrilateral based prisms **Frustum:** bucket, funnel, lamp bulb etc

Table 3 shows the list of objects identified and classified according to their dimension (s).

In addition, the nets of cube, cuboids, cylinder, cone, and pyramid (square and triangular based) were drawn on card board papers and cutout with scissors in order to produce the solid shapes. The drawings of the nets are shown below:-

| Square based pyramid | Cube | Cuboid |
| Cylinder | Triangular based pyramid | Cone |

Figure 2.

The identified properties of the geometrical shapes in figure 1 by the participants are in table 2.

Table 4. Properties of identified solid shapes.

Name of solid shape	No of edges	No of faces	No of vertex (ices)
Cuboid	12 parallel edges are equal	6 opposite faces are equal	8
Cube	All the 12 parallel edges are equal	All 6 opposite faces are equal	8
Cylinder	2 circular edges	2 circular faces and 1 curved face	None
Cone	1 circular edge	1 circular face and 1 curved face	1
squared based pyramid	8 straight edges	1square face and 4 triangular faces	5
Triangular based pyramid	6 straight edges	4 triangular faces	4

The assessment questionnaire was administered at the end of the involved workshop activities by participants. It contains sections A and B. The responses to section A were analyzed as indicated in Table 4.

Table 5. Frequency counts and Percentages of respondents' assessment on ALT

Item	Item description	SA	A	U	D	SD	Total
1	The workshop on ALT is meaningful and creative	33 (38.82%)	52 (61.18%)	—	—	—	85
2	It is interesting and participatory	58 (68.24%)	27 (31.76%)	—	—	—	85
3	ALT is highly innovative because it is a complete departure from the conventional teacher centered method of instruction	49 (57.65%)	35 (41.18%)	1 (1.17%)	—	—	85
4	The workshop on ALT has broadened my teaching techniques.	45 (52.94%)	40 (47.06%)	—	—	—	85
5	The activities on the ALT were well organized and executed. They have assisted to clear my misconceptions on 3-dimensional geometry	44 (51.74%)	39 (45.88%)	2 (2.35%)	—	—	85
6	The workshop was successful and rewarding.	48 (56.47%)	37 (43.53%)	—	—	—	85

It is observed in Table 5 that "Strongly Agree "and "Agree" have the highest frequency counts of respondents. This indicates that the participants rated ALT high. For instance, all the respondents (100%) agreed that the workshop on ALT is meaningful and creative. Similarly 100% of the respondents agreed that the workshop is interesting and participatory. 68.24% of the respondents strongly agreed that "ALT" is interesting and participatory. Also, 98.83% agreed that it highly innovative, 100% agreed that it has broadened their teaching techniques, 97.62% agreed that the technique has assisted to clear their misconceptions on three dimensional geometry and 100% agreed that the workshop was successful and rewarding.

Discussion of Findings

The three research questions generated were answered using descriptive statistics. Research question one reveals that ALT had not been among the commonly used instructional methods by the participants. The commonly used methods indicated include: discussion, demonstration, play-way, role-play, guided discovery and problem –solving in mathematics lessons. The analysis on research question two reveals that practical and descriptive geometry was found difficult to teach by 76.5% of the participants, particularly 3-dimensional figures. It is on this note, the researcher prepared lesson activities on ALT using geometry. Because of time, other identified difficult topics like word problems could not be addressed by ALT.

The results of the analysis on research question three reveals that the participants classified geometrical figures in to 1-dimensional, 2-dimensional and 3-dimensional with their description and examples. The nets of 3-dimensional shapes such as cube, cuboids, cylinder, cone, square -based, and triangular- based pyramid were drawn on card board papers and later produced as solid shapes by participants. The properties of the solid shapes were also identified as in Table four respectively. The results of assessment of ALT by participants are reported in Table five. It is indicated that participants rated ALT high. That is, they saw the workshop on ALT as meaningful and creative, interesting and participatory, innovative, assists to clear misconceptions and dislike for mathematics. The workshop was generally considered successful, and rewarding.

It could be inferred from the analyzed responses of the participants that certain topics in the primary Mathematics curricula were found difficult to teach. In the light of that, the lesson on ALT was found to have positive impact on the participants' attitude, interest and motivation toward solid geometry. This arises from their commitment and good performance in the workshop activities. The ability to design activities by primary school teachers that would reflect the characteristics of ALT would ease teachers' difficulties with the teaching of certain topics in Mathematics and enhance meaningful learning.

Implications of the findings

The following implications are drawn from the findings of the ALT workshop

(1) The Nigerian Primary School teachers have not been employing the technique of designing activities which require learners' active participation in the area of brainstorming, developing question on their own and answering them, working in groups, or in peers to learn from each other with little or no involvement by the teacher among others.

(2) The perception held by the primary school teachers that certain topics are difficult to teach, could be confirmed that inadequate knowledge of mathematics is imparted to the pupils, and which could be a major factor to low performance in the subject at the primary school level.

(3) The policy requiring Nigerian primary school teachers to teach all subjects irrespective of their course specialization has implication for teachers' attitudes and commitment to ensure good performance in the subject. The researcher observed that teachers who specialized in other subject disciplines participated actively in the practical activities on ALT. This implies that technique could be effective for all kinds of teachers irrespective of their subject disciplines.

RECOMMENDATIONS

The Primary school education is the foundation level of Nigeria educational system and it needs to be given adequate attention. Particularly subject like Mathematics and other science related courses need urgent attention for the Country to grow in science and technology. The teaching of Mathematics at the primary level of education should be handled by only trained Mathematics teachers with a minimum qualification of Nigeria Certificate in Education (NCE) to enhance the teaching methodology and also ensure a solid foundation of Mathematics knowledge in pupils.

Nigerian primary school teachers should be encouraged to be creative, innovative and inspiring in their teaching, through regular attendance of Mathematics conferences, seminars and workshops on ALT to enrich their methodology in handling difficult mathematics topics.

Workshops in Mathematics should place emphasis on pragmatic approach that is learner centered rather than the traditional approach that is more of teacher-centered. This is to expose teachers to different ways of designing practical activities to handle the teaching of Mathematics concepts and encourage meaningful and effective learning.

The teachers' privilege to attend the workshop on ALT should as a matter of urgency, be encouraged by their respective states and local governments to train other teachers by releasing fund to organize similar workshops. The Nigerian government in collaboration with the UNESCO should finance more workshops on ALT to facilitate adequate understanding of Mathematics topics identified to be difficult by the Nigerian primary school teachers. Primary School Pupils should be given opportunities by their teachers to make conjectures and such conjectures should be collectively or collaboratively discussed in subsequent classes.

REFERENCES

Cockcrift, W.H. (1982). *Mathematics counts.* London: HMSO.

Felder, R.M. & Brent, R. (2003). Learning by doing the philosophy and strategies of active learning. *Chemical engineering education, 37* (4) 282- 283.

Mifflin (1998). *Strategies for research and theory for college and university researchers.* London: Houghton, Mifflin.

MC. Connell, J.J. (2005). Active and cooperative learning. ACMSIGCSE Bulletin 34(4), 34-38.

Nuffield Mathematics Project (1967). I do and I understand Edinburgh London: New York Chambers.

Oyeneye,F.H.(1996).Teaching primary mathematics. In V.W fomoung,O.PAwotunde,   N.S Wuyep, & L.M Ango, (Eds). *Effective lesson planning and delivery* Jos: IFCAPS Publisher.

Petty, G (2004). Formative teaching method. *A practical guide* (3rd ed.) Nelson Thomes: Cheltenham.

Salman, M.F.(2004). Analysis of gender influence and performance of JSSs students' techniques in solving simultaneous linear equations by graphical methods. *GenderDiscuss*, *1*(I) 87-99.

Salman, M.F. (2005). Teachers identification of the difficulty levels of topics in the primary school mathematics curriculum in Kwara state abacus. *The Journal of Mathematical Association of Nigeria. 30* (1), 20-29.

Author   : **Medinat F. Salman**

E-mail   : salman_mf2005@yahoo.com

Address   : Department of Science Education,

Faculty of Education,

University of Ilorin,

Ilorin, Kwara State, Nigeria