EFFICACY OF SQUAR-TABLE APPROACH ON STUDENTS ACHIEVEMENT AND INTEREST ON SQUARE ROOT OF NUMBERS IN JUNIOR SECONDARY SCHOOL MATHEMATHEMATICS: A KEY TO SUSTAINABLE CHANGE IN TECHNOLOGICAL DEVELOPMENT.

by

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Abstract

The main purpose of this paper is to determine the Efficacy of Square Table Approach on Students Achievement and Interest on Square Root among Junior Secondary Schools in Nsukka Urban Local Area. The sample for the study was 236 pupils from four intact classes purposively selected from 23 public schools in Nsukka Urban Local Government Area. 'Two instruments were used for the data collection Square Root Achievement Test (SRAT) and Square Root Interest Inventory (SRII). Mean and Standard Deviation were used to answer the research questions, while ANCOVA was used in testing the hypothesis at the 0.05 level of significance. Results indicated that the Square Table approach was effective in enhancing student's achievement and interest in Square Root. It was recommended among others that teachers should use the Square Table approach in teaching Square Root.

Introduction

Mathematics is the science that developed from the investigation of figures and computation of numbers. It is a key to all science and often described as a language and currency of science and technology (Agwagah, 2008). The importance of mathematics in the developing nation like Nigeria made mathematics a core and everyday subject in the primary and junior secondary schools level of education. The introduction of mathematics as a core and everyday subject is to enable the primary school pupils' to acquire the basic skills needed for further mathematics learning. The skills acquire at basic level also strengthened more by learning ofthe subject everyday at junior secondary school level which serves as the transition level between the primary and senior secondary. The mathematic topics study at this level serve as the part of the bases for the future learning of the subject at the senior secondary school.

Junior secondary is unique level of school system because it is end point of basic education, According to Ige, (2014) Junior Secondary Education is the stage where the vocational thrust of basic education is consolidated and where core, vocational, non-prevocational and academic subjects are offered and taught.For these reasons, adequate attention is needed in teaching and learning of mathematics at this level for the smooth transition of the learning of mathematics and other mathematics related subjects at senior secondary level to be effective. Mathematics learning at Junior Secondary school is a continuation of primary school mathematics. All the basic skills and principles of almost all the topics in junior secondary mathematics have been learnt at primary school level. Such topics are number and numeracy, square and square root of numbers.

Despite the fact that mathematics is a core and everyday subject, taught at primary and secondary levels, students' achievement in mathematics is discouraging. Researches' have shown that the poor achievement of students in mathematics is not peculiar to Nigerian alone but it a universal problem observed all over the world. Achievement according to Nwoye (2017) is the students' success in meeting of short or long mapped out goals or objectives. Some researchers have carried out some studies on factors attributed to the students' poor achievement in

mathematics. Some of these factors according to earlier researchers are: students lack of interest on the subject (Ugwuanyi, 2016), lack of Motivation (Liu & Lin, 2010), Poor Retention (Nneji, 2009) andinability of mathematics teachers adopting appropriate teaching approach in teaching of mathematics concept to mention but a few.

Teaching approach is the way or form in which a context is presented for better understanding. According to Agwagah (2001), one of the varieties which will stimulate the interest of students in mathematics learning is the use of appropriate approach such as games in teaching of any mathematics concept mostly at primary and junior secondary levels. Games are the most natural means of expression which teachers can use to stimulate students'' interest and enhance achievement in mathematics learning. Therefore, there is a need to adopt new approaches that will be activity oriented in teaching of some difficult concepts or topics in mathematics, to remove the abstract nature of mathematics and add variety in teaching and learning of the subject. Such new concepts are simultaneous equation, number base, square and square root of numbers. One of the new approaches is **Square Table Approach. It is an approach where a table of square of numbers from 1-9 will be developed, presented and used in finding** of square root of both perfect and non-perfect numbers**.**

A perfect square is a number that is a product of two identical numbers while non-perfect square is number that is a product of two non-identical numbers. Perfect squares numbers are numbers whose square roots are integers while non perfect square numbers are numbers whose square roots are not integers (Robert, 2018). Square root of numbers is one of the topics in the junior secondary school mathematics curriculum students have misconception about it. Students have the notion that square root is peculiar to perfect square numbers only not knowing that any number has its square root. With these new approach (Square Table Approach), students would be able to find square root of any number without the use of calculator be it perfect or non perfect number. For the students to find the square root of number with the use of square table approach, they will firs check if the givennumber is aperfect square number or non perfect squares number to enables them to know which rules of the approach they willuse in solving the problem because the rule of the approach varies. To do this the following rules are to observe:.

PROCEDURES

* Squares of all integer all perfect squares end in 1,4,5,6 or 9 (i.e. even numbers of zeros.)
* A number that ends in 2,3,7 or 8 is not a perfect square.
* For numbers ending in even zeros, then remove the zeros at the end of the number and apply the following test;

1st: A perfect square never ends in 2, 3, 7 or 8.

Example1. 15623

By just noticing the number itself,we can conclude that 15623 cannot be a perfect square. We do not have to go to step 2.

2nd: Obtain the digital root or sum of the number. A perfect square will always have a digital root or sum of 0, 1, 4, 7 or 9

Example 2. 15626

1st: This number ends in digits 6, so it satisfies the rule. But still we cannot conclude that this number (15626) is a perfect square.

2nd: Let's take the digital root or sum of this number, that is $1 + 5 + 6 + 2 + 6 = 20 = 2 + 0 = 2$.
So, the digital root or sum of this number is 2. A perfect square will never have
a digital root of 2. Hence, we conclude that 15626 is not a perfect square.

Example 3. 623461

1st: Notice that the last digit of the number is 1. This number could be a perfect square.

2nd: The digital root or sum of this number is6+2+3+4+6+1 = 22 = 2+2 = 4.

So it satisfies both step 1 and step 2. However, we cannot conclude that 623461 is a perfect square though.

NOTE: However, this shortcut comes in really handy to eliminate obvious choices which are not a perfect square to solve competitive examination where you need to find the perfect squares.

STEP II: FINDING THE SQUARE ROOT OF PERFECT NUMBERS WITH THE USE OF SQUARE TABLE

1st: Formulate the Square Table

1^2	1
2^2	4
3^2	9
4^2	16
5^2	25
6^2	36
7^2	49
8^2	64
9^2	81

2nd: Identify the last digit of the number whose square root is to determined.

Example 1: Find the square root of 729

72**(9)**

3rd: To check the equivalent square of the number in which the last digit of the number whose square root is to determined lies in the square table. These number are 3 and 7.

4th: Cancel the last two digit of the number whose square root is to be determined; that is 7~~29~~ so that 7 is the remaining digit

5th: To check the square of the number which is closest to the remaining digit the square table.**This number is 2**.

6th: Find the product of the number in the 5th step and the next whole number after it;that is 2*3 = 6

7th: Compare the result in the 4th step with 6th step.

8th: **i**. If the result in the 4th step is lesser than the result in the 6th step choose the lesser number in 3rd step.

ii.But, if the result in the 4th step is greater than the result in the 6th step; the greater number in the 3rd step.

By observing; 7 is greater is than 6. Therefore,choose the number **7** in the 3rd step.

9th: Conclusion;arrange the results obtained in 5th and 8th step in tense and unit position respectively to get 27.

Therefore √729 = 27

Example: 2

Find the square root of 1024

Following the above approach, we have:

2nd step: 1024 ⟶

3rd step:2 and 8
4th step:10241 ⟶
5th step: The number is **3**.
6th step:3*4 = 12
7th step:12 and 10
8th step: By observing,10 is lesser than 12. Therefore,choose the number **2** in the 3rd step.
9th step: Arranging the result obtained in 5th and 8th step in tense and unitposition respectively we get 32.
Therefore, √1024 = 32

STEP III: FINDING THE SQUARE ROOT OF NON-PERFECT NUMBERSWITH THE USE OF SQUARE TABLE

1st: Formulate the square table.

1^2	1
2^2	4
3^2	9
4^2	16
5^2	25
6^2	36
7^2	49
8^2	64
9^2	81

2nd: Simplify the number whose square root is to be determined bychecking the number whose square is closest to the number on the square table.
For example, To find the square root of 3 we have that;
√3 = √4- 1 (where 1 is the remainder and is written in powers)
= 2^1
3rdstep: To double the whole number obtained in the 2nd step and divide the remainder with it.
= 2 = 2 + 2 = 4 so that we have $\frac{1}{4}$
4thstep: Simplify the result (the fraction) to its lowest term and leave your answer in decimal form; that is $\frac{1}{4}$ = **0.25**
5th step: To check the operation sign in the 2nd step. By observation, the operation sign used is the minus sign (-).
6th step: To subtract the result obtained in the 4th step from the whole number obtained in 2nd step. That is **2 – 0.25= 1.75**
7th step: Conclusion; The result of **√3 = 1.75**

Example: 2. Find the square root of 23
Following the same procedures, we get;
2nd step: √23 = √25-2 (where 2 is the remainder and is written in powers)
= 5^2

3rd step: 5 ~~5 + 5 =►~~10 so that we have$\frac{2}{10}$

4th step:$\frac{2}{10}$ = $\frac{1}{5}$=**0.2**

5th step: By observation, the operation sign used is the minus sign (-).

6th step:5(whole number)**- 0.2= 4.8**

Therefore, √23 = 4.8

Example 3. Find the square root of 109

2nd step: √109 = √100+9 (where 9 is the remainder. The 9 will be numerator while denominator will be 10+10 = 20, the change to decimal to get 0.45)

3rd step: By observation, the operation sign used is the plus sign (+).

4sth step: 10 (whole number), 0.45

10 + 0.45= 10.45

Therefore, √109 = 10:45

The purpose of the study was to determine:

- The effect of square table approach on mean achievement scores of students taught square root of numbers and those with conventional method.
- The effect of square table approach on mean interest rating score of students taught square root of numbers and those taught with conventional method.

Research Questions

- What is the different in the mean achievement score of students taught square root of number with square table approach and those taught with the conventional approach?
- What is the difference in the mean interest ratingof the students taught square root and those taught with conventional approach?

Hypothesis

- **HO_i:** There is no significance difference between the mean achievement scores of students taught square root with square table approach and those taught with conventional approach.
- HO_2: There is no significance difference between the mean interest of students taught square root with square table and those taught with conventional approach

Research Method

The design used for the study was Quasi-experimental research design. Specifically, it was non-equivalent control group design. The study was carried out in Nsukka Urban Local Government Area of Enugu State.The sample for the study was 236 public Junior Secondary students, who were purposively selected from the 2355 pupils, which is the entire Population. Four Junior Secondary schools were randomly selected from the area for the study. From each school, one intact class of elementary JS was randomly selected. The first two intact classes selected were used as the experimental group while the last two foraged the control group.Two instruments were used namely: Square Root Achievement Test (SRAT) which consists 20 square root problems (10 perfect square questions and 10 non-perfect square numbers) respectively.Square Root Interest Inventory (SRII) was developed with 20 items. The items were based on 4 points scale which was Likert type rating scale of Strongly Agree (SA)=4 points, Agree (A) = 3 points,

Disagree (D)- 2 points and Strongly Disagree (SD)= 1 point.Mean and standard deviation were used in answering the research questions, while the hypothesis were tested using the analysis of Co-Variance (ANCOVA) at P<0.05. The Pretest scores were used as covariate to the posttest scores.

RESULTS

RESEARCH QUESTION 1

What is the difference between the mean achievement scores of Students taught Square root with square table approach and those taught with conventional approach?**.**

Table 1: Mean andStandardDeviation of Students on Achievement Score of Students on the Square Root

Groups	**N**	**Pretest**		**Posttest**		**Mean gain**
		Mean	**S.D**	**Mean**	**S.D**	
Experimental Group	120	51.32	14.87	68..24	15.75	16..92
Control Group Mean difference	116	53.35 2.03	21.68	54.33 13.91	21.75	00.98

From the table above, the mean of the students taught square root with square table approach is 51.32 with standard deviation 14.87 for the pretest, while the mean for the posttest is 68.24 and standard deviation 15.75. For the control groupthe mean scores for the pretest is 51.35, with standard deviation 21.68. While for posttest the mean score is 54.33 with standard deviation 21.75.The mean difference, of the experiment and control groups is .2.03 and 13.91 respectively.The mean gain for the experiment and control group is 16.92 and 00..98respectively.

This indicates that square root approach has a positive effect on students Achievement score in square root learning than the conventional approach.

.**Hypothesis One**

There is no significant difference in the mean achievement scores of students taught square root of numbers with square table approach and those taught with conventional approach

Table 2: Summary of Analysis of covariance (ANCOVA) of students' mean achievement score in square root of numbers when exposed to square table approach and those not exposed

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2677.940[a]	2	1338.970	37.269	.000
Intercept	8721.636	1	8721.636	242.761	.000
PretestAch	53.306	1	53.306	1.484	.224
Method	2642.802	1	2642.802	73.561	.000
Error	8370.954	233	35.927		
Total	170325.000	236			
Corrected Total	11048.894	235			

Result of the analysis in Table 2 shows that teaching strategy is a significant factor on students' achievement in square root of numbers; $F(1, 233) = 73.561$, $P = .000$. Thus, the null hypothesis of no significant difference is rejected. This is because the exact probability value (.000) is less than level of significance set at 0.05. Therefore, the researchers conclude that there is a significant difference in the mean achievement scores of students taught square root of numbers with square table approach and those taught with conventional approach.

Table 3: Mean and Standard Deviation of Students Interest Rating on Square Root Interest Inventory

Group	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Experimental Group	120	42.40	5.23	49.59	7.41	7.19
Control Group	116	25.34	3.36	26.53	5.27	1.19
Mean difference		17.06		23.06		

Table II above indicates that in pretest for experimental group has the mean of 42.40 and the standard deviation 5.23. Then for posttest the mean is 49.59 with standard deviation 7.41.
The control group for the pretest has a mean of 25.34 and standard deviation 3.36. Then for posttest the mean is 26.53 with standard deviation 5.27. **The mean** difference for the Pretest and Posttest is 17.06 and 23.06 respectively. The mean gain for the groups is 6.58 and 1.19 respectively.

Hypothesis Two
There is no significant difference in the mean interest ratings of students taught square root of numbers with square table approach and those taught with conventional approach.

Table 4: Summary of Analysis of covariance (ANCOVA) of students' mean interestratings in square root of numbers when exposed to square table approach and those not exposed

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	27573.202[a]	2	13786.601	331.318	.000
Intercept	20179.694	1	20179.694	484.957	.000
PretestInt	1900.835	1	1900.835	45.681	.000
Method	19700.687	1	19700.687	473.445	.000
Error	9695.442	233	41.611		
Total	520946.000	236			
CORRECTED TOTAL	37268.644	235			

Result of the analysis in Table 4 shows that teaching strategy is a significant factor on students' interest in square root of numbers; $F(1, 233) = 473.445$, $P = .000$. Thus, the null hypothesis of no significant difference is rejected. This is because the exact probability value (.000) is less than level of significance set at 0.05. Therefore, the researchers conclude that there is a significant difference in the mean interestratings of students taught square root of numbers with square table approach and those taught with conventional approach.

DISSCUSSION:

The findings of this study revealed that adoption of appropriate teaching approaching in teaching of mathematics enhances students achievement and interest in mathematics learning.. This implies that teaching approaches have effects on students' achievement and interest in mathematics learning. This study is in line with Eze (2006) who investigated the effects of mathematics scrabble game on students' achievement and interest in computational skills. . The finding of the study revealed that students taught with games method had higher interest and achievement means score than those taught with conventional approach. It may be argued that innovative teaching approach is effective on students achievement and interest in mathematics learning.

CONCLUSION:

In finding of the square roots of perfect square number with the conventional approach, students used only two operations which are division and multiplication. The compound operations involve in finding of square root of numbers scares the students away and even damp their interest in mathematics learning.. Again students have the notion that there is no square root of non-perfect numbers. This study therefore have proved to the students that both perfect and non perfect square numbers have square root. With the use of square table approach, junior secondary school teachers will find teaching of square root of numbers easier and more enjoyable. It will as well stimulate their interest in mathematics teaching and add variety to mathematics teaching and learning.

RECOMMENDATION

Hence, based on the finding of this study, the following recommendations are made:

- Mathematics educators should make efforts to design appropriate teaching strategies to remedy the difficulties of the textbooks and rote learning in mathematics teaching and learning.

Teachers should adopt square tableapproach in teaching of square root of number. This will give mathematics learning a new look and will motivate pupils to learn mathematics.

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