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New strategy to control the rate of mathematics failure in secondary schools

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Abstract

This paper was set up to determine the causes of poor academic performance in mathematics at senior school certificate examination (SSCE). To achieve this, a case study was adopted which targeted three different secondary schools in Damaturu of Yobe state. Participants would be randomly chosen and only those learners doing 'O' leve mathematics. Teachers who teach mathematics at 'O' level will also be targeted. The information will be gathered through the use of questionnaire, documents analysis, interview and observations. Many researchers/authors showed that teaching methods, student's negative attitude towards mathematics, lack of teaching experience by some teachers and lack of adequate resources are some of the causes of poor academic performance in mathematics at senior school certificate examination (SSCE). A number of recommendation would be made about the strategies of teaching mathematics and motivation of students to develop interest in mathematics.

Keywords: Teaching Methods; Mathematics failure; New Strategy; Teaching experience

1. Introduction

Mathematics is an indispensable subject to humanity because of its versatile application in every aspect of human activity. It is necessary to note that mathematics is of significant importance in the field of engineering and by extension, to all sciences and beyond. It is a solid foundation for every successful Scientist. Mathematics failure remains one of the critical problems facing most secondary schools today. Researchers argued that curriculum implementers have not been given sufficient attention to mathematics teaching and learning which led to the nagging problem. Many writers are of the view that government should design large and more realistic mathematical laboratory practical, games and simulation to cover binomial theorem, algebra, regression analysis and so on.

Education is one of the tools for integration of any society and for realization of personal development, national consciousness and promotion of unity, economic, political, scientific, cultural and technological development. Adeyemo(2011) states that mathematics education is a bedrock and indispensable tool for scientific and economic advancement of a person and a nation at large. It is a fundamental part of human thought and logic in his attempt to understand the worldview in which he lives, Ajagu A. A.(2000). Mathematics provides an effective way of building mental discipline and encourages logical reasoning. Mathematics prepares one for future life. Consequently, many nations take mathematics as a compulsory subject at 'O' level since it is a fundamental subject for human life.

Mathematics is the mother of science and space, it is the language of the new millennium. It is the queen of science and technology. No nation can develop scientifically and technologically without proper foundation in school mathematics (Amode, 1996). However, if the rates at which mathematics failure turned out in this country every year are not properly checked and addressed, it will eventually lead to more damage to our tertiary institutions. One may ask whether the

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problem is with the curriculum or the implementers of the curriculum. The obvious truth is that the curriculum implementers have not given adequate attention to the mathematics (Salam M. F., 2003).

Moreover, Mathematics is a world of wonder that is, a place where with only a few numbers and points at our command, the most amazing formulae and geometric figures appears as out of a magician's hat. Mathematics is a tool that is a servant to our needs. It is needed in all facets of life. It has its own logic that is, a way of thinking by applying this way of thinking and reasoning to numbers and to space, we can come up with ideas and conclusions that only the human mind can develop. These ideas often lead us to the hidden secrets of the ways in which nature works. It is in line with these hidden secrets of mathematics that an attempt is being made to develop methods of impacting this knowledge of mathematics.

There are some traits or attitudes which mathematically minded people or learners possess. This means that if a student acquires mathematics efficiently, these traits will be embedded in him. The traits among others are; persistence, self-confidence and patience, inquisitiveness, thoroughness competence, risk-taking, resourcefulness, rationality, optimism, hardworking and resilience. The mentioned traits and skills will help mathematics minded graduate to develop centres for the production of Mathematics teaching resources; production of materials for mathematical games and so on (Bolaji C., 2002).

2. Statement of the problem

Massive failure of mathematics has become worrisome. In order to reduce and minimize mathematics failure in our secondary schools so that students can have flying colors in WAEC and NECO that will enable them get entry requirements into our tertiary institutions, curriculum implementers should give special attention to mathematics. The current wave of mathematics failure being witnessed globally especially in the developing countries should be stopped. Every year fresh school leavers are released into the country without acquiring the requirement that will enable them to get admission into our Universities. Therefore, this study examines the methods of teaching mathematics and strategies mathematics teachers need to adopt to overcome the massive failure in our secondary schools.

Objective of the research

The main aim of senior secondary education as enshrined in the national policy on education is to ensure that every student on leaving school is well prepared for higher education as well as acquires relevant functional skills capable of preparing him/her for useful living. The curriculum focuses on value re-orientation and wealth generation.

The new senior secondary curriculum has the following subjects as compulsory, which include: English language, general mathematics among others. The objectives of this research are:

- To examine the causes of poor academic performance in mathematics at senior school certificate examination (SSCE).
- To find out the challenges faced by teachers in teaching mathematics at 'O' level.
- To suggest possible mitigation strategies to address the situation.

2.1. Research questions

The following research questions provide guide for this Research:

- What are the root causes of poor academic performance in mathematics at senior school certificate examination (SSCE)?
- What are the challenges faced by teachers in teaching mathematics at 'O' level?
- What methods and strategies should mathematics teachers adopt

2.2. Research hypotheses

Based on the ongoing research questions, the following hypotheses are raised:

Table 1 Research Hypothesis

<p>H₀: Methods of learning mathematics have effect on their performance in S.S.C.E. H₁: Methods of learning mathematics have no effect on their performance in S.S.C.E.</p>
<p>H₀: Challenges faced by mathematics teachers have effect on students' performance in the subject. H₁: Challenges faced by mathematics teachers have no effect on students' performance in mathematics.</p>
<p>H₀: Strategies of teaching to adopt have effect on students' performance in the subject. H₁: Strategies to adopt have no effect on students' performance in mathematics.</p>

3. Contribution of the research to knowledge

The aim of learning mathematics is not only to know how to add, subtract or multiply numbers, but also to have knowledge and understanding of some of the objectives which include;

- To acquire and develop skill in the use and understanding of mathematics,
- To learn and develop technique of problem solving,
- To develop the ability to apply mathematics in his future vocational life,
- To develop the habit of systematic thinking and objective reasoning,
- To develops self-confidence for solving mathematical/ other problems,
- To show originality and creativity,
- To develop , appreciate skill in drawing, reading , interpreting graphs and statistical tables,
- To develop skill in measuring, weighing and surveying.
- To generate interest in mathematics and to provide a solid foundation for everyday living.
- To develop computational skills
- To foster the desire and ability to be accurate to a degree relevant to the problem at hand
- To develop the precise, logical and abstract thinking
- To develop the ability to recognize problems and to solve them with related mathematical knowledge
- To provide necessary mathematical background for further education
- To stimulate and encourage creativity (Uka, 2015).

4. Significance of the research

Mathematics as a subject is very essential for the development of any society. No wonder it is presented as a compulsory subject for learners in both primary and secondary school and also a pre-requisite for gaining admission into tertiary institutions. At the tertiary levels, it is taught so as to produce graduates who are highly skilled to make positive impact on the society (Adeyemo, 2011).

The national policy on education (2004) states the broad aims of secondary education as

- Preparation for useful living in the society
- Preparation for higher education

In specific terms, the secondary school should:

Diversify its curriculum to cater for the differences in talents, opportunities and roles possessed by or open to students after their secondary school course

Equip students to live effectively in our modern age of science and technology

Raise a generation of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour and appreciate these values specified under our broad national aims, and lives as good citizens.

Inspire its students with a desire for achievement of self-improvement both at school and in later life (Uka, 2015).

4.1. Research methodology

The method is to sample three public schools for a period of one year in order to see the outcome in both WAEC and NECO. That is one of the public school is male school (GSS Damaturu), one is Female school (GGC Damaturu) and one is Coeducation. That is mixed school (FEPODAM Staff School). Workshop and seminar will be organized by researchers for both students and teachers. Questionnaire will be constructed to get the view of public and at the end we analyze the results using Chi-Square with the aid of SPSS version 23.

4.1.1. Research location

This research will be conducted within Damaturu Town of Yobe State in Northeast geo – political zone of Nigeria. More specifically, the research will be carried out in the three public schools in Damaturu namely: Government Girls College (G.G.C.) Damaturu, Government Secondary School (G. S.S.) Damaturu and Federal Polytechnic Staff School Damaturu (FEPODAM).

4.1.2. Method of data collection

The written (questionnaire) mode of survey administration will be use because it requires minimum resources (time and cost) and is best suited to eliciting confidential information. Written survey allows the respondent the greatest latitude in pace and sequence of response.

4.1.3. Instrument of data collection

The instruments that the researchers will use in collecting primary data for the research is questionnaire. This will be developed on the basis of the literature review that will be conducted. However, secondary sources of data will be utilized.

4.1.4. Method of data analysis

For the purpose of data analysis and presentation, standard deviation and Chi- Square of descriptive statistics will be used. Generally, descriptive statistics will be used in describing the various features of the research problem. This will also be used to test hypotheses, predict and generalize the research problem based on the sample data collected Aremo (2003).

5. Brief literature review

Studies have shown that many people's images of mathematics are negative and is perceived as difficult in many cultures and largely masculine. Ashikhia (2010) states that some societal views about mathematics such as mathematical problems have one answer and can be solve in a particular way and its solitary activity done by individuals in isolation requires good memory and is for clever ones. People view mathematics as a difficult subject and as such their performance is affected. Students seem not to have encouragement from people outside the school system. According to Bolaji (2002) the fear of mathematics has led to various scholars to conclude that mathophobia is a major contributory factor to the problem of learning and teaching of mathematics. Hence, it immensely contributes to poor academic performance in mathematics by ordinary level students. Mathematics is viewed negatively. This occurs with many scholars who assert that a review of school based education research has shown that majority of secondary school students find mathematics as the most difficult, abstract, deadly and boring subject. Erukoha (2002) have also observed that student interest in mathematics decline as they move from the primary school to secondary school level because they have fear that mathematics is difficult subject. According to Onyeagwu (2013) mathophobia can be caused by teachers' methodology, mathematical knowledge, assessment and the nature of the disipline of mathematics. The notion of mathematics as a difficult subject is taken by some people as a challenge such that if they succeed in solving mathematical problems, they feel satisfied and motivated while if they fail the sense of failure result in low self-esteem. Teaching experience contribute to poor academic performance in mathematics at SSCE. Researchers observed that unqualified teachers do not have experience and skills to properly instruct students in mathematical operations. Armstrong (2009) noted that teachers who have specialized in the subject which they teach or in the education of that subject and had around 26 to 30 years of teaching experience, influence student performance positively. This concurs with a study Adeyemo (20011) which revealed that teachers' teaching experience was significant to student's learning outcomes as measured by their performance. Thus lack of relevant teaching experience may have a negative impact on the performance of students in mathematics. Irving A. (1997) noted that significant number of teachers lack long teaching experience and they have weaker practical instructional skills. Therefore, according to him the longer a teacher

takes in teaching O level classes, the more equipped he becomes in preparing learners for senior school certificate examination (SSCE). Onjeagwu (2003) states that poor academic performance in mathematics is traceable to poor teaching. Irving (1997) state that poor mathematics achievement is attributed to classroom factors such as poor teaching methods. A study by Aremo (2003) showed that lack of appropriate materials for use by mathematics teachers compounds the problem of poor academic performance in mathematics.

6. Results

6.1. Research Question 1

What are the root causes of poor performance of mathematics in our secondary schools? The teachers were asked to respond on the root causes of poor performance in the subject. The result is as shown in table 1.

Table 2 The responses were based on the teaching methods

S/n	Teaching methods frequently applied	Responses in percentage
1	Demonstration method	45
2	Lecture method	78
3	Discovery method	25
4	Problem solving method	40

From the table 2 above, the result shows that lecture method is the most frequently utilized in class instruction among the mathematics teachers more than the other teaching methods which is one of the root causes of poor performance. Lecture method is not the best at this level.

Table 3 Crosstabulation for question 1

Teaching_methods * responses_in_percentage crosstabulation						
		Responses_in_percentage				Total
		25.00	40.00	45.00	78.00	
Teaching_methods	Demonstration method	0	0	1	0	1
	Discovery method	1	0	0	0	1
	Lecture method	0	0	0	1	1
	Problem solving method	0	1	0	0	1
Total		1	1	1	1	4

Table 4 Chi-Square Test for question 1

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.000a	9	0.213
Likelihood Ratio	11.090	9	0.270
N of Valid Cases	4		

From the Chi-Square table above, p value is 0.213 which is greater than the value of $\alpha = 0.05$. i. e. $p > \alpha$. Meaning we are to accept our null hypothesis H_0 which states that Methods for impacting the knowledge of mathematics have effect on the students' performance in S.S.C.E. This shows that there is significance relationship between methods of teaching and the students' performance.

6.2. Research question 2

What are the challenges faced by mathematics teachers? The teachers' response on the challenges faced in teaching mathematics are given below in table 5.

Table 5 Challenges Faced By Mathematics Teachers

S/n	Challenges faced by teachers	Number of responses
1	Lack of motivation	166
2	Inadequate resources	345
3	Negative attitude towards mathematics	530
4	Standard teacher - pupil ratio 1:40	400

The table above shows that students' negative attitude towards mathematics has an effect on their performance. That is most students believe that mathematics is difficult and so discourage from learning the subject.

Table 6 Crosstabulation for question 2

Challenges_faced_by_teachers * number_of_responses crosstabulation						
		Number_of_responses				Total
		166.00	345.00	400.00	530.00	
Challenges_faced_by_teachers	Inadequate resources	0	1	0	0	1
	Lack of motivation	1	0	0	0	1
	Negative attitude towards maths	0	0	0	1	1
	Teacher-pupil ratio	0	0	1	0	1
Total		1	1	1	1	4

Table 7 Chi-Square Test for question 2

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.000a	9	0.213
Likelihood Ratio	11.090	9	0.270
N of Valid Cases	4		
a. 16 cells (100.0%) have expected count less than 5. The minimum expected count is .25.			

From the Chi-Square table above, p value is greater than the value of α . i. e. $p > \alpha$, This shows that we are to accept our null hypothesis H_0 which says Challenges faced by mathematics teachers has great effect on students' performance in the subject. Meaning there is significance relationship between challenges faced by mathematics teachers and students performance. The challenges faced are lack of motivation, inadequate resources (mathematics laboratory and other teaching aids), students negative attitude towards mathematics and lack of standard teacher - students ratio of 1:40 were some of factors affecting the performance.

6.3. Research question 3

What strategies will mathematics teachers adopt? The ratings of the teachers' responses on which strategies to employ in teaching mathematics are shown in table below.

What strategies should mathematics teachers adopt?

Table 8 Teachers' perceptions on which strategies of teaching mathematics would be employed, rate shown in the table below

S/n	Teaching strategies	percentage responses
1	Laboratory practical activities	0.80
2	Group discussion	0.75
3	Teaching for mastery	0.60
4	Relating to real life situation	0.85

From table 8 above, the engagement of students in practical activities and relating behavioural objectives of teaching mathematical topics to real life situation were rated very high and accepted. While teaching for mastery and teaching with games were rated low and rejected.

Table 9 Crosstabulation for question 3

Teaching_strategies * percentageresponse crosstabulation						
		Percentageresponse				Total
		.60	.75	.80	.85	
Teaching_strategies	Group discussion	0	1	0	0	1
	Practical activities	0	0	1	0	1
	Relating to real life situation	0	0	0	1	1
	Teaching for mastery	1	0	0	0	1
Total		1	1	1	1	4

Table 10 Chi-Square Test for question 3

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.000 ^a	9	0.213
Likelihood Ratio	11.090	9	0.270
N of Valid Cases	4		

a. 16 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

From the Chi-Square test table above, p value is greater than the value of α . i. e. $p > \alpha$. This shows that we are to accept our null hypothesis H_0 which states that New Strategies to be adopted by the mathematics teachers will yield positive effect on students' performance in the subject. Meaning there is significance evidences of relationship between the new strategies of teaching and the students' performance.

7. Conclusion

Mathematics is an important subject that is useful in every facet of human endeavour. A good foundation in mathematics is considered a great asset for successful education. That is why mathematics is made compulsory in our primary and secondary schools and also a pr-requisite for gaining admission into all our tertiary institutions. So on concluding, we believe that with mathematical knowledge and skills, other sciences will be guaranteed. A mathematical knowledge enhances significant creativity in all human endeavour. Therefore federal and state ministries, departments and agencies (MDA) in charge of education to start giving special motivation for mathematics teachers from primary school level to our secondary education. This will enhance the performance of students in mathematics.

Recommendations

In order to enhance good performance of students in mathematics for senior school certificate (SSCE), the following measures are being recommended:

- The standard of teacher- Pupil ratio of 1:40 as stated in the national policy on education should be maintained.
- There should be mathematics laboratory in all our secondary schools.
- Funding authorities should ensure adequate supply of instructional materials that will enable teachers teach effectively in our schools.
- Teachers should not only assess students' mathematics achievement based on speed and accuracy only but consider manipulative and communicative skill.
- All the three tiers of government should encourage mathematics teachers by organizing workshops and seminars so as to inculcate the right type of methods and strategies necessary for impacting the knowledge of mathematics.
- Government and stakeholders in mathematics education should discourage lecture method at the lower levels and encourage demonstration method, discovery method, group activities and laboratory practical activities in learning mathematics.
- Problem based learning and group activities – That is teachers of mathematics should encourage group activities and problem solving activities which will enhance the students' performance in mathematics.

Compliance with ethical standards

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Disclosure of conflict of interest

There is no conflict of interest.

Statement of informed consent

Information was gathered through the use of questionnaire. This questionnaire was distributed across three different secondary schools in Damaturu.

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