THE EFFECT OF USING FORMULA APPROACH ON THE TEACHING OF MATHEMATICAL CONCEPTS IN SENIOR SECONDARY SCHOOLS IN KADUNA STATE

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ABSTRACT

This research was a quasi-experimental study, which was carried out to se how formula approach as an instrumental strategy could enhance the performance of Senior Secondary School Students in Zaria Educational Zone of Kaduna State. Thirty four (34) Senior Secondary School Students in SS3 were used in this study in which seventeen (17) are males and seventeen are females. An experimental treatment was carried out in the experimental groups while the conventional approach was followed in the control group. The study revealed that formula approach if effectively administered will enhance better performance of the students in senior secondary schools. This is because, the students that were taught by the formula approach performed significantly better than those that were not. Similarly, the study was able to remove the much talked gender difference between males and females since there was no significant difference between the performance of the two groups.

Background to the Problem

Mathematics is one of the most important subjects in Nigeria Educational System, hence it is made compulsory for all students to offer the subject at Senior Secondary School Certificate Examination (SSCE) level. This is because Nigeria as a nation solely depends upon mathematics as one of the most important subjects that could help the nation to meet its objective for science and technological development. Ezeilo (1975) supports this fact when he said that there can be no real technological development without mathematics.

In spite of the important place of mathematics in our educational system, students in secondary schools still register continually poor results at both JSSCE and SSCE and in other external examinations. It has been discovered that among the factors that influence the achievement of learners in school mathematics, teacher's effectiveness as measured through the acquisition and use of good instructional skills and methodologies appear very prominent. In this regard, low achievement of school mathematics learners have been attributed to poor and ineffective instructional skills and methodologies by mathematic teachers. Elaborate work has been done in attempt to see how learning can be effected easily and simply with complete mastering but still the problem persists. Etukudo (2003) advocates for the need for pedagogical bases that can cater for the changes that can take place in science and mathematics with respects to varied factors like organization of knowledge and structured discipline. Ale 1997 said that the ability to relate one body of knowledge to the other and understand the change in the structure of the material encountered by learners has been the major problem of learning and advocated that the problem of organization of the curriculum material to meet the need of learners should be looked into. The formula approach that breaks down the concept into formula, small enough for complete grasping by learners make mathematics concepts easier to learn. This is because the learner is afforded with the opportunity of learning easily by memorizing the formula first. According to Ali (1989) it is necessary to consider the justification of matching students learning style with the dimension of teaching. Even though, memorization is discouraged by some mathematics psychologists, to ensure that teaching and learning styles that synchronizes memorization has been involved at the early stage of teaching.

Etukudo (2003) said the precision which goes with formula approach in which case the learning starts with understanding a given formula term by term and point by point enables the learner to easily and effectively group the body of knowledge intended to learn, accommodating and assimilating it with optimum ease. On the contrary, procedure approach involves the studying of problem solving processes and absorbing from the integral steps to the solution matrix not withstanding its complexity.

Many teachers are of the opinion that understanding the structure of the formulae and analyzing it step by step is what is required by the learners not its memorization. The formula approach is said to possess the quality which can satisfy a better means of understanding the nature, structure, language and interrelated ideas as well as induce intrinsic motivation and self discovery which Burrow et al (1971) suggested. Meyer (1978) pointed out that the reduction of a body of knowledge into precise formulae that is capable of enabling the learner to learn in his natural way of learning can foster understanding.

Having put all these research findings into consideration, one would see that to achieve a remarkable success in teaching and learning of mathematics at the senior level, there is the need to shift emphasis slightly from the predominant procedure approach to formula approach to teach some concepts of Senior Secondary School Mathematics. Hence, the present study was therefore designed to see whether the use of formulea approach as a mathematics teaching strategy could enhance better performance in mathematics achievement. Consequently, the problems of this study are:

1. To what extent does the students who are taught using formulae approach would perform better than those taught using the regular procedure approach?
2. Is there gender difference in the performance of senior secondary school students when taught by formulae approach?

Purpose of the Study

1. This research was carried out to find out the existence or otherwise of any significant difference between the performance of the students taught with formulae approach and those taught with the procedure approach.
2. To investigate whether there is gender difference in the performance of senior secondary school students when taught by formulae approach.

Hypotheses

This study was guided by the following hypotheses

i. There is no significant difference in the performance of Senior Secondary School Students taught quadratic equation by formulae approach and those taught by procedure approach.
ii. There is no significant gender difference in the performance of senior secondary school students taught quadratic equation by formula approach.

Research Methodology

The population of this study consists of the SS3 students from 10 schools in Zaria Educational Zone of Kaduna State.

Design of the Study

The design of the study was a quasi-experimental one comprising of a pre-test and post-test. In the first round of randomization process, four schools were selected out of the twenty schools in the education zone of which two schools are boys schools and two are girls schools. Out of the four schools, two were finally selected by randomization process. The schools were Government Secondary Schools Dogon Bauchi and Government Secondary School Dakache. Thirty Four (34) students consisting of Seventeen (17) Males and Seventeen (17) Females were randomly selected from Sixty Five (65) SS3 students, of Government Secondary School Dogon Bauchi used as experimental group (EG) taught by formula approach. Similarly, thirty four (34) students consisting seventeen (17) males and seventeen (17) females were randomly selected from the SS3 of Government Secondary Schools Dakache used as control school (CG) taught by procedure approach.

Three separate instruments were developed by the researcher and administered for the purpose of the study. These were the pre-test, post-test and lesson notes. The test carried a total of Hundred (100) marks i.e. each correct item carried twelve and a half ($12\frac{1}{2}$). The pre-test consist of eight items that satisfied both difficulty index and taken from the mathematics topics of SS3 during the first term. This test was designed to serve the following purpose:

i. To place all the students on the same academic putting before the treatment started.
ii. To establish an equivalence in the abilities for the two groups i.e. experimental and control groups

The post-test consist of eight items that satisfied both the difficult and discriminating power taken from the topics that were covered during the treatment interventions. The mean scores from the post-test provided the bases for comparing the effects of the treatment given to the experimental group.

Lesson Notes

Two separate lesson notes were designed by the researcher, one for the experimental group and the other for the control group. The lesson note for the experimental group was developed according to the way the experimental treatment was given while the one for

the control group was written in the conventional way of teaching quadratic equation with methods of completing the square or factorization method.

Validity and Reliability of the Instruments

The instruments were given to colleagues to assess their face validity, while the reliability was established by using split-half method. The Spearman Brown formula used gave correlation coefficient of 0.80 and 0.85 for pre-test and post-test respectively.

Procedure

The study lasted for eight weeks. In the experimental group, a special treatment was administered to the students. This group was specially taught on how to use formulae approach to solve various quadratic problems using some strategies on how to effectively use formulae approach to solve problems. In the control group, the usual conventional method of solving quadratic equations used.

Data Analysis

The score of each candidate was tabulated in percentages from which mean, standard deviation and t-value were computed and used in testing the hypotheses.

Results and Discussion

The results of the study were presented in the tables below. The results of the data analysis shows that there was no significant difference between the performance of the control and experimental group at the pre-test level.

The result is shown in table 1 below

Table 1: Mean, Standard Deviation and t-value of Experimental and Control Group in Pre-test

Group	Mean	Standard Deviation	t-Value Calculated	Degree Of Freedom	Sign Level	Critical Value
EG (n=34)	52.3	8.12				
CG (n=34)	55.8	8.60	1.15	49	0.05	1.96

From the t-test carried out, the calculated t of 1.15 is les than the table value of 1.96, this indicates that there is no significant difference between the experimental and control

group at the pre-test stage of the study. This result further indicates that both groups were cognitively the same before the experiment.

Table 2: Means, Standard Deviation and t-value of Experimental and Control Group in Post-test

Group	Mean	Standard Deviation	t-Value Calculated	Degree Of Freedom	Sign Level	Critical Value
EG (n=34)	74.54	12.64				
CG (n=34)	63.72	16.82	2.94	49	0.05	1.96

From the t-test calculated, it shows that the administration of the treatment to the experimental group was well carried out since the t-calculated of 2.94 is more than the critical t of 1.96; this indicates that there is a significant difference between the performance of the experimental group and that of the control group. Details of the results in table 2 shows that hypothesis 1 formulated was then rejected.

Table 4: Mean, Standard Deviation and t-value of Male and Female Students in EG and CG in both Pre-test and Post-test

Test	Group	Gender	Mean	Standard Deviation	t-Value	Degrees of Freedom	Sign level	Critical Value
Pre – Test	CG	Male	68.3	8.4	4.81	20	0.05	1.96
		Female	49.5	8.5				
	EG	Male	60.2	8.7	4.52	20	0.05	1.96
		Female	42.3	7.8				
Post - Test	CG	Male	74.7	13.6	2.05	20	0.05	1.96
		Female	52.8	15.2				
	EG	Male	71.6	14.2	0.26	20	0.05	1.96
		Female	69.3	11.4				

From the t-test carried out, the calculated t of 4.81 is more than the table t of 1.96, this indicates that there is a difference in the performance of male and female in the control group at pre-testing stage. The same thing happens in the experimental group in which the calculated t of 4.52 is higher than the table of 1.96. Also during the post-testing stage, the calculated t of 2.06 is more than the table t of 1.96 in the control group. These findings however, support the claims of Aiyedun (2000), Jahun and Momoh (2001) and Etukudo (2003) who found that males performed much better than females in mathematics. However, the findings in the experimental group during post-test shows the contrary in which the calculated t of 0.26 is less than the table t of 1.96, which indicates that the female performed better than males. This finding shows that it is not in all cases that males perform better than females as shown in this case. The result of this data

analysis revealed that there is no significant difference in the performance of male and female students when taught quadratic equation using formula approach. This confirms the fact that formula approach is capable of removing the gender difference that always exists in mathematics achievement of secondary school students.

The findings again confirmed that presentation of mathematics instruction with formular approach as suggested by Osibodu (1988) enhances understanding and quick grasping. The use of formula approach is an attempt to present the instruction in axiomatic form; hence it possesses the quality of inducing higher performance. This implies that the presentation of the instruction in formula enhances understanding and clarity, in addition it ensures gender equality in learning and performance of students in mathematics as indicated in this study.

Recommendations

The following are the recommendations, which may help both the teachers and the learners to enjoy mathematics, which many students in secondary schools find it difficult to comprehend.

1. The teaching of mathematics using procedures approach has been identified as an aspect which students find very difficult to follow due to its complicated processes, it is therefore recommended that teachers should adopt formula approach in the teaching of mathematics by ensuring that seemingly clumsy concepts are reduced to formula which could be easily translated for proper comprehension by the students.
2. Teachers of mathematics should expose students to formula and graphical methods of solving quadratic equations as the third Alternative Method in order to minimize the commitment of factorization and completing of squares errors usually committed as a stage of solving the transformed equations.
3. The teaching of mathematics in secondary schools would be greatly enhanced if teachers and authors of text-books reduce most of the examples to working that practically and systematically uses formula approach.
4. Students should be encouraged to memorize the formulae but teachers should make sure the students know how to interprets the formulae to avoid wrong use in the application of the formulae.

Conclusion

Mathematics remains the pivot on which any true science can rest and no true science can succeed without going through mathematical demonstration. It is in light of this country that wants to develop technologically begins by developing for mathematical arts right from the classrooms. This development has to start somewhere by making sure that classroom teachers are resourceful and innovative in nature. The current practice of sticking to only one method of instruction should be reviewed with the view to giving room to teachers to vary their teaching strategies for the benefit of their students.

The use of formula approach in teaching quadratic equation has proved to be more effective method of teaching mathematics. This is because not only do the students taught with the use of formula approach performed significantly better than those that were taught with procedure approach, but formula approach has proved that it is capable of removing gender difference that is common in the teaching of mathematics. The method also possess the quality of engendering step-by-step approach towards knowledge, comprehension and assimilation of mathematics concepts. This approach if properly followed by teachers will generate quality, which would make it possible for practicalizing the teaching of mathematics in classrooms.

Mathematics educators all over the world are advocating for the use of electronic machines and programming to teach mathematics, this approach is most suitable for the preparation of students towards being able to change pieces of information into formula that could easily be programmed for use with computer.

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