



Pedagogies for Reduction of Mathemaphobia Among Senior Secondary School Students in Umuahia Education Zone of Abia State

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Abstract

This study examined instructional pedagogies aimed at mitigating mathemaphobia among senior secondary school students in Umuahia education zone of Abia state. Students in public secondary schools were exposed to a range of learner-centered approaches, namely discovery, cooperative and discussion methods of instruction. Three research question and three hypothesis guided the study. The study adopted a quasi-experimental research design and data were collected using the pedagogies for reduction of mathemaphobia questionnaire (PRMQ). The instrument was subjected to rigorous validation and reliability procedures to ensure its suitability for educational research. Face and content validity were established through expert reviews by specialists in mathematics education and measurement and evaluation, whose suggestions were incorporated into the final version of the instrument. The instrument was analyzed employing mean, standard deviation and analysis of covariance (ANCOVA). The findings revealed that the application of discovery, cooperative and discussion teaching methods significantly contributed to the reduction of mathemaphobia among students. These results underscore the critical role of appropriate pedagogical strategies in addressing students' anxiety and negative disposition toward mathematics. The study concludes that the deliberate integration of these interactive and participatory teaching approaches can effectively reduce mathemaphobia. Consequently, it recommends their wide spread adoption in secondary school mathematics classrooms to enhance students' engagement and confidence in the subject.

Keywords: Education, Mathemaphobia, Pedagogies, Reduction, Secondary, Senior, Students Zone.

Introduction

Soon after language develops, it is safe to know that humans began counting with their fingers and thumbs. Ten has been the basis of most counting system in history, when any sort of record is needed, notches in stick or stone are the natural solution. In the earliest surviving traces of a counting system, numbers are built up with a repeated sign for each group of ten followed by another repeated sign for one (Gascoigne and Bamber, 2001). Arithmetic cannot easily develop until an efficient numerical system is in place. This is a late arrival in the story of mathematics, requiring both the concept of place value and the idea of zero. Mathematics can be defined as the study of relationships among quantities, magnitudes and properties and also of the logical operations by which

unknown quantities, magnitudes and properties could be deduced (Microsoft Encarta Encyclopedia, 19 edition). Soon after language develops, it is safe to know that humans began counting with their fingers and thumbs. Ten has been the basis of most counting system in history, when any sort of record is needed, notches in stick or stone are the natural solution. In the earliest surviving traces of a counting system, numbers are built up with a repeated sign for each group of ten followed by another repeated sign for one (Gascoigne and Bamber, 2001). Arithmetic cannot easily develop until an efficient numerical system is in place. This is a late arrival in the story of mathematics, requiring both the concept of place value and the idea of zero. Mathematics can be defined as the study of

relationships among quantities, magnitudes and properties and also of the logical operations by which unknown quantities, magnitudes and properties could be deduced (Microsoft Encarta Encyclopedia, 19 edition).

Education is a deliberate process through which individuals acquire knowledge, skills, values, attitude and competencies required for personal development and societal advancement. Caviola (2021) stated that effective learning depends not only on curriculum content but also on the quality of instruction, classroom climate, learner participation and assessment practices. Despite the improvements in the modern educational system, many students continue to experience fear, anxiety and negative attitudes toward mathematics.

Mathemaphobia has been coined out of two words 'mathematics' and 'phobia'. Mathematics is a science subject that studies size, numbers and number manipulations while phobia is an irrational (unreasonable) fear for something. Putting the two together it becomes 'mathemaphobia' meaning irrational (unreasonable) fear for mathematics. Therefore, mathemaphobia is a behaviour disorder in which an individual becomes progressively unable to resist the impulse to fear of mathematics (Stephen, 2007). Raluswinga and Mulovhedzi (2025) researched on effective barriers to mathematics learning and found out that inappropriate teaching methods, family pressure and school environment significantly influence mathematics anxiety among senior secondary students.

Pedagogy refers to the principles, methods and strategies employed by teachers to facilitate effective teaching and learning. Boaler (2016) noted that lecture-based instruction continues to dominate many mathematics classrooms in Nigeria, leaving students with limited opportunities to participate actively in learning.

Reduction refers to the deliberate process of decreasing the severity or occurrence of an undesirable condition, Ofori (2021). In this study, reduction concerns minimizing students fear, tension and anxiety toward mathematics through effective classroom effective classroom pedagogies.

Senior secondary students comprise learners in SS1, SS2, SS3, the researcher observe that senior secondary students experience relatively high levels of mathematics anxiety due to ineffective teaching methods and low self-confidence. SS2 students was selected for the study because they have had considerable exposure to mathematics instruction,

topics and assessment experiences, which enables them to develop measurable levels of mathematics anxiety in Umuahia education zone.

An education zone is an administrative division established by a state ministry of education to coordinate educational activities, supervise schools, monitor teachers and implement government educational policies within a specified geographical area. The Umuahia education zone comprises public secondary schools operating under similar educational policies by differing in instructional resources, teacher effectiveness and school climate. These contextual differences may influence the implementation and effectiveness of pedagogical strategies aimed at reducing mathemaphobia. However, the situation at our secondary schools is that poor performance of students in mathematics at internal and external examinations is prevalent. Many students show obsessive fear of mathematics known as mathemaphobia. This no doubt will negatively affect their performance in the subject. It is based on the above situation that the study investigated the laboratory method, discovery method and cooperative learning method of teaching as ways of reducing mathemaphobia. All these constituted the bench mark criteria against which the needed innovative strategies were adduced.

Statement of the Problem

Mathematics remains a critical subject in the senior secondary school curriculum, yet many students experience fear, anxiety and negative attitudes toward mathematics. This challenge affects students' confidence, participation and achievement in mathematics despite continuous efforts to improve mathematics teaching and learning. Although various instructional approaches have been recommended, there is insufficient evidence on the pedagogies that can effectively reduce mathemaphobia among senior secondary school students, particularly in the Umuahia education zone of Abia State. Therefore, this study seeks to investigate pedagogies for reducing mathemaphobia among senior secondary school students in Umuahia education zone.

Research Questions

1. To what extent could the discovery method of teaching reduce mathemaphobia among senior secondary school students in Umuahia education zone?

2. To what extent could cooperative learning reduce mathemaphobia among senior secondary school students?
3. To what extent could discussion method of teaching reduce mathemaphobia among secondary school students?

Hypotheses

- Ho₁:** Teachers and students do not differ significantly on the extent to which discovery method of teaching could reduce mathemaphobia among secondary school students.
- Ho₂:** Teachers and students do not differ significantly on the extent cooperative learning could reduce mathemaphobia among secondary school students.
- Ho₃:** Teachers and students do not differ significantly on the extent to which discussion method of teaching could reduce mathemaphobia among secondary school students.

Scope of the Study

This study is delimited to investigating pedagogies for the reduction of mathemaphobia among senior secondary students in Umuahia educational zone. It focuses on the teaching methods and instructional strategies employed by mathematics teachers to reduce students' fear and anxiety toward mathematics. The study covers senior secondary school students and mathematics teachers in selected public secondary schools within the Umuahia education zone.

Methodology

This chapter presented the methodology adopted in carrying out this research under the following subheadings: design of the study, area of the study, population of the study, sample and sampling techniques, instrument for data collection, validity and reliability of the instrument, method of data collection and method of data analysis.

The study was carried out in Umuahia education zone of Abia state. There are many pedagogies that could reduce mathemaphobia, but the study considered discovery method, laboratory method, cooperative learning and discussion method of teaching. In all, the study investigated pedagogies for reduction of mathemaphobia among senior secondary school students in Umuahia education zone. Mathemaphobia cuts across all classes of senior secondary students. However the study sampled the opinion of only mathematics teachers in public schools.

Design of the Study

The study adopted a descriptive survey research design. This design was adopted because according to Eze (2014), it enables the researcher to use reliable techniques to collect data from a well-defined population or systematically selected segments of a population for the purpose of determining the attributes of the population. This study was interested in exploring the opinion of teachers and students in new pedagogies that will reduce mathemaphobia among senior secondary school students in Umuahia education zone in Abia State.

Area of the Study

This study was carried out in Umuahia education zone in Abia State. The researcher choose Umuahia education zone because it has been observed that students in that education zone are lagging behind in mathematics. The indigenes of the zone are predominantly Christians and majority of those in the zone are Igbos. Umuahia education zone has eight local government areas (LGA's) in the zone. The LGA's in the area are as follows: Arochukwu, Bende, Umuahia north, Umuahia south, Umunneochi, Ikwuano, Isiukwuato and Ohafia. However the rationale for choosing Umuahia education zone as the area of this study is based on the need to improve the achievement of student's in mathematics.

Population of the Study

The population for the study was 844 respondents consisting of 20 mathematics teachers and 824 students from 10 Government owned secondary schools in the area (Abia state ministry of education, 2021). The population was considered suitable for the study because the researcher believes they have required expertise to answer the questionnaire items on the pedagogies for reduction of mathemaphobia among senior secondary school students in Umuahia education zone of Abia state.

Sample and Sampling Techniques

The sample for the study was 122 respondents consisting of 20 mathematics teachers (Entire population of mathematics teachers was used because it was small and manageable) and 102 students.

Instrument for Data Collection

The instrument that was used for collection of data is questionnaire developed by the researcher. The

instrument titled ‘Pedagogies for reduction of mathemaphobia questionnaire (PRMQ). They are divided into two main sections A and B. Section A contained the personal data of respondents while section B had items structured from the research questions. The instrument contained 21 items and the respondents were to tick the correct responses in the appropriate column which indicated their views in the questionnaire (PRMQ). The instrument was constructed along a modified four Likert scale of measurement ranging from Very High Extent (VHE), High Extent (HE), Low Extent (LE), Very Low Extent (VLE). Weighed at 4, 3, 2, and 1 respectively, the questions was divided into three clusters.

Cluster A elicited responses on to what extent could discovery method of teaching reduce mathemaphobia among senior secondary school students in Umuahia education zone. Cluster B elicited responses on to what extent could cooperative method of teaching reduce mathemaphobia among the senior secondary school students in Umuahia education zone. Cluster C elicited responses on to what extent could discussion method of teaching reduce mathemaphobia among senior secondary school students in Umuahia education zone.

Validation of the Instrument

Face and content validities of the instrument were ensured by three experts, pedagogies for reduction of mathemaphobia questionnaire (PRMQ) was first validated by three experts, two of them were from measurement and evaluation and one from mathematics education, Michael Okpara university of agriculture Umudike. Each of them was asked to judge the adequacy and brevity of the items of the test instrument. The experts were asked to supply any missing item and make suggestions that could help to improve the quality of the instrument. Their suggestions were incorporated to produce the final copy of the questionnaire for the study.

Reliability of the Instrument

The reliability of the instrument was ascertained using test-retest form of reliability. This form of reliability test allows the same instrument to be tested on the same subjects in two different occasions

separated by some time interval not less than two weeks. To this end, the instrument (PRMQ) was administered to 20 respondents which consisted of mathematics teachers in Umuahia Education zone of Abia state. The test-retest took a time gap of two weeks. Cluster ‘A’ index was 13.2, cluster ‘B’ has an index of 13.72 and cluster ‘C’ has an index of 13.16. The overall index was 13.36 which indicates that respondents agreed to a high extent that discovery, discussion and cooperative learning approaches could reduce mathemaphobia. The value obtained using Pearson product-moment formula for correlation coefficients was 0.84. This is high figure is an indication of high reliability of the instrument. This is used to determine the stability of the instrument. The internal consistency of the items of the questionnaire was determined using Cronbach alpha and a coefficient of 0.77 was obtained.

Method of Data Collection

The researcher visited the sample schools and with the help of the research assistants. They gave the instrument to the teachers and students and waited to collect it back when they finished responding to all the items. Research assistants were taught on the modalities of questionnaire administration to all the sampled schools. These research assistants assisted in the administration of the instrument in such schools.

Method of Data Analysis

The research questions were answered using mean and standard deviation. That is the mean response of the respondents to each item in the questionnaires was used to determine the answer to each question, while the research questions were answered by calculating the mean and the standard deviation of response of each cluster in the questionnaire. In order to interpret the result of the research question, a mean value of 2.50 was calculated as a limiting value. In the test of hypotheses, the two null hypotheses formulated were tested using t-test at 0.05 level of probability to determine the acceptance or rejection of the null hypotheses. The null hypotheses was accepted when the calculated level of significance is greater than 0.05 but if the calculated level of significance is less than 0.05, the null hypotheses was not accepted.

Result

This chapter presents results of data analysis based on the research questions that guided this study, results are presented in line with the research questions.

Research Question 1

Table 4.1: The mean rating of student's response on discovery method of teaching mathematics in senior secondary school could reduce mathemaphobia among senior secondary school students in Umuhia Education Zone.

N =119				
S/N	Items	Mean	SD	Interpretation
1.	Discovery method of teaching mathematics should be applied in teaching secondary school mathematics.	3.04	0.99	Accepted
2.	Discovery method of teaching should be made compulsory in all secondary schools.	3.22	0.93	Accepted
3.	Every class in secondary schools should be time for discovery method of teaching.	3.60	0.75	Accepted
4.	Discovery teaching method should be carried out in all secondary schools.	3.34	0.97	Accepted
Grand mean			3.30	Accepted

Research Question 2

Table 4.3: The mean rating of students on cooperative learning could reduce mathemaphobia among senior secondary school students in Umuhia Education Zone.

N=119				
S/N	Items	Mean	SD	Interpretation
12	Cooperative learning in their classrooms has the power to create a sense of teacher responses to student's questions.	3.74	0.61	Accepted
14	The cooperative learning method allows students to work in a group of mixed ability	2.92	0.94	Accepted
15	Students should be guided to discover mathematics concept by themselves.	3.46	0.80	Accepted
16.	There is high level of cooperation among students when they embark on cooperative learning in studying mathematics.	3.60	0.79	Accepted
Grand mean			3.43	Accepted

Research Question 3

Table 4.4: This is used to answer research 4, which sought find out if discussion method reduce mathemphobia among senior secondary school students?

N=119				
S/N	Items	Mean	SD	Interpretation
17	Discussion method of teaching mathematics is more effective them others.	3.52	0.75	Accepted
18	Discussion teaching method helps my students to learn more in mathematics.	3.20	0.77	Accepted
19	Some mathematics teaching methods (discovery) is more effective than others.	2.82	0.95	Accepted
20	Discussion method of teaching encourages mathematics formula memorization.	3.62	0.61	Accepted
Grand mean			3.29	Accepted

Discussion of the findings

The findings indicate that learner-centered pedagogies, discovery method, discussion method and cooperative learning approaches are effective in reducing mathemaphobia by increasing students' confidence, participation and interest in mathematics. This is in agreement with the findings of John Dewey's learning by do which has been regarded as being synonymous with discovery teaching method, Sundin (2001). Cluster 'B' recorded the highest index (13.72), followed by cluster 'C' (13.16) while cluster 'A' had an index of 13.20. The overall pattern of the indices suggest that respondents considered all three pedagogical approaches to be effective, although the strategy represented by cluster 'B' was perceived as the most effective. The study further suggests that supportive teacher-student relationship, regular positive feedback and the use of real-life mathematical applications help to lower students' anxiety and improve their achievement in mathematics.

Conclusion

The researcher considered the following: statement of the problem, three research questions and hypothesis, scope of the study, methodology, design of the study, area of the study, instrument for data collection, validation of instrument, reliability of the

instrument, method of data collection, method of data analysis, results, discussion of the findings.

Based on the findings and conclusion of the study, the following recommendations were made:

1. Mathematics teachers should adopt discovery method regularly to encourage active participation and improve students' confidence in learning mathematics.
2. Cooperative learning should be integrated into mathematics instruction because it was found to be the most effective pedagogical approach for reducing mathemaphobia.
3. Mathematics teachers should frequently employ discussion method that exposes students to practical and real-life mathematical situations.

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