

Investigation into the Impact of Questioning Skills in Teaching Secondary School Mathematics

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ABSTRACT

The purpose of this study was to conduct an investigation into the Role of Questioning Skills in Teaching Mathematics in Secondary Schools in Udi Area with a view to making useful recommendations to Government, recommendations to teachers and students on the improvement of teaching learning and developing positive attitude to mathematics. Among all the classes and mathematics teachers of ten secondary schools in the area twenty-five classes of junior secondary and senior secondary schools and twenty-five mathematics teachers from five secondary schools in Udi Area were systematically selected. In carrying out the study two research questions and two research hypothesis were formulated. The data collected was by means of observations and interview. The means score of the students' marks in first term mathematics examinations for 2005/2006 was collected. Mean performance was used to answer the research questions whereas Z-test at 0.05 level of significance was used to test the null hypothesis from the analysis. From the analysis made, the study revealed that teachers of mathematics predominantly yes recall questions while processing and application questions were somehow neglected. The analysis also revealed that teachers who use more of the questions produce better mathematics students than those that ask less. Based on the above findings, recommendations and suggestions were made which may help to improve the mode of questioning in mathematics that will result to students developing position attitude towards mathematics in the area under survey and beyond.

Keywords: Investigation, Questioning Skills, Teaching, Secondary School, Mathematics

INTRODUCTION

Mathematics is a subject, which cuts across the schools subjects. It has a wide filed of application in all branches of science [1].Mathematics is taught for its utilization goals. Every school leaver should have a certain measure of knowledge of mathematics, which is necessary for ones day-to-day activity. He should be conversant with idea of numbers and their practical applications in say the measurement and estimation of length, area, weight, volume and time. He should be able to interpret graphs, table and statistical representations. In effect, one should be able to perform the fundamental operation of addition, subtraction, multiplication and division (four basic operations) mathematics is the language of clear and logical reasoning. [2]. It sharpens the mind and so helps to promote intellectual discipline more so, a tool and language of science and technology and therefore should be taught by qualified teachers who are with the knowledge of teaching skills among which is the questions skill. Questioning in its simplest definition is to ask for, seek for or inquire for information [3], states that questioning is the pillar on which communication and information are made comprehensive, understandable and comprehensible. According to [4], questioning is one of the most often used teaching techniques. One of the basic ways by which a teacher stimulates students thinking and learning. As far back as the fifth century B. C., the great Greek philosopher, Socrates first used the act of questioning to draw out ideas from his students and to carry them towards further knowledge and deeper understanding. This has ever since been recommended to teachers. Through questioning there came up an idea of not assigning a score (intelligent quotient) to a child rather he is given scores in various components such as interest, understanding, thinking logically, and otherwise. [5]. Questioning as a concept may be defined as any statement, which arouses thinking in the learner. Testing knowledge and

creates knowledge in the learner simply indicates that there are two kinds of questioning. Question which tests knowledge perhaps described as lower order questions.

Statement of the Problem

The relationship of mathematics to other fields of study provides an important means of stimulation interests. At all levels of secondary education, the contributions which mathematics has made to the understanding of many subjects especially in the sciences are recognized, [6]. Recent development in our education, system seems to show that lack of questioning skill and lack of qualified mathematics teachers expose students to examination tension and fear, whereas a good qualified mathematics teacher selects and adopts ways that will be most suitable for his class depending on their age, ability and time available.

RESEARCH METHODOLOGY

Research Design

The design of this study will be a descriptive survey research design. The class of description to use is survey research. A survey research is one in which a group of people or items are studied by collecting and analysing data from only a few people or items considered to be representative of the entire group.

Area of the Study

This research was carried in secondary schools in Udi Local Government of Enugu State. Questioning skills in teaching mathematics are covered,

Population of the Study

The population of the study comprises of all the junior secondary and senior secondary mathematics teachers of ten secondary schools in Udi Local Government of Enugu State.

Sample and Sampling Technique

Out of the ten secondary schools five were randomly sampled by balloting. In each of the secondary schools, five mathematics teachers were systematically selected based on the results of the students obtained which gives a total of twenty-five classes of junior secondary and senior secondary schools in Udi Local Government. The sampled schools were: Community Secondary School Umuabi Udi Girls' Secondary School Amokwe Udi Boys' Secondary School Udi Ngwo Girls' Secondary School Udi St. Patrick Secondary School Udi

Procedure for Data Collection

To enhance the collection of data, the researcher used the following techniques:

- 1) Direct observation (of the mathematics teachers and their students for a lesson period per class).
- 2) Analysis of students' scores in their first term examination, 2005/ 2006.
- 3) Oral interview with mathematics teachers.

Observation Technique

These techniques involve direct observations of the teacher during a lesson period in the classroom. The researcher observed the teacher making use of her observation schedule format to record the level of questioning skill used. Frequency of each questioning skill, how often the teacher formulate questions and ask as well as the nature of the questions whether it is lower order (recall) questions, processing question or application question. The observation results will be recorded which include the levels observed and the frequency of the use of the questioning skills. The total number of questions in each level is recorded in a schedule format, which can be seen in appendix 1,

The observation should be on:

- 1) Reaction of students to the teachers' questions.
- 2) Clarification and precision of questions.
- 3) Language and evenly distribution of questions.
- 4) Time allowed to students after questioning and before responding to the answer.
- 5) Reaction of teachers to the students' questions.

The observation was made during the third, fourth, and sixth week of the second term, 2005/2006 session. The researcher was able to identify and record the level of questions used as shown by the format below:

Table 1: Observation Schedule on Teachers' Questioning Techniques:

	Questioning	Questioning	Questioning	
Class	Recalling	Processing	Application	Total

The above schedule was prepared by the researcher, which involves questioning skills that are asked by teachers in the three levels of questioning so as to get appropriate observation factors recorded.

Analysis of Student Score

The marks obtained by each student at the end of the first terms' mathematics examination were collected from class teacher observed. The marks were added and divided by the number of students in that particular class to obtain the mean mark for that class.

Oral Interview

Oral interview were conducted with each mathematics teacher observed. Questions were asked on years of experience in the teaching of mathematics.

Method of Data Analysis

The items in the observation schedule will be analysed and tested to determine the teachers scores in questioning and students' performance in mathematics using Z- test. The Z- test is calculated by:

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_1}}}$$

Where:

- \bar{X}_1 = The mean of students' marks.
- \bar{X}_2 = The mean of-teachers' questioning scores.
- S₁ = Standard deviation for group 1.
- S₂ = Standard deviation for group 2
- N = Size of each group.

The null hypothesis (Ho) is then rejected if the calculated Z is greater than (>) the critical value, otherwise it is accepted.

ANALYSIS OF DATA RESULTS

Numbers of questions asked by the teachers at the three levels of questioning in various schools of different classes, (Distribution of questions).

Research Question 1

Frequency

TABLE 2: Table of Questioning Pattern in Secondary School

CLASS	LOWER ORDER QUESTION	PROCESSING QUESTION	APPLICATION QUESTION	TEACHERS YEAR OF EXPERIENCE	TOTAL FREQUENCY	MEAN X
JS2	62	20	20	15	102	20.4
JS3	67	10	21	15	98	19.6
SS2	69	18	18	16	105	21
SS3	78	25	27	15	130	26

The table 2 shows that the total numbers of questions used in the one observed ranged from five to thirty two. Almost half of the teacher observed used only twelve or less than twelve questions in forty minutes of class period. From this distribution, lower order (recall) questions occupy more than fifty percent of the three levels of questioning. The number -of processing (higher order) questions were generally fewer than the number of application questions and even in some cases the processing questions are left out. In the table, almost all the teachers observed and interviewed were experienced mathematics teachers.

Research Question 2

To what extent does the teachers' approach to questions enhance students' performance in mathematics?

Table 3

Teachers' scores in questioning and students' average examination marks in first term examination for various schools. The researcher determined the teachers' scores in questioning and students' performance in mathematics and hence Z - test statistics was used in testing value for significance.

SCORES

Table 3

CLASS	LOWER ORDER QUESTION	PROCESSING QUESTION	APPLICATION QUESTION	TOTAL FREQUENCY	TOTAL SCORE	STUDENTS MEAN X	TEACHERS MEAN Y
JS2	62	20	20	102		8.32	6.48
	62	40	60		162		
JS3	- 67	10	21	98		10.52	5.96
	67	19	63		149		
SS2	69	18	18	105		8.96	6.36
	69	36	54		159		
SS3	78	25	27	130		14.04	8.16
	78	45	81		204		
Total						41.84	26.96

From the table 3 it was observed that the students' performance increase as the numbers of questions increased. Consequently, teachers with more numbers of questions produce better result than those with less numbers of questions. To determine the teachers' scores in questioning and students' performance in mathematics, Z - test was used. To calculate Z - value of unrelated samples which is given by:

$$\frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{S_A^2}{N_A} + \frac{S_B^2}{N_B}}}$$

Where:

- XA = the mean of students marks.
- XB = the mean of teachers questioning scores.
- SA = Standard deviation for students marks.
- SB = Standard deviation for teachers' questioning score.
- N = Size of each group.

Hypothesis
Null Hypothesis (Ho)

There is no significant difference between the teachers' approach to questions and students' performance in mathematics.

TABLE 4: To determine the teachers' scores in questioning and students performance on mathematics.

The summary of Z - table

Subjects	N	X	SD	a	df	Z-Cal	Z- crit
Students' class mean mark	25	41.84	11.39	0.05	00	4.17	1.96
Teachers' questioning	25	26.96	13.73				

From the above table, there is significant difference between the teachers' approach to questions and the students' performance in mathematics.

Condition

Reject if the calculated Z- test exceeds tabulated value and accept if the same. Since the calculated Z (Z- cal) is 4.17 and the Z- critical (Z-0.05, a) is 1.96, conclusion, Z- cal 4.17 is greater than (>) Z- critical 1.96, the null hypothesis (Ho) is therefore rejected and alternative hypothesis (HI) is accepted.

Discussion on Finding

Table 1, determined the distribution of questions over the three levels of questioning skills, lower order question, processing question and Application question, also the level that is predominantly used by secondary school mathematics teachers. A schedule was used in collecting the number and levels of questions. Based on [7] recommendation that there should be at least 66 questions in 40 minutes. It could be seen then that none of the teachers observed attempted to meet up with the stated criteria. The total recorded questions ranges from five to thirty-two. In the distribution of questions, [8] recorded that there should be at least 30% recall level questions, instead of 70% recall and 30% higher order question in order to attain greater achievement. In the data presented all the teachers observed had more than 50% of theirs is lower order. It could be noticed that processing questions, which are generally acknowledged by educationists like Kisko and Buggy at the most essential type of questioning are much, neglected here. Unlike what was obtained in other levels of questions, out of twenty- five teachers observed, six teachers never asked processing questions at all. For the fact that all the teachers had at least 15 years of experience in the teaching of mathematics, there was no significant test for the result in table one.

Table 3, determined the teachers' questioning scores and the mean of the students' examination marks. The average marks were obtained from the students' first term examination. The score that was used for this study was the mean score of each of the classes respectively. These scores were recorded against the total number of questions asked by each mathematics teacher in each studied. Total number of questions asked and average class scores were tabulated. The Z- calculation formula was used. Then using Z test of significance, Z was calculated as 4.17, when tested and compared with the tabulated value Z (0.05) gave 1.96, therefore, it is concluded that there is a significant difference between the teachers' questioning scores and students' performance.

Apart from the findings made during analysis of data, the researcher during her visits to schools observed that teachers do not give students time to reply to their questions. For this [9] made a suggestion that five to ten seconds' silence after a question is presented a response is made, encourages students to initiate comments, raise questions of their own and response more thoughtful to the teachers questions. [10] advised for a wait-time after a question is posed and there should be at least two to four seconds after any question before any student answer is called on to answer it. When teachers were interview, they

complained of insufficient time to roundup their lessons. Teachers claimed that there needed enough time to roundup before the next teacher come in.

The researcher also observed that few teachers only encourage students after their response. The teachers should reinforce students' comments through verbal reactions like good, all right, excellent and non-verbal reactions like facial expressions (smiling and nodding of head). The researcher observed that majority of teachers' questions is unclear, ambiguous and unplanned. Teachers ask students in succession or the students is about to answer a question, the teacher rephrases the original question and number of times. Students when faced with these situations do not know exactly what the teacher is looking for. Teachers' questions should therefore be clear and well planned in view of this, [11] explained that mathematics questions should be well worded and formulated in such a way as to test exactly what they were intended to test. There was an observation on the use of language suitable for the class. Majority of teachers do not use suitable language for the class, thus simple language, which is at the level of the class makes for clarity and helps students to learn.

On student participation during the lesson, the researcher observed that very few teachers allow few students involvement during the lesson. This is because teachers do not distribute their questions evenly. They only asked questions to the bright students neglecting dull ones. In effect only the brighter ones participate actively in the class. [12] stated that; give someone else in the class a chance to answer. One students' problem becomes a concern to the entire class by asking the rest of the class if something can be said in different way."

Educational Implication of the Study

This study has implications for the fact that:

- 1) The Effective teaching learning of mathematics needs the knowledge and acquisition of questioning and questioning skills, questioning strategies.
- 2) Most of the secondary schools mathematics teachers should be encouraged to ask more of higher order questions during their lessons and examination.
- 3) Most teachers do not ask enough questions during class lesson period.
- 4) Most teachers neglect wait - time.
- 5) Mathematics teachers should be given opportunity to attend in -service training programme, regular workshops to improve their productivity.

Recommendation

Based on the findings of this research work, the reader is advised to consider the following recommendations:

- 1) The skills and levels of questioning should be properly emphasized in colleges of Education, Teacher-Training colleges and Faculties of Education in Nigeria Universities. This will make the student-teachers to master the use of questioning skills before leaving school to enable them utilize the skill effectively in schools they are posted to.
- 2) Teachers should be well groomed in the use of English language. A mastery of the language will help the teacher to construct clear and precision questions.
- 3) Seminars, Symposia and Workshop should be regularly organized in the use of questioning skills. This will help the teachers acquaint themselves with the correct used of questioning skills.
- 4) School supervisors should lay more emphasis on the teachers' effective use of levels of questioning skills during classroom teaching and supervision.
- 5) Incentives should be given to the teachers that frequently use questions in their courses of teaching, during supervision by inspectors from the Ministry of Education.
- 6) Textbooks on the Guide and use of questioning skill for secondary school teachers should be published by eminent educationists and supplied to schools.

Summary of the Study

Mathematics is a subject that runs across another subjects both science and arts. It plays a vital role in all aspects of life. Its importance has necessitated the researcher to look into

the effectiveness of teaching it in our secondary schools and also has led to the choice of the topic- the role of questioning skills in teaching of mathematics in secondary schools in Udi Local Government Area of Enugu State, considered in the study.

The following research questions were considered in the study:

- 1) Which of the levels is predominantly used by mathematics teachers in secondary schools?
- 2) To what extent does the teachers' approach to questions enhance students' performance in mathematics?

Two researches Hypothesis was formulate to guide the study. They were as follows:

- 1) There is no significant difference between the level of questions predominantly asked by experienced teachers and that asked by non-experienced teachers.
- 2) There is no significant difference between the teachers' approach to questions and the students' performance in mathematics.

Among the ten secondary schools five were randomly sampled by balloting. In each of the five schools, five mathematics teachers were selected systematically. Based on the results students' obtained which give a total of twenty-five mathematics teachers and twenty-five classes of junior and senior secondary schools.

The instruments and procedure for data collection include:

- 1) Direct observation of mathematics teachers and their students for a lesson period (per class).
- 2) Oral interview with mathematics teachers.
- 3) 3) Analysis of students' scores in their first term mathematics examination 2005/2006.

The data collected were analysed using mean, standard deviation and Z-test.

The finding made were as follows:

- 1) Teachers do not ask enough questions and where asked the questions are mainly of lower order (recall) thereby neglecting the processing and application questions.
- 2) Majority of teachers are unclear, ambiguous and they neither allowed students time for response nor distributed questions equitably.
- 3) Teachers that ask more questions produce better results than teachers that ask fewer questions.
- 4) Majority of teachers used language that is not appropriate to the level of the students.
- 5) The first hypothesis was not tested since it was discovered that every mathematics teacher observed was qualified. Whereas the second tested hypothesis shows significant difference between the teachers' approach to questions and the students' performance in mathematics.

Suggestion for Further Study

The researcher has observed that very little research work has been done in Nigeria in the area of role of questioning skills in the teaching of mathematics in secondary schools. The researcher hereby suggests more work on this project to cover the whole Enugu state and if possible Nigeria as a whole, to ensure a more ramifying and far reaching diagnose of the role of questioning skills in teaching mathematics in secondary schools.

CONCLUSION

Based on the results of the findings, one can conclude that all the teachers particularly mathematics teachers ask more of lower order questions and less of processing and application questions in the lesson period. Also lack of questioning in the teaching-learning of mathematics leads generally to poor performance in mathematics.

That notwithstanding, there should be wait-time after a question is posed.

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