

Remediation of Poor Achievements in Some Perceived Difficult Concepts in Mathematics among Selected Senior Secondary School Students' in Lagos Metropolis

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Abstract

This study investigated the remediation of poor achievements in some perceived difficult concepts in mathematics among selected senior secondary school students in the Lagos metropolis. The participants were 300 students consisting of 150 male and 150 female SS III students drawn from three Senior secondary schools in Educational District IV of Lagos State through the Stratified Random Sampling Procedure.. The study used Quasi-Experimental Pre-test, Post-Test Control Group Design. Mastery Learning and Problem-Solving were used as treatment approaches while a control group was exposed to the traditional teaching method. The relevant data were generated using a Validated Mathematics Achievement Test (MAT). The instrument has a reliability coefficient of 0.80 when tested during the pilot study.. Two hypotheses were formulated to guide the study and tested at 0.05 level of Significance. The two hypotheses were rejected and the findings revealed that mastery learning and problem solving are efficacious in ameliorating student poor achievement in the perceived difficult concept in mathematics. The study also found that the significant effect of mastery learning and problem solving on adolescent achievements was due to gender. In the light of these findings, a number of recommendations were given one of which is that teachers should redouble their efforts in the teaching of some topics that are perceived as difficult by students in mathematics by ensuring adequate coverage of syllabus and its applications so as to demystify the topics. Teachers are also encouraged to have frequent revision exercises as well as diagnostics and remedial evaluations with their students, so as to enhance students' mastery of the knowledge and various skills gained in previous lessons.

Keywords: Remediation, Poor Achievements, Perceived Difficult Concepts.

Introduction

Mathematics has been of social and economic importance to man, and its place in man's way of life and development cannot be over-emphasized. There is however more to mathematics than numbers and calculations. It is this importance of mathematics in everyday life that justifies its inclusion in the curricula at all levels of education. Every man requires a certain amount of mathematical knowledge in order to survive in the present highly technological and complex society. This is to assist the individual to compare and estimate the values of articles, determine the prices of foodstuff, reckon distances and time, weigh evidence and sift substance from chaff. (Adedayo, 2006). Mathematics abounds everywhere from the mundane issues that are taken for granted to the most sophisticated breath-taking inventions and discoveries. There is no single and all-embracing answer to what mathematics is. This is because mathematics means different things to different people. In view of its universality and diversity, it is referred to as the language of science and technology (Adedayo, 2006); queen of science; the science of counting, science of numbers, quantity and space (Abakporo, 2005); the study of abstractions and their relationships (Usman, 2002).

Mathematics is a compulsory subject for all students at the secondary school level in Nigeria . Although not all students are expected to become mathematicians, it is compulsory because

of its application in everyday life (Oladele, 2004). The professional knowledge of rudimentary mathematics is very necessary for a person to be able to function very well within his immediate environment. The role of mathematics in the commercial, scientific and technological development of the civilized nations is always acknowledged.

The general objectives of school mathematics, irrespective of the level can be summarized as follows: Develop computational skills; develop ability to think deductively; produce the mathematical background needed in other school subjects; develop originality, creativity and curiosity in the students; develop and appreciate the aesthetic values of mathematics; develop ability to solve mathematical problems and provide solid foundation for further studies in mathematics (Usman, 2002; Adedayo, 2006).

There had been incentives for promoting better mathematics teaching/learning at all levels by the Federal and State Governments, private companies and individuals as well. Special mention would be made of:

1. The National Mathematics Centre Abuja, which organizes National Mathematics competitions at all levels of education. Awards are presented to winners and runners up. The centre generally aims at promoting and popularizing the teaching and learning of mathematical sciences.
2. Promasidor Nigeria PLC, makers of Cowbell milk, which also organizes Mathematics competition at the State and National levels also offers awards and many prizes to winners and their teachers.
3. Some Petroleum Companies award Prizes and Scholarship in all **STM** subjects e.g. Chevron, Mobil Producing oil and many others.
4. Some State Governments and philanthropists e.g. Lagos State Government, Babs Fafunwa Educational Foundation and many others award prizes and scholarships to best students in mathematics.
5. Science Teachers Association (STAN) and
6. Cadbury Nig. Plc, makers of Bournvita organizes mathematics competition for students and the best mathematics teacher. Their efforts are all highly commended.

In Nigerian secondary schools, students are exposed to two types of Mathematics namely:

- a. General Mathematics, which all students are expected to pass at credit level before gaining admission into any of the universities, and other tertiary institutions of higher learning
- b. Further Mathematics, for those gifted in mathematics and it is recommended for science and commercial students because in future, their profession cannot do without mathematics for example in Engineering, Accountancy, Pharmacy, etc. However, this study was limited to the General Mathematics Curriculum, which is compulsory for all Secondary School Students. The General Mathematics curriculum has the following basic topics namely: (i) Number and Numeration (ii) Algebraic Process (iii) Mensuration (iv) Plane Geometry (v) Trigonometry (vi) Statistics (vii) Bearing and Distances (viii) Construction and (ix) Probability.

The Nigerian Mathematics Curriculum is student-centred. It emphasizes meeting of learner's developmental needs and interest (Adedayo, 2006). There is evidence to show that student's cognitive and affective domain in mathematics fall below expectation (WAEC Chief Examiner, 2004 – 2014). Concerned stakeholders have been making concerted efforts to ensure that these problems, which are attributed to poor achievement in mathematics as well as poor attitude towards the subject, are identified and tackled effectively. Some of the key

issues affecting poor performance were detected through critical examination of students' selection of questions at terminal examinations (SSCE/NECO) and their general performance in the questions so selected. It has been observed that students like avoiding questions in some particular topics during examination. Another observed fact is the recurring pattern of poor performances in some selected topics. This may be due to the fact that either they have not been taught the topics or that students' do not understand when taught. It is therefore, imperative to identify some of these topics which students fail, fear and perceived difficult. There is the need to look at the characteristics of such concept and reasons why students fail them in examinations so that corrective measures can be taken to avert such failures in the nearest future. Such topics/concepts in mathematics include those that students perceived as complex and are difficult to be solved easily and generally have problems when studying or learning. The WAEC Chief Examiners' Report [2004 – 2014] revealed candidates' area of weaknesses and strengths in Mathematics. According to these reports, candidates showed likeness for Numerical Statistics, Algebraic Processes, The Four Arithmetic Rules and Logarithm with its application. Candidates' likeness for these topics could be attributed to their understanding of the topic among other factors. Hence, candidates performed better in these topics, than Geometry, Bearing & Distances, Trigonometry, Probability, Graphs, Longitude & Latitude, Introduction to Calculus, Matrices & Determinant etc. which they perceived to be difficult. Some of the identified difficult topics in Mathematics and the specific areas where students have challenges are:

- **Statistics:** Confusion between bar chart and histogram; not computing class boundaries when drawing histogram and cumulative frequency curve of grouped data, not being able to answer questions from the cumulative frequency curve, inability to find median and mode of ungrouped frequency table, probability involving combinations of multiplication and addition.
- **Angle of Elevation and Depression:** Inability to draw the correct diagram, to apply the correct Trigonometric Ratio. And, carryover of JSS difficulty
- **Graph:** Not identifying the part to shade in Linear inequality, not finding gradient and answering questions on quadratic graphs; graphs of trigonometry ratio are difficult to plot and draw.
- **Construction:** If parallel lines are involved, then there is difficulty solving problems through construction.
- **Longitude and Latitude:** Drawing, distance along line of latitudes.
- **Bearings:** Problem of drawing, identifying what to find and using appropriate technique like trig ratios etc.
- **Word Problem:** Especially those that lead to simultaneous quadratic and linear equations, profit and loss, variation etc.
- **Plane Geometry:** Proofs of standard theorem, drawing of diagrams, identifying the appropriate theorem or principles to use etc.
- **Solid Shapes:** Drawing of diagram, use of appropriate formulas. Making appropriate construction, identifying angles, sides, areas, volumes to calculate.
- **Set Theory:** Estimating elements of sets written in inequality form, drawing Venn diagrams when 3 or more circles are involved. Answering questions using Venn diagram.
- **Quadratic Inequality:** Especially of $ax^2 + bx + c \geq k$.
- **Directed Number:** This affects so many topics like those equations involving division by negative numbers, quadratic Formula involving negative numbers etc.
- **Logarithmic Equations:** Problem of conversion of logarithmic equation to linear or polynomials.

- **Number Basis:** Multiplication, operations on number basis that involve decimals.
- **Variation:** Inverse and partial.
- **Algebraic Fraction:** Solving equations involving surds, simplification etc.
- **Modular Arithmetic:** Concept of modular arithmetic such as addition, subtraction and multiplication operation in modular arithmetic.
- **Matrices and determinant:** Addition, subtraction, scalar multiplication and multiplication of matrices.
- **Introduction to calculus:** Differentiation of algebraic functions, integration of simple algebraic functions.
- **Vectors transformation** Vector in a plane: vector as a directed line segment, Cartesian component of a vector, magnitude of a vector, equal vector, addition and subtraction of vectors, zero vector, parallel vector, multiplication of a vector by scalar. Transformation in the Cartesian plane: reflection of point and shapes in the Cartesian plane, rotation of point and shapes in the Cartesian plane. **(WAEC, Chief Examiners Report 2004- 2014)**
- According to Smith & Olaoye (2012), some of the most common reasons for disliking Mathematics and perceiving some of its concepts as difficult includes: rigidity and lack of creativity, anxiety of the students, difficulty and complexity of Mathematics and poor teaching method. They noted that students may mention “difficulty” and complexity” of mathematics as reasons for lack of interest in mathematics. These mean that Mathematics has become difficult because:
 1. There are changes in the material;
 2. Old methods of learning are not adequate anymore;
 3. Introduction of new topics into the curriculum of the subject;
 4. Phobia for the subject; and,
 5. Inability of reasoning fast.
 6. Adedayo [2006], opined that some topics are not easily understood by students due to their demanding and abstract nature. These are the Perceived difficult topics which the students also find difficult to solve during examinations. He stated that such difficult topics have the following characteristics:
 - They are not easily understood by most students’;
 - They require more effort and skills before one can understand and solve them;
 - They exist in both Senior and Junior Secondary levels;
 - They are topics that stimulate fear and anxiety in students;
 - Students do not find the topics easy to solve in examinations and the few that attempt questions in them usually score low;
 - High achievers in mathematics experience a little difficulty in solving questions on such topics when compared to other topics;
 - Students are prone to various errors while solving such topics;
 - They are mostly abstract topics;
 - They are usually found in theory papers and carry more marks;
 - They are usually responsible for general poor performance in mathematics;
 - If handled properly, students will discover that they are not as difficult as they think (Adedayo, 2006)

These topics can be regarded as perceived difficult topics because of the following reasons:

- Students omitted answers on these topics deliberately because they do not understand them;

- Those who venture into them usually leave them in a hurry and answer only the rudimentary aspect;
- Students usually avoid attempting questions set on such topics especially if given a choice (Adedayo, 2006; Abakporo, 2005)

Adeleke (2007) conducted a research on topics preference of Senior Secondary students in Mathematics. In her findings, Numbers and Numerations, Algebraic Process and Statistics were found to be the most preferred topics while Bearing and Distances, Probability and Mensuration were the most disliked topics. Akinsola (1987) and Nnaji (1998) also conducted studies on some concepts which students perceived to be difficult to understand especially at the senior secondary school level. They worked independently on the survey of difficult topics in Mathematics. Some of the two researchers' findings showed that the following topics such as Longitude and Latitude (distance along the great circle and parallel of latitude), Bearings and Distances, Probability, Two-variable Inequality, Change of subject of formula, Arithmetic and Geometric (sequences and series) Number Bases, Graphs (linear and quadratic types) and set theory constitute the major difficult topics for the students.

However, Brunner (1962) asserted that any topic, no matter how difficult it may be, can be taught to a student at any point in time provided that such a student is ready to learn. According to Lobachevsky (1980), there is no branch of Mathematics however abstract which may not in some ways be applied to phenomena of the real world. Ilogu (2005) asserted that students should have been satisfactorily equipped physiologically, psychologically and experimentally to tackle the learning tasks. This is possible if the learning tasks are organized in a logical sequence so that enough background experiences are available to tackle a more difficult task; therefore, students need to be motivated by their teacher to have interest in mathematics. It was observed that the West Africa Examination Counsel (WAEC) has of recent introduced some new topics into the core mathematics curriculum. Majority of these topics were formerly in additional mathematics or the advanced level mathematics curriculum of those days. It was discovered that majority of these topics that were not formally in the WAEC syllabus are always in the JAMB/Post UTME examination, In order to arrive at a balance between the two examinations taken by student which are the qualification entries student must possess before gaining admission into any tertiary institution in the future it is therefore imperatives that mathematics teacher should not remain complacent while Senior Secondary School Students fail , fear , get frustrated, developed negative attitude towards the subject and derailed from careers of their interests in which they might have had job satisfaction to another profession in which they might lack interest in the nearest future. There is the need to remediate our secondary school student's poor performances in mathematics in order for them to have bright future and excel in life. The Mastery Learning and Problem-Solving Approaches were identified as the treatment to be used. This study therefore explored how these two methods could be used in improving our Senior Secondary School Students' poor achievement in mathematics.

Statement of the Problem

There has been consistent poor performance and a high failure rate in Mathematics among Senior Secondary School Students (WAEC Chief Examiners' Report, 2004-2014; Adedayo, 2006; Abakporo, 2005; Adeyegbe, 2003 and Uwadiae, 2000). Aburime (2007), stated that Mathematics is a very important subject in Nigeria. Yet, for more than twenty years despite the importance, about sixty-seventy percent of secondary school students still fail and perform woefully in the subject. Mathematics education in Nigeria has been in a sorry state and mathematics achievement has been very low and frustrating at the Senior Secondary

School level .So far, every effort made to save Nigerian education from the devastating effect of persistent poor Mathematics achievement is yet to yield the desired result.

The researcher observed that almost every year, students perform poorly in Mathematics both in internal and external examination. A close examination of the performance of Nigerian students in the Senior Secondary School Certificate Examination May/June (SSCE) in the period [2004-2014] revealed that majority of Nigerian students failed woefully in these examinations. These poor performances have far reaching effects on the future career choices of the students as they would be denied the opportunity for the optimal development of their potentials in many areas. Analysis of the SSCE results showed that averagely only a small proportion of candidates passed Mathematics at credit level and above. (See data in table 1 below

Table 1: Statistics of Performance in Mathematics of the Senior Secondary School Certificate Examination (SSCE)of May/June Results ,Nigeria . (2004-2014)

Year	No. Registered	No. of students with credit pass	Percentage of students with credit pass
2004	844525	287484	34.04
2005	730379	282394	38.66
2006	1149277	472674	41.13
2007	1249089	584024	46.76
2008	1369142	188394	13.76
2009	1373009	356981	28
2010	1351557	534841	39.57
2011	1540250	587630	38.15
2012	1672224	649156	36.57
2013	1692435	529425	31.28
2014	1605248	616377	38.68
Average	1325194	358507	31.82

Source: WAEC (2004-2014). Research Division Annual Reports.

From table 1, it is evident that Mathematics, which is a core and an important subject has never received the pride of place in the table of subjects that students usually pass. There is no gainsaying that many students have much difficulty solving mathematical problem.

There is need for appropriate remediation to reduce this high failure rate, and make the subject interesting to students. There is the need to proffer appropriate solutions to such concepts/topics identified and perceived as difficult by students, and account for some of the reasons for failure in the subject. The study thus focused on assessment of the problems highlighted and how to find appropriate remediation.

Purpose of the Study

The primary purpose of this study was to:

1. Remediate Senior Secondary School Student poor achievement in some perceived difficult concept in mathematics.
2. Examine the role of gender on students' academic achievements on the perceived difficult concepts.
3. The effect of **MLA** and **PSA** on the three domains of learning (cognitive, affective and psychomotor);

4. To proffer solutions and offer suggestions on how to reduce the difficult level of the perceived difficult topic.

Research Hypotheses

1. There is no significance difference in student Mathematics Achievement Post-test scores of the perceived difficult concept of participants in the treatment and control groups.
2. Gender will not significantly predict Post-test scores of Mathematics Achievement Test between the treatment and control group.

Methodology

Research Design

The research design adopted for this study was quasi-experimental pre-test and post-test control group design. Quasi-experimental design is a design in which experimental participants are assigned randomly from a common population to experimental and control groups. This type of design requires that participants be tested with the same instruments before and after treatment. To determine the effects of the treatment, the result of the participants in the treatment group will be compared with the scores of participants in control group.

The Study Area

The study was carried out in Lagos State. The research area was chosen because Lagos is a metropolitan city with high density population of adolescents from all parts of the country. According to the Lagos State Digest of Statistics (2013), Lagos State has 20 Local Government Areas, 37 Local Council Development Areas (LCDA) and 254,238 students in the 305 Senior Secondary School Examinations.

Population

The target population comprised of all the adolescents in Senior Secondary School two (SS3) in Education District IV of Lagos State. The choice of SS3 was necessitated by the fact that the category of student sitting for the next SSCE and their scheme of work (syllabus) consist mostly of the perceived difficult concept identified under this study.

Sample and Sampling Procedure

Education District IV comprises three Education Zones namely Mainland, Apapa and Surulere. A school was chosen randomly from the list of secondary school in each of the Education Zone, making a total of three schools from the Education district. Three hundred (300) participants for the study were chosen using stratified random sampling technique from the three schools. Their age ranges between 14-18 years, with the mean age of 16years. The participants were made up of 150 males and 150 females. There were six groups comprising of four experimental groups (of which two groups received Mastery Learning and two groups received Problem Solving Approach) and the last two groups was the control group. Treatment was presented to students in their intact classes. This method lent itself to varied statistical tests.

Instrumentation

Mathematics Achievement Test (MAT) was used as research instruments. This is 30 –item validated multiple choice standardized objective test compiled and prepared by the researcher from past mathematics question papers of WAEC/NECO for seven years (2008-2014) covering some perceived difficult topics. It had a high stability co-efficient of 0.80 when

tested during the pilot study at 0.05 level of significance. The items covered only the topics studied during the experimental period. The research instrument was validated using face, content and experts validity procedure.

Procedure for Data Collection

The actual studies spanned a period of 10 -weeks. The Pre- test was carried out two weeks before the experimental treatments, whereby the Mathematics Achievement Test (MAT) was administered to all the participants. The researcher actually visited the experimental schools and taught the students using Mastery Learning Approach (MLA) and Problem Solving Approach (PSA) as treatment procedure. All experimental participants were exposed to the different treatment sessions which spread over 6weeks with an average of a minimum of two hours per session plus extra remedial classes. The post treatment session was carried out two week after the last treatment session, making ten weeks altogether.

Treatment Approaches

Mastery Learning Approach (MLA):

The Mastery Learning Approach was developed by Bloom (1971). It was based on a theoretical model developed by Carroll (1963) which states that the degree of learning acquired by a learner is proportional to the time spent on the learning divided by the time needed for the learning. The model is based on the assumption that instructions will be of good quality and appropriate for the students, if instruction of poor quality is given more time which will be needed to master the learning. Mastery learning consists of six components, each component with its own peculiar functions. The components are as follows:

- (i) Pre assessment / pre-test / formative evaluation
- (ii) Instructional Objectives
- (iii) Instruction towards the Study
- (iv) Diagnostic / 2nd formative evaluation
- (v) Prescription (Remediation)
- (vi) Summative evaluation /post-test.

Each of the components has an important function in helping students learn the basic skills and concepts of the curriculum to be taught.

Pre-Assessment /Pre-test (Entry Behaviour): It is the pre-test which helps in identifying the areas of weaknesses and strengths of the students before the instructions of the programme. The goals and objectives of the programme as well as the selection of the materials and instructional methods are determined as a result of pre-assessment.

Instructional Objectives: The Mastery Learning Approach lays emphasis on the selection of objective. This is because an objective to the teacher is just like a compass to the sailor. A sailor without a compass will be sailing at the fog of his own making without any direction. Hence, objectives determine the content and amount of instructional time.

Instruction Towards the study: There is no restriction on the type of instruction that can be used in a mastery learning programme. The content selected to be taught and the emphasis given to the specific aspects of the contents are the two variables affecting students learning.

Diagnostic Test: This model employs evaluation procedures which were classified as formative evaluation. This assessment measures what each student has learnt and what he has failed to learn in the course of the programme. It is usually arranged at regular intervals, that

is, at the end of each unit, throughout the instructional programme. The information obtained here is used to improve upon those segments of the instructions that have not been effective. Instruction can be adapted to the needs of individual students.

Prescription: This consists of instruction activities recommended on the basis of diagnostic assessment. When the information obtained as a result of the diagnostic assessment suggests that the students still needs further instruction on the unit in which his performance was below the mastery level, the prescription is referred to as the Remediation. The student may be given additional instruction or he is asked to repeat the instruction, or he may receive special instructions to develop his pre-requisite skills. When a student does not demonstrate mastery on a diagnostic assessment measure, the student's problem needs careful analysis in order to determine the appropriate prescription. The students continue recycling through remediation and diagnostic evaluation until he performs at the minimum pass level. This recycling continues until the students have mastered the crucial skills.

Post-Assessment: This is the last and final component of this model. It is to measure whether each student has reached the goals identified in the objectives. If a student has failed to attain a minimum pass level or failed to master a crucial objective, the student is recycled through the instructional programme or additional instruction is prescribed for him. The student will continue to receive instruction until he reaches the minimum pass level.

The Problem-Solving Approach (PSA)

The problem-solving approach means finding a way out of a difficult situation that is unique and novel to the students. According to skinner (1968), problem solving is a process of overcoming difficulties that appear to interfere with the attainment of a goal. Woodworth and marquis (1948) sees problem solving as a situation that occurs in novel or difficult situations and is not obtainable by the habitual methods of applying concepts and principles derived from past experience in very similar situations.

It leads to the learning of new Mathematical concepts and principles. The teacher (researcher) emphasized on the method of solution to a problem rather than the solution itself. It was noted that the process of solving one problem or the solution often created a solution to some other problems. Polya (1957) identified four phases of problem solving as:

1. Understanding the problem
2. Devising a plan
3. Carrying out the plan
4. Looking back

Phase 1: Understanding the Problem- This is often the most difficult and probably the most fundamental step, at this stage. It involves forming a suitable mathematical model defined in related terms, rejecting extraneous information and analyzing the questions. In the process, the researchers attempted to search for a pattern, a relationship or a similarity with the student's mathematical problems.

Phase 2: Devising a Plan- To devise the plan for the solution of a given problem, all mathematical skills and techniques previously acquired are called to play and if the required skills are not possessed, we consult others or refer to texts books.

Phase 3: Carrying out the Plan- This involves the use of the plan obtained earlier to find the solutions to the given problem.

Phase 4: Looking Back - This stage involves checking of the result, and the argument used, exploring the possibility of deriving the result through a different approach and finally looking into the possibility of deducing or generalization of such a result.

The Control Group

The control group was on the waiting list (that is the participants were not exposed to any treatment), but they were later exposed to some other topics outside the identified perceived concepts and were taught with the traditional method of teaching so that they could also benefit from the research (Placebo treatment).The control group was post-tested after eight weeks to obtain their post test scores.

Data Analysis

The Hypotheses were analyzed with One Way Analysis of Variance (ANOVA). The Post HOC analyses were performed using Least Square Difference (L.S.D) and the Scheffe Multiple Comparison test. All hypothesis were tested at 0.05 level of significance

Hypothesis 1: There is no significance difference in student Mathematics Achievement Post-test scores of the perceived difficult concept of participants in the treatment and control groups.

The analysis is as presented in Table 2 , 3 and 4 .

Table 2: Summary of the Descriptive Statistics of Pre and Post Test Mathematics Achievement Test (MAT) Across Experimental Groups.

Condition	Pre-test Scores			Post-test Scores		Mean differences
	N	Mean	Std. Deviation	Mean	Std. Deviation	
Mastery Learning (MLA)	100	54.91	4.50	79.25	4.91	24.34
Problem-solving (PSA)	100	53.47	2.95	77.26	4.06	23.79
Control	100	53.08	4.92	53.51	3.19	0.43
Total	300	53.82	3.46	70.00	4.05	16.18

***Increased mean scores on the (MAT) scores are indicative of higher achievement. .**

As shown in table 2 above, the descriptive data presented indicates that the three experimental groups recorded mean scores ranging from 54.91 for the MLA, 53.47 for the PSA and 53.08 for the Control group. Table 2 further shows that at post-test, the MLA recorded the greatest improvement in the performance of students with mean of 79.25, followed by the Problem-Solving with a mean of 77.26 and then the control group recorded minimal improvement with a mean of 53.51.

To determine whether these differences were statistically significant, the ANOVA results in Table 3 were displayed.

Table 3: ANOVA Test of Differences in Mathematics Achievement Test (MAT) Scores across Groups.

Source of variations	Sum of Squares	Df	Mean Square	F-cal	F-crit
Between Groups	358.49	2	179.25	5.91	3.02
Within Groups	13557.03	297	30.33		
Total	13715.52	299			

P < 0.05; df = 2 and 297;

From table 3, The one-way ANOVA showed F to be significant beyond 0.05 level: $F(297) = 3.02$ and $F_{cal} = 5.91$; $P < 0.05$. From the evidence above, calculated $F = 5.91$ is greater than the tabulated F which has a value of 3.02. Hence, hypothesis one was rejected and the alternate accepted, which means that there is significant difference in student Mathematics Achievement Post-test scores of the perceived difficult concept of participants in the Mastery Learning, Problem-solving and the control group. Since the F-test shows that there is a significant difference, Post-Hoc test was performed in order to determine where the significant difference lies i.e. the method that is most efficient in the study.

Table 4: The Scheffe Multiple Comparison Test

Experimental Treatments		Mean Difference(I-J)	F-crit.	Remark
(I) Class of Treatment	(J) Class of Treatment			
Mastery Learning	Problem-Solving	1.99	2.05	N.S
	Control	5.74 *	2.11	Significant
Problem Solving	Control	3.75 *	1.95	Significant

Shows that it is significant at 0.05 level of significance.

From the above table, it is evident that there is a significant difference between the performance of students in the Mastery learning group & the Control group. There is also a significant difference between students in the Problem-solving & the Control group but the difference between the students in the Mastery Learning & the Problem-solving group is not significant at 0.5 level of significance. Therefore, it was concluded that both MLA and PSA were effective in improving participants mathematics achievements, although the Mastery Learning method was observed to be the best method of improving students' achievements in Mathematics.

Hypothesis Two: Gender will not significantly predict Post-test scores of Mathematics Achievement Test between the treatment and control group.

In order to find out the significant difference between the experimental and the control groups of the post-test scores of Mathematics Achievement Test with respect to gender, the table of statistics for the data under study was drawn and is displayed below:

Table 5: Descriptive Distribution of Pre and Post Test of Gender across the Three Experimental Groups

Sex	Experimental Conditions	N	Pre-test Scores		Post test scores		Mean Differences
			Mean	SD	Mean	SD	
Male	Mastery Learning	50	39.52	4.78	47.23	4.02	7.71
	Problem-Solving	50	39.25	4.09	46.56	4.12	7.31
	Control Group	50	39.36	4.11	46.20	3.99	6.84
	Total	150	39.37	4.32	46.66	4.04	7.29
Female	Mastery Learning	50	40.15	3.95	46.35	4.11	6.20
	Problem-Solving	50	39.23	4.01	46.00	4.09	6.77
	Control Group	50	40.11	3.98	44.89	3.99	4.78
	Total	150	39.83	3.98	45.41	4.06	5.91

Increased mean scores for post-test on MAT are indicative of higher performance after treatment.

In order to investigate the level of interactive effect between gender and treatment of the post test scores of Mathematics Achievement Test , a 2-way ANCOVA analysis was carried out to verify if the interactions between the gender and treatment have significant effect on the student’s achievement in mathematics. The results of the analysis are presented below:

Table 6: 2-Way ANCOVA Showing the Significance of Gender and Treatment

Source	Type I Sum of Squares	Df	Mean Square	F ratio
MODEL	75894.77	6	12649.13	382.70
GENDER	72310.44	2	36155.22	1093.88
TREATMENT	1723.10	2	861.55	26.07
GENDER TREATMENT (experimental conditions)	1861.23	2	930.62	28.16
Error	14675.23	444	33.05	

P < 0.05; df = 2 and 444

Looking at the ANCOVA table, we see that the value for the calculated F (of the combined effect of gender and post-test score i.e. the experimental condition) of the analysis which is 28.16 greater than the tabulated F score of 3.00 at 0.05 level of significance, at 2 and 444 degree of freedom. Under this circumstance, we reject the null hypothesis and accept the alternative hypothesis. This implies that the interaction effect between gender and treatment in the Post-test Scores of mathematics achievement test is significant. Hence, the difference observed is as a result of the interaction between gender and treatment conditions, based on the significant difference observes between gender and treatments condition. Further analysis of the data became necessary, using the Least Square Difference (L.S.D.) Pair Wise Multiple Comparison.

Table 7: Least Square Difference (LSD) Pair Wise Multiple Comparison

Gender	Experimental condition	Male		
		Mean Difference		
Female		MLA	PSA	CONTROL
	MLA	1.97 **	1.32 **	2.43 **
	PSA	1.21 **	0.56	1.67 **
	CONTROL	0.85 **	0.2	1.31 **

*** Shows that it is significant at 0.05 level of significance**

It was observed that at the P-value (0.74), the interaction between gender and the experimental conditions is significant for all the groups, except for the males in the PSA group. Hence, it can be concluded that the Mastery Learning is more efficacious in interaction effect among gender.

Discussion

The results of hypothesis one clearly indicated that the participants in the two experimental groups MLA and PSA had higher mean scores of 79.25 and 77.26 respectively at post-test. These were higher than the control group mean of 3.51. It is not surprising to find out that there is a significant difference in the performance of students in the Post-Test of Mathematics Achievement Test between students who received MLA and PSA treatment compared to the control group which did not receive any treatment. Also, the Mastery Learning had the highest standard deviations followed by the Problem Solving and the

Control group. Since the MLA and PSA had positive significant effects on students' achievement in Mathematics, the hypothesis was rejected. However further evidence from the study revealed that students who received mastery learning had higher achievement than those who received Problem Solving Approach. This is consistent with earlier studies demonstrating the efficacy of the Mastery Learning Approach. This support many earlier findings: Block (1971); Bloom (1976); Babalola (1983); Salami (1987).; Rao, Moenly & Sachs(2012)The reason for the better achievement may be due to the efficacy of the method in which stresses the fact that almost every student can learn the basic skills that form the core of the school curriculum when the instruction is of good quality, is appropriate for the learner and the student spends adequate time on the learning. That is, a percentage level of mastery must be attained by the learner before the instructor can move to the next topic. In practical sense, the researcher set a target of about 60% for the students. i.e criterion reference. Students who could not achieve this were sent back to re-learn the topic during the remedial and tutorial classes thereby spending adequate time on the learning until the topic was mastered. This justifies the Bloom's developmental approach of the Mastery Learning on the proposition that almost every student can learn the basic skills that form the core of the school curriculum when the instruction is of good quality is appropriate for the learner and student spends adequate time on the learning. This means that an average Mathematics teacher in a normal Nigerian secondary classroom can use the MLA effectively for students of secondary schools. Equally, the principle of practice and expectancy in the learning theory also seems to validate the effectiveness of MLA as an effective instructional strategy. Students taught with MLA showed high-enthusiasm which resulted in a better performance in Mathematics. Findings from the present study also support the notion that effective teaching using good instructional materials encourages learners to take charge of their own learning. Instructional Strategies of MLA and PSA had significant effect on learners' performance. These findings are consistent with the assertion that strategy improves content learning and vice – versa as earlier indicated by Zimmerman (2010) which also agrees with the work of some researchers (Akinsola, 1987; Abakporo, 2005; Adedayo, 2006).

Significant levels for differences were established between experimental and control groups using F- Test confirmed significant main effect of treatment in Mathematics scores for achievement in Mathematics. The Scheffe Multiple Comparison showed that the two (2) experimental groups had Mean Scores that were higher than that of the control group with Mastery Learning Approach (MLA) having the highest. The MLA best learning outcomes could be attributed to the fact that MLA consists of activities which help process materials with short-term memory by keeping them active in consciousness, so that it can be more deeply processed for recall for long periods. One other issue raised by this finding is that MLA is more effective in enhancing cognitive achievement of students in Mathematics while PSA is more effective in the psychomotor skills.

Hypothesis Two: Gender will not significantly predict Post-test scores of Mathematics Achievement Test between the treatment and control group. The result in table 4 indicated that male student has a greater Mean difference of 7.71 while the female has a Mean difference of 6.20 using the Mastery Learning as evident on table 4. Also the male has a Mean difference of 7.31 and the female has Mean difference of 6.77 using the PSA at $P < 0.05$ level of significance. The hypothesis was therefore rejected. It follows that significant gender difference does exist between gender and performance in the post- test score of student's achievement in Mathematics across the experimental conditions. The table reveals that the treatments (MLA& PSA) were found to be effective in enhancing the outcomes of the learners in Mathematics. There was a general increase in post –test scores over pre-test scores

for affective (attitude) outcomes in the two (2) experimental groups. In other words, all the two experimental groups performed better than the control groups. The MLA has highest Mean score of 7.71 while PSA has 7.31, and the control group has 6.84 for the male students. Further analysis using Two-Way ANCOVA to verify the level of interaction between gender and treatment have significant effect of the students achievement in Mathematics which confirmed the main effect of treatment on subject scores for achievement in Mathematics. . The findings of the present study give empirical support to the fact that the MLA and PSA are more effective than the traditional/ conventional method commonly used in Nigerian classrooms. However, MLA enhances higher achievement in Mathematics than PSA and the traditional teaching method. These finding also buttress earlier results obtained from investigations that were conducted by Oke (2003); Ekwere and Ige (1998). The present study emphasized reception learning and learners active involvement in the learning process so as to arouse his /her interest and performance towards the learning and teaching of Mathematics. The male students were doing better than the female students after treatment. This was expected and the result supports Tobias (1976) which claimed that Mathematics results from a culture that makes Mathematics ability a masculine attribute. Some of the reasons for this differential gender achievement could be due to the fact that male generally love and dominate careers such as engineering pilot, surveying etc. However, empirical reviews also gave reasons for some no differential gender achievements, which could be due to common aspirations in careers as both male and female are in all types of career. Secondly, the influence of peer groups in solving Mathematical problem together motivates students and eliminates gender bias. The result also support Mangal (2013) who studied gender difference in standardized college entrance test scores in eight subjects area. Female outscored males in five areas, two results were mixed, in one, males outscored females. However, the result supports that of Fennama (2009) which found that there are no gender related differences in Mathematics achievement of elementary school pupils.

Summary of Findings

Based on the research hypotheses, the following were the highlights of the findings:

- There is a significant difference in student Mathematics Achievement Post-test scores of the perceived difficult concept of participants in the treatment and control groups.
- Gender will significantly predict Post-test scores of Mathematics Achievement Test between the treatment and control group.
- Mastery Learning Approach and Problem Solving Skills were effective for improving students' poor achievements in perceived difficult concept in mathematics.

Conclusion

On the basis of the findings of this study, the following conclusion was made.

- The Mastery Learning Approach, which takes into consideration both slow and fast learners' active involvement in knowledge, enhances meaningful learning of the subject matter. It allows the teacher to pay attention to individual students to assess the mastery level attained by each student. Hence, it can be inferred that the MLA can be used to teach those concepts that are perceived to be difficult in Mathematics with ease.
- The MLA & PSA turned students into active participants in the class and promoted in-depth learning throughout the period.

Recommendations

The following recommendations are made based on the findings:

- Teachers should redouble their efforts in the teaching of topics that are perceived difficult in mathematics and ensure adequate coverage of syllabus and its application so as to demystify the topics.
- Teachers are encouraged to do frequent revision exercises with their students in order to enhance students' mastery/ retention of various knowledge and skills gained in previous lessons.
- The three tiers of Government (Federal, State and LGA) should ensure that more qualified mathematics teachers are recruited to teach the subject in the schools so that the class size of 30-35 students/ teacher ratio is maintained in order to ensure maximum teacher control on the students.
- Teacher should lead the students to solve many problems using the PSA to ensure that the topics are well comprehended by the students'
- Teachers should ensure that the three domains of learning are inculcated in their teaching, assessment methods and lesson notes.

Contributions to Knowledge

The study contributed to knowledge in the following ways:

- The study contributed to knowledge by emphasising the need for teachers to create improve instructional programmed plan for discovering learning difficulties of students and the need to allocate-more time to teaching& /remedial work for Mathematics on the school time table.
- The MLA and PSA methods turn the students into active participants in the class there by promoting in-depth learning of the subject matter by the students throughout the period of the study.
- The use of comprehensive instructions that emphasizes students' mastery of learning enhances good classroom teaching and learning of the next prerequisite topic in the subject.

The study has shown that there is no topic or concept that is to be perceived difficult by students of Mathematics but all that is needed by students is doing regularly class work/assignment, remedial/extra work, solving mathematical problems frequently and mastery of concept. This study also documents the impact of MLA and PSA in the remediation of students' poor achievement in some perceived difficult concepts in mathematics.

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